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ABSTRACT

This paper summarizes a new paradigm of instructional supervision, which shifts the focus from individual behavior to the improvement of work processes and social system components of the school district. The proposed paradigm, the Knowledge Work Supervision model, is derived from sociotechnical systems design theory and linked to the premise that school systems are knowledge organizations and that teaching is knowledge work. "Knowledge work" is any work that uses or produces knowledge to deliver products or services to customers. Groups of teachers, Redesign Management Teams (RMTs), collaborate with specially trained Knowledge-Work Supervisors who provide tactical guidance for the supervisory process. A districtwide steering committee provides strategic guidance for the entire knowledge-work supervision process. Because knowledge work is nonlinear, nonroutine, and often chaotic, a different kind of supervision is required. Given the systemic characteristics of a school district, the dominant orthodox paradigms of supervision (that is, clinical supervision and supervision-as-performance evaluation) seem inappropriate because they focus on individual teachers and their classrooms. The following recommendations are offered: (1) building principals alone cannot coordinate the entire process; (2) each school system has unique organizational characteristics that either constrain or enhance the effectiveness of supervision; (3) organizational structures, as well as individual behaviors and attitudes, must also be changed; (4) the process must be related to districtwide organizational goals; (5) problem-solving capacity must be built into each school within the system; and (6) the process must be designed as a comprehensive, systemwide program of supervision. (LMI)

Designing High Performance Schools Through Instructional Supervision: A New Paradigm for Supervising Knowledge-Work

by

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INTRODUCTION

A legend says in ancient times there was a leader named King Gordius. He was the ruler of Phyrygia. According to the legend, he tied a knot that could not be untied except by the future ruler of Asia. Faced with this problem, and knowing that others before him had failed, Alexander the Great cut the knot with his sword and then went on to rule Asia and other parts of the world. Alexander succeeded because he approached the problem using a different paradigm.

In modern times, the term Gordian Knot refers to an intricate problem, especially a problem that appears to be insoluble. In many ways the problem of trying to improve instruction in schools through instructional supervision is a Gordian Knot. Despite practitioners' best efforts and the field's best theoretical models, there is virtually no evidence that orthodox instructional supervision solves the problem of improving instruction throughout a school system. The problem seems insoluble unless it is approached from a different paradigm.

THE ORTHODOX PARADIGMS OF INSTRUCTIONAL SUPERVISION

A paradigm is a pattern, example, or model that guides thought or behavior. Barker[1] defines a paradigm as "...a set of rules and regulations (written and unwritten) that does two things: (1) it establishes or defines boundaries; and (2) it tells you how to behave inside the boundaries in order to be successful." Barker's use of this definition as a test to identify paradigms is enlightening. He says...

> "Let us look at more important paradigms. Like your field of expertise. Almost everyone has one, either at work or at home. You may be an engineer, or a salesperson, or a chef or a carpenter or a nurse or an economist. Are these paradigms?"
>
> "Again, let us apply the test. What does the word 'field' suggest? Boundaries. How do you feel when you are outside your field? Not competent, right? Not competent to do what? Solve problems. Why do people come to you? To receive help from you in solving problems in your field. That sounds like a paradigm, doesn't it?" (p. 33)

There are two paradigms of supervision in the field of education. One is primarily espoused in the literature (clinical supervision and variations of it) and the other is primarily practiced in schools (supervision as performance evaluation).

The espoused paradigm of instructional supervision found in the literature (an occasionally in practice) focuses on helping individual teachers improve teaching and grow professionally. Although there are many approaches toward these two important goals, the dominant theoretical paradigm for achieving these goals is the process of one supervisor

working with one teacher at a time, collecting observational data about that teacher's classroom teaching, analyzing the observational data, reporting the analyses back to the teacher, and making plans for that teacher's improvement of teaching and professional growth, then moving on to work with another teacher. This approach is called by many names, including: Clinical Supervision,[2] Differentiated Supervision,[3] Developmental Supervision,[4] and Cognitive Coaching.[5] Variations on this theme include teachers supervising teachers[6] with the core supervisory process remaining focused on the classroom behavior of teachers.

Even though the research on the effectiveness of the clinical supervision paradigm is primarily anecdotal, many professionals have strong beliefs about the value of using this approach with individual teachers. However, an epistomological analysis of what is known about the effectiveness of clinical supervision indicates: 1) it is not commonly practiced in schools (the supervision-as-evaluation paradigm is the dominant model-in-use); and 2) when it is used, there is no evidence that it is effective for improving teaching (which is also true of the supervision-as-evaluation paradigm) throughout an entire school system (although it does seem to benefit some individual teachers). Yet, professional educators are faced with the challenging task of trying to do just that--improving instruction throughout an entire school system. If the espoused and in-use paradigms of supervision cannot help educators improve instruction throughout entire school systems, then there is a need for one that can help them accomplish that goal.

By using the new paradigm of supervision described in this article, it is believed that practitioners can cut the Gordian Knot represented by the historically insoluble problem of

trying to improve instruction throughout an entire school system. This belief is based on the fact that the proposed paradigm is derived from *socio-technical systems (STS) design* theory[7] which has guided the redesign of hundreds of organizations throughout the world. This belief is also linked to the premise that school systems are *knowledge-organizations* and that teaching is *knowledge-work.*

PARADIGMATIC CONCEPTS AND PRINCIPLES

The paradigm of supervision described herein is for an organization that performs knowledge-work. Knowledge-work is work that produces information or generates ideas or that uses information and ideas to deliver products or services. Knowledge-workers often enjoy a great deal of autonomy in how they think about and do their work. Knowledge-organizations include engineering firms, law firms, medical practices, consulting practices, and school districts.

It is posited here that a special paradigm of supervision is needed to supervise knowledge-work--a paradigm that shifts the focus of supervision from the individual professional to the work processes. Peter Drucker[8] seems to support this proposition when he says:

> "An old definition of 'professionals' was people who could not be supervised in their work. That definition is now the rule rather than the exception. People on the assembly line have no choice but to perform their given task on that line. That is not true of service workers; their focus can wander from the task at hand. You cannot supervise them or, in many cases, give orders. The knowledge worker has to consider the job important and *want* to do it. You

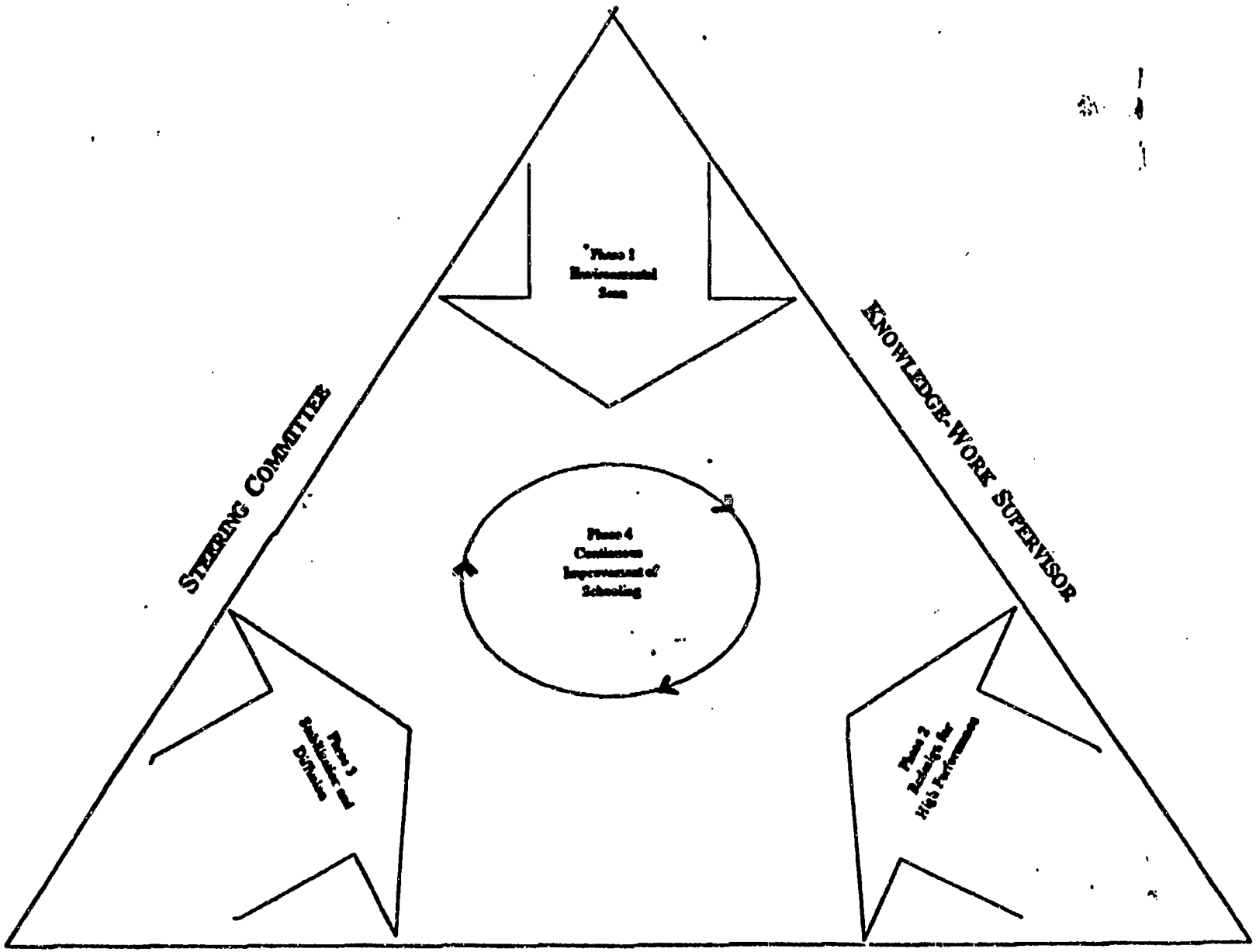
> can train these workers, work on their specifications, retrain them, transfer them, and reward them, but in their job you cannot **[emphasis added]** supervise them."

The proposed new paradigm of supervision is called *knowledge-work supervision.*

The paradigm suggested in this paper is more than just another supervision model. The field of supervision is full of models. However, most of these models are couched in the traditional paradigms of either clinical supervision or supervision-as-evaluation that require supervisors to work with or evaluate individual teachers. The proposed approach couches supervision in an entirely different set of concepts and principles--a different pattern of supervisory ideas, practices, and outcomes--a different paradigm.

The knowledge-work supervision paradigm is depicted in Figure 1. It has four phases and is cyclical in nature. Phase 1 is an environmental scan where a district-level Steering Committee assesses the expectations and requirements of the district's environment. Phase 2 is a supervisory process to redesign the technical and social sub-system of a *target unit* (one school, or network of schools, that is targeted to begin the knowledge-work supervision process) for the purpose of moving that school toward higher levels of organizational performance. Once the improvements are made, then knowledge-work supervision strives to stabilize the changes and, then, diffuse the changes to all other schools in the district until the entire organization has been redesigned through knowledge-work supervision. This is Phase 3. After the changes have been stabilized and diffused, knowledge-work supervisors then begin a process of continuous improvement that identifies and acts upon opportunities for incremental improvements in the technical and social sub-

Figure 1: The Paradigm of Knowledge Work Supervision



systems of the district. This is Phase 4. After a pre-determined period of time, the district returns to Phase 1 of the paradigm. Knowledge-work supervision continues for the life of the organization.

The ultimate goal of knowledge-work supervision is to redesign two work processes in a school system: the linear work process known as the instructional program and the non-linear work process known as classroom teaching. Achieving this goal helps a school district move toward higher levels of organizational performance. Once the two work processes are redesigned, then knowledge-work supervision focuses on the continuous improvement of the two processes.

Knowledge-work supervision begins within a single school known as a *target school* or with an integrated network of schools (e.g., a high school and all of the middle and elementary schools that feed into it) known as a *target organization*. As the redesign process is completed for the target school or target organization other schools come on-line to begin the redesign process until the work processes of the entire district have been redesigned through knowledge-work supervision.

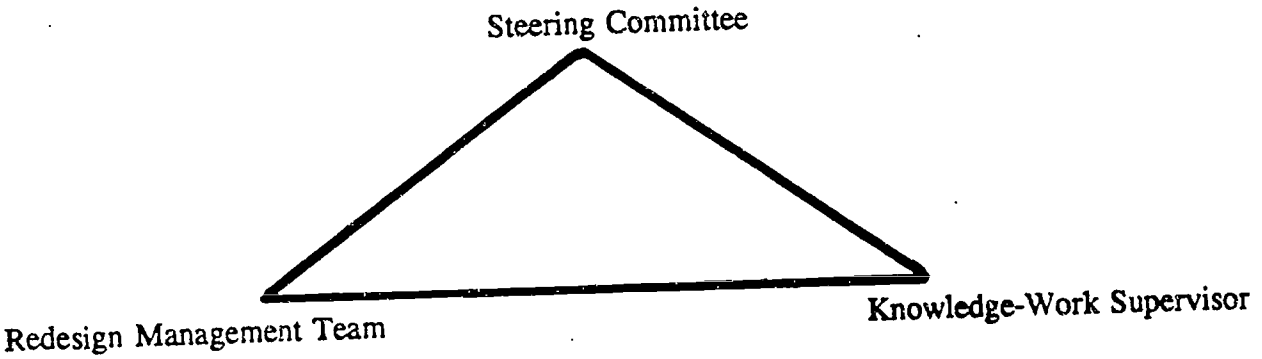
PHASE 1: ENVIRONMENTAL SCAN

Supervision of knowledge-work begins with an assessment of the school system's environment by a district-level Steering Committee established to oversee the knowledge-work supervision process for the entire school district. Special environmental scanning tools are used to identify and describe environmental factors impacting the school system. Key stakeholders inside and outside of the school system are identified and their expectations assessed. All of this early diagnostic information is used to re-examine the school system's

basic mission and to define a vision statement describing what the school system represents and hopes to accomplish.

After completing Phase 1 of knowledge-work supervision, the Steering Committee establishes a three-party knowledge-work supervision structure like the one illustrated in Figure 1.2. This structure is established in each of the target schools or target organizations. The three parties are the Steering Committee (SC), the Redesign Management Team (RMT) composed of teachers, and a Knowledge-Work Supervisor (KWS). The SC oversees the

Figure 1.2: The Structure of Knowledge-Work Supervision



supervision process by providing strategic guidance, the RMT does most of the work for the redesign process, and the KWS provides tactical guidance, technical assistance, and training to the RMT. The specific work activities for the RMT and the KWS are described below.

PHASE 2: REDESIGNING FOR HIGH PERFORMANCE

The major redesign activities are: 1) diagnose the technical sub-system of the target school(s); 2) diagnose the social sub-system of the target school(s); 3) develop redesign proposals and an implementation plan; 4) implement and evaluate the approved redesign proposals.

Diagnosing the Technical Sub-System

The first supervisory activity in the redesign phase for the RMT and KWS is to diagnose the technical sub-system of the target school or target organization. The technical sub-system is "the total collection of processes, procedures, instructions, techniques, tools, equipment, machines, and physical space that are used in transforming the organization's inputs into the desired outputs (products or services). 'X' is transformed into 'Y' by doing 'Z.'"[9] In most of today's organizations there are two types of inter-related conversion processes in the technical sub-system: linear and non-linear. School districts also have linear and non-linear conversion processes.

Linear work is composed of activities that are repetitive and done step-by-step. The essential characteristic of linear work is that each step can be specified in advance (i.e., Step A is composed of...and always precedes Step B, which is composed of....).

Non-linear work is comprised of activities that can be done in parallel, separated from each other, or in a variety of sequences. In non-linear processes, future work cannot be decided until some of the results of the current work activities are completed. Consequently, non-linear work is often experienced as chaotic. An example is the pattern of decisions made by a teacher while teaching.

To improve linear work, the RMT and KWS look for errors that occur early in the sequence of activities that cause most of the problems further down the line. To improve non-linear work, practitioners look for ways to incorporate needed perspectives, views,

values, people, information, and so forth, into the work process early-on to prevent critical errors later.

Whether the organization uses a linear or non-linear conversion process, or both, one of the primary goals of the technical sub-system is to identify and correct variances (i.e., errors or disturbances in the conversion process) so that the organization can achieve its goals successfully. According to STS design theory, the way to identify and correct variances is to conduct a comprehensive analysis of the conversion processes.

A comprehensive analysis of the technical sub-system helps organizational members identify the boundaries of work units (e.g., departments, teams, grades, or levels of schooling) within the conversion process from the point where inputs enter the system, through the conversion process, and, then, delivered to the customer. Second, this kind of analysis identifies key variances in the conversion process, assesses their impact, and evaluates the current way in which the organization controls the errors in the conversion process. Third, this diagnosis assesses the impact of other related organizational systems on the technical sub-system, especially suppliers, customers, and support systems (e.g., management). Fourth, a comprehensive analysis clarifies the demands that are made on the social sub-system to operate, coordinate, and maintain the technical sub-system. And, finally this analysis identifies opportunities to improve the control of the technical sub-system and other support systems.

Diagnosing the Linear Work Process in School Systems. School systems are knowledge-organizations and the work of schools is knowledge-work. School-based

knowledge-work is accomplished through the close interaction of a non-linear conversion process (classroom teaching) with a linear conversion process (the instructional program, K - 12). Additionally, there are other supportive work processes that affect the instructional program and classroom teaching (e.g., the work of administrators, secretaries, and education specialists).

The diagnostic activities for Phase 2 of the knowledge-work supervision process begins by examining the linear conversion process of the *target school* or *target organization* (i.e., one school and its network of "feeder" schools). This diagnosis is conducted by the RMT and KWS. The amount of time to conduct the diagnosis varies depending on the availability of people, the complexity of the linear instructional program within the target school, and the accessibility of diagnostic data.

The diagnosis of the linear conversion process (i.e., the instructional program) has two desired outcomes:

- Key players in the target school develop an in-depth knowledge of their "whole system," including information about what goes on and what goes wrong in the linear conversion process.
- Key players reach agreement on requirements for redesigning the linear work process of the target school that prevent, eliminate, or control variances in the conversion process.

After collecting the diagnostic data, the RMT and KWS conduct a series of meetings to analyze and interpret the data. They also develop specifications for redesigning the linear instructional program--it's distinguishing characteristics, inputs, and outputs. The need for

additional data may also be identified. If there is a need for other data, then plans are made to collect them. These discussion meetings are scheduled to allow adequate time for examining the data. The meetings are also designed as team-building opportunities for the RMT and KWS. Excellent communication skills are taught and practiced. Ways of managing conflict or differing opinions, perspectives, and values are developed. Decision-making is consensual. The meetings achieve the following objectives:

1. Identifying major inputs and outputs of the linear instructional program. To perform this task, the RMT and KWS collect diagnostic data to answer specific questions about the target school. If the target school has "feeder" schools connected to it, then the instructional program must be examined backwards from the target school through each of the feeder schools to identify errors (or variances) in the process. The RMT and KWS collect data to answer the following questions:

- What are the distinguishing characteristics of our instructional program?
- What are the current inputs to our instructional program? (Inputs are the human, financial, and technical resources that come into the target school so that the instructional program can function.)
- What are the current outputs, goals, and feedback for our instructional program? (Outputs are the "fruit of the labor"--the results produced through the current functioning of the instructional program.)

After collecting the data, the RMT and KWS discuss the results. They identify distinguishing characteristics of their linear instructional program and list its current inputs

and outputs. Using these data as points of discussion, the RMT and KWS discuss the following questions in as many meetings as necessary to reach consensus:

- Are the distinguishing features of our instructional program acceptable to us?
- What criteria (or specifications) should we use to improve our major inputs?
- What criteria (or specifications) should we use to measure the quality of our major outputs; goal attainment; and adequacy of feedback?
- What are the most important things we learned from this assessment of the linear conversion process? (The answers to this question are used to develop specific proposals for redesigning the linear conversion process.)
- What opportunities or creative ideas present themselves for redesigning the instructional program? (The answers to this question are used to develop specific proposals for redesigning the linear conversion process.)

2. Describing the linear process (i.e., the characteristics of the instructional program for converting inputs to outputs). Next, the RMT and KWS chart the work flow in the linear conversion process. To do this analysis, the RMT and KWS identify the major steps that students must currently follow to move through the instructional program within the target school. If the target school is a high school or middle school, then there are probably multiple linear conversion processes feeding into that school (i.e., there may be several "feeder" schools each with linear instructional programs feeding into the high school or middle school). The work flow through each of the "feeder" pathways is analyzed.

Listing the major steps in the work flow as grades that children must complete is not sufficient for this analysis; i.e., it is not helpful to record "Step 1: Kindergarten; Step 2: 1st

grade;" and so forth. Instead, the RMT and KWS do a finer analysis to identify the key steps in the instructional process; e.g., Step 1: "Children are identified for placement in kindergarten;" Step 2: Upon entering kindergarten, the ability levels of the children are diagnosed;" and so forth.

After charting the major steps in the work flow of the target school, the RMT and KWS discuss the most important things they learned from the assessment; and, identify opportunities or creative ideas for redesigning the linear instructional program.

3. Describing each step in the linear conversion process and clustering those steps into unit operations needed to complete the conversion process (e.g., grades, levels of schooling, cohorts, or "family" groups). After identifying the major steps in the instructional program, the RMT and KWS describe each step in detail. Then, they cluster related steps according to which school or level of schooling performs them. The clusters are charted or mapped. It is important to have a chart for each of the pathways that "feeds" into the target school.

4. Identifying variances (i.e., errors) found in the current functioning of the instructional program. The RMT and KWS, at this point, have collected and analyzed a lot of data about the linear conversion process of the target school. They also have identified and described the major steps in the conversion process. Now, they begin to search for variances (or potential variances) in the conversion process.

5. Charting the key variances in the linear conversion process and describing how they are currently handled. RMT and KWS chart the key variances on a *variance analysis table* and describe how these variances are currently controlled (or not controlled).

6. Designing ways to prevent or control key variances. After charting the key variances, the RMT and KWS discuss how to prevent or control the key variances.

7. Summarizing what's learned from the analysis of the linear conversion process. After completing the analysis of the linear conversion process, the RMT and KWS discuss and summarize what was learned. The major learning from this activity is used to develop proposals to redesign the linear work process.

8. Designing specifications and generating ideas for redesigning the instructional program to move it toward higher levels of performance. While the results of the analyses and summary of major learning are still fresh in the minds of the RMT and KWS, specifications for redesigning the instructional program are developed. These specifications become design criteria. When selecting or designing specifications it is important for the RMT and KWS to avoid over-specifying the design criteria. Providing minimal specifications gives people flexibility in deciding how to implement and use the new design.

In closing, it is important to reiterate that depending on the level of schooling being diagnosed (i.e., high school, middle or junior high school, or elementary school), the length of the linear conversion process and the number of linear conversion processes will vary. For example, a high school's linear conversion process is thirteen steps long (kindergarten through twelfth grade) and there may be several "feeder" pathways leading into the same high school thus providing that school with several "13-step" linear conversion processes to examine. For a K - 6th grade elementary school, the linear conversion process is only six steps long. For any school that is examining its linear conversion process it is critical to examine all the steps of the conversion process of which it is a part and all of the conversion

processes feeding into it. This requirement creates complexity, especially for high schools that have several "feeder" school pathways; but, an outstanding systemic diagnosis cannot be performed unless these multiple linear conversion processes are examined.

Diagnosing the Non-Linear Conversion Process in Schools.

Metaphors for Understanding Non-Linear Work. Wheatley[10] describes in lay terms useful metaphors for understanding non-linear work derived from the *new science*. Three fields in the new science that provide useful metaphors are quantum physics, self-organizing systems, and chaos theory. Several principles from these fields serve as powerful metaphors for understanding the nature of the non-linear, non-routine, and often chaotic work of classroom teaching.

Wheatley notes that the new science clearly explains that there is no objective reality waiting to reveal its secrets. There are no recipes or formulae, no checklists or advice that describe "reality." There is only what we create through our engagement with others and events. Nothing really transfers; everything is always new and different and unique to each of us.[11]

This basic characteristic of new science findings serves as a useful frame-of-reference for understanding classroom teaching. There is no single recipe for effective teaching. Effective teaching is created through teachers' engagement with other teachers in meaningful deliberations, interactions with their students in classrooms, and through their relationships with other elements of the school system. Thus, expecting standardized classroom teaching where all teachers teach using the exact same methods may be like wandering in the realm of impossibility.

Wheatley describes another concept that helps shed light on the nature of classroom teaching as non-routine work. This concept is *autopoiesis* (from the Greek for self-production). This is "The characteristic of living systems to continuously renew themselves and to regulate this process in such a way that the integrity of their structure is maintained."[12] It is a natural process that supports the quest for structure, process, renewal, and integrity.[13]

According to Wheatley, autopoietic structures illustrate a paradox; i.e., each structure has a unique identity or boundary, yet it is merged with its environment. At any point in its development, the structure is perceived as a separate entity, yet its history is tied to the history of the larger environment and to other autopoietic structures.[14] In many ways, classroom teaching is an autopoietic structure. Although it is possible to view teaching as a separate event, its history is tied to the history of the larger environment within which it exists--the school and the school system. This condition leads to the inference that it may be inappropriate to examine classroom teaching separate from its larger environment.

New science says that space is filled with invisible fields; e.g., gravitational fields, electromagnetic fields, and quantum fields. Kurt Lewin acknowledged the existence of these fields in his change theory and his force field analysis technique.[15] Even though invisible, fields are considered real. Using this concept, think of the space inside schools as ocean-like whereby fields and invisible structures blend unendingly. And whenever two or more fields meet, potentials for action grow exponentially.

Imagine the concept of field in a school system. Envision teachers as fields of energy spread throughout the school system, continuously growing in potential as they come in

contact with other fields. How can this energy be converted into behavior? Using field-theory as a guide, this energy might be converted into behavior by creating opportunities for teachers to come in contact with other fields. Some examples of other fields in organizations are people, culture, values, ethics, and vision.

Take vision, for example. Assuming that vision is a field that needs to permeate all organizational space instead of serving as a linear destination to a desirable future, it must then fill an organization like water fills a swimming pool--it must be everywhere at once. This can happen, according to Senge,[16] by helping people develop their own personal visions and by sponsoring on-going conversations about those visions. The new paradigm for knowledge-work supervision described in this article does this by engaging groups of teachers (formed as RMTs) and KWSs in an examination of their key deliberations.

Physicist John Archibald Wheeler is a proponent of the concept of a "participative universe." In a participative universe, the act of looking for certain information evokes the information that is looked for and, then, eliminates simultaneous opportunities to observe other information.[17] Every act of observation loses more information than it obtains and precludes the observation of other possibilities. Thus, no form of observation is neutral. Physicists call this condition *contextualism*--a sensitivity to the interdependence between how phenomena manifest themselves and the environment which causes them to appear. So, how is objective information in a participative universe gathered?

The new paradigm for supervision described in this article proposes a way to gather information in the participative universe of a school system. Information is gathered by engaging groups of teachers (i.e., RMTs) and KWSs in an examination of their knowledge-

work processes. Through this kind of interaction multiple perspectives are generated and there is a broad distribution of information, viewpoints, and interpretations to help educators make sense of their world.

Further, interaction such as that required by the paradigm of knowledge-work supervision is built on the proposition that information is a wave function (a term described later under the heading of quantum physics). As a wave, information moves through organizational space developing ever increasing potential explanations of phenomena and events. If the information wave interacts with only one teacher at a time (as with orthodox supervisory practice), there will be only one interpretation of that information. However, if that same wave of information meets simultaneously with groups of teachers then at each point of contact between the groups and the information, multiple interpretations of the information will appear. Instead of having a few interpretations, group participation evokes many. An organization swimming in many interpretations can then discuss, combine, and build on them. This is the kind of participative, deliberative process enacted through knowledge-work supervision that engages groups of teachers and knowledge-work supervisors in an examination, and subsequent improvement, of their work processes.

Quantum physics is another new science that provides useful metaphors for understanding knowledge-work. Quantum physics challenges thinking about observation and perception, participation and relationships, and the influences and connections that are created across large complex systems.[18] The quantum world teaches that there are no pre-fixed, definitely describable destinations. There are, instead, potential outcomes that form

into multiple realities, depending on who's looking and what he or she is interested in discovering.

In the world of quantum physics, matter can be particles (localized points in space) or it can be waves (energy dispersed over a finite volume). As a whole, matter has potentialities for both particles and waves. It is possible to observe particles or observe waves; but both cannot be observed simultaneously. Quantum matter is, therefore, defined in relationship to the observer and the matter changes to meet his or her expectations. Thus, individuals do not create reality--reality is always present. Instead, through their perceptions, they evoke it by bringing forth the potential that is already present in the situation.

The characteristics of quantum physics have significant metaphorical value for examining classroom teaching. For example, observing classroom teaching to assess its relative effectiveness, or to describe its features, may be an invalid approach to understanding teaching because the observation process evokes only that which is observed and simultaneously looses all other potentialities. Thus, the observed teaching changes to meet the observer's expectations. In other words, that which is observed depends on who the observer is and on what he or she is interested in discovering. Thus, focusing on certain teaching or classroom variables causes other variables to disappear just as particles disappear when quantum physicists set out to observe wave functions.

Self-organizing systems is another field within the new science that provides insights to the nature of classroom teaching as knowledge-work. Self-organizing or dissipative

structures provide new ways of understanding change, as well as the uses of chaos in creating new possibilities for developmental growth.

Information is central to the functioning of a self-organizing system. Information is the primal energy that structures matter into form--the necessary ingredient for continued life.[19] Self-organizing systems also succeed because they maintain their overall form and identity (i.e., stay under control) only by tolerating great degrees of individual freedom within the system. Maintaining control by allowing high levels of autonomy is an intriguing metaphor for supervising knowledge-work.

It is possible to relate the characteristic of control through individual freedom to schooling. Acting on this principle, school systems would recognize the inherent need to allow teachers individual freedom within defined parameters in the exercise of their teaching responsibilities; e.g., teachers could be encouraged to use many different teaching methods instead of being expected to use only one. This characteristic also resembles the principle of *equifinality*[20] in the field of systems theory. This principle suggests that a system can achieve a particular goal from several different starting points and by following a variety of paths. In other words, it is possible (and even desirable) for everyone in a school system to work toward the same goal using different methods and approaches.

Another new science field that provides insights to the nature of knowledge-work is chaos theory. Although chaos theory is based on Newtonian mechanical principles, it is also a component of quantum physics. Scientists observe that chaos and order exist in tandem. In a chaotic system, scientists observe movements that, though random and unpredictable,

never exceed finite boundaries. Chaos, says T.J. Cartwright,[21] is "order without predictability."

The notion of "order without predictability" may very well describe what happens inside schools. There is a certain order to life in schools (e.g., as reflected in the general patterns of teacher behavior), but the non-routine aspects of teaching work are often chaotic thereby making specific outcomes relatively unpredictable. For example, Popham[22] contends that "...it is impossible to conclude from a particular teacher's use or non-use of research-based instructional procedures whether the teacher is actually getting good results from pupils." Yet, the orthodox paradigms of instructional supervision strive to achieve predictability in classroom teaching.

Some of the physical structures observed in chaos theory are called fractals. Fractals can be simulated and observed using computer-generated models built upon a few mathematical equations that are iterated by feeding them back onto themselves. After innumerable iterations, these images take on a fractal form with detailed shapes at finer and finer levels. As the observer examines the fractals at increasing levels of magnification the same design is repeated again and again.

Natural fractals are everywhere in nature. They are the structures that provide shape to the physical world. They are the patterns that form clouds, landscapes, circulatory systems, trees, and plants. If fractal patterns are everywhere, it is possible to infer that human behavior may also have fractal-like patterns. If so, the deliberations that teachers participate in would exhibit those fractal-like patterns. After identifying the fractal-like pattern in teachers' deliberations, and confirming that the pattern is desirable, knowledge-

work supervisors could examine other "fields" in the school to determine if that desirable fractal-like pattern is being repeated (as it should be). If the observed fractal-like pattern was undesirable, then interventions could be designed to create new fractal-like patterns within the school.

2. The diagnostic process. Non-linear, non-routine work is a set of tasks where the sequence of work is optional, or where several tasks occur in a parallel manner. Sometimes this work process is chaotic. The way to improve a non-routine conversion process through knowledge-work supervision is to assure an early, whole-system information exchange among key players to avoid critical errors and failures later on; and, by assuring on-going information-sharing among those professionals affected by critical work activities.

There are two desired outcomes of a diagnosis of the non-linear conversion process. These are:

a. The RMT and KWS develop an inventory of key deliberations that teachers participate in, identify who participates in these deliberations, describe where and how these deliberations take place, and characterize the information participants bring to and take from these deliberations.

b. The RMT and KWS design a set of critical specifications that are minimally defined (to allow people working in the conversion process the flexibility they need to improve the conversion process without extraordinary design constraints) to correct or avoid errors caused by faulty deliberations, a lack of or badly timed information, inadequate

involvement or commitment of the right participants, and inappropriate forums for deliberations.

Some of the important concepts for doing a diagnosis of a non-linear conversion process are explained below. These concepts are derived from the work of Pava.[23]

To analyze a non-linear conversion process the RMT and KWS apply an analysis technique different from the one used with linear work. To analyze the linear conversion process, the RMT and KWS used a variance analysis technique that identified and charted the variances (errors or potential errors). Because the non-linear, non-routine conversion process of classroom teaching is often chaotic, convoluted, and complex, the RMT and KWS cannot chart variances on a traditional matrix analysis table. Instead, they examine the deliberations of groups of knowledge-workers (i.e., teachers), identify gaps and errors in those deliberations, and then redesign the knowledge-work to eliminate or control the gaps. The RMT and KWS also examine and correct linear work procedures and technological devices that support the knowledge-work (e.g., grade reporting procedures and computer networks). If the supportive work processes are routine and linear, then the RMT and KWS can use traditional STS techniques to identify and chart variances in these supportive procedures.

The thinking process that occurs within the heads of knowledge-workers is called a *deliberation*. Teachers-as-knowledge-workers deliberate (or think) about many topics. Some of these topics are critical to their effectiveness on-the-job. These are called *key deliberations*. Other topics are not critical. Some even distract the knowledge-worker from those topics which he or she should be deliberating. Some deliberations result in decisions;

others do not. To identify the key deliberations, a list of the key work-related topics that teachers think about is made by the RMT and KWS.

In the context of schooling, the concept of deliberation as described here resembles the philosophy of Richard McKeon who wrote about the linkage of thought with action--of theory with practice. He theorized[24] four modes of relationships between theory and practice. One of those, in particular, fits well with the deliberation process described in this article. That relationship mode is called the deliberative or problematic mode and it brings theory and practice together through a process of inquiry so that problem-solving becomes the responsibility of everyone in the school system.

The concept of deliberation is also similar to the concept of "the practical" first proposed by Joseph Schwab in 1970.[25] He suggests that curriculum problems focus on how to act rather than on ways to know.[26] He suggests that these kinds of curriculum problems are best solved by practical reasoning, or deliberation.

Occasionally, the knowledge-worker's deliberation process reaches out to solicit the input of others. Knowledge-workers reach out by discussing their topics with people they think can be of help. The places where these external deliberations occur are called *forums*. Forums can be structured (e.g., regularly scheduled team meetings), semi-structured (e.g., off-site training workshops), or unstructured (e.g., two colleagues conversing over coffee).

The people the knowledge-worker includes in his or her deliberations are called *participants*. These people participate in the knowledge-worker's deliberations by bringing advice, opinions, additional information, and insights to the deliberation. They also take information from the deliberation. Sometimes the knowledge-worker involves the right

people in his or her deliberations and sometimes he or she does not. The characteristics of the information taken to and from the forums affects the quality and effectiveness of the deliberation process.

When people take action on their deliberations, they often follow prescribed work procedures (e.g., evaluation procedures) and use technological devices to assist them (e.g., computer systems). These procedures and devices are intended to support their deliberations.

These deliberations, forums, participants, work procedures, and technological devices comprise the non-linear, non-routine conversion process of a knowledge-organization. To analyze this kind of conversion process the RMT and KWS engage in a diagnostic process that focuses on variances (errors or potential errors) that exist in the deliberations, forums, participation, work procedures, and technological devices. To improve this non-routine conversion process, all other professionals in the school are taught how to control their deliberations more effectively by deliberating the right topics, reaching out to the right participants, engaging others within the right forums, applying the right work procedures, and using the right technological devices. Pasmore[27] refers to this kind of improvement process as "managing deliberations."

This section described a process for diagnosing the linear and non-linear conversion processes of the technical sub-system of a target school (or set of inter-related schools) that has been targeted to begin the knowledge-supervision process. This diagnosis is critical to the success of knowledge-work supervision because the results are used to develop minimal critical specifications to redesign the target school's instructional program and classroom teaching.

Although diagnosing the technical sub-system of a target school is important, it is not the only diagnosis that occurs. In the next section, the process of diagnosing and redesigning the social sub-system of the target school is described. This diagnosis is equally important because the characteristics and elements of the social sub-system have a significant impact on the functioning of the technical sub-system. And, in fact, one of the principles of knowledge-work supervision is to maximize both the technical and social sub-systems in relation to each other because both must function effectively and optimally in order to achieve a high performing organization.

Diagnosing the Social System

The RMT and KWS analyze the target school's social sub-system by examining the interactions teachers have with the technical sub-system and among themselves. The analysis also focuses on the quality of jobs and work life. The ultimate goal for improving the social sub-system is to assure that teachers have *whole jobs*, that there is a high *quality of work life* for everyone, and that teachers experience *effective working relationships* as they strive to perform their essential work activities together. These three principles of knowledge-work supervision are the basis of error-free work processes and are essential to customer satisfaction.

Diagnostic Goals: There are two desired outcomes as the result of this analysis:

a. The RMT and KWS describe the current quality of work life, the degree of satisfaction of the teachers in the social sub-system as they work in the linear and non-linear conversion processes, an analysis of how effectively teachers interact individually and in groups, and an

assessment of the degree to which various jobs satisfy basic psychological criteria.

b. The RMT and KWS develop minimal critical specifications for new roles, relationships, and ways of working together. These specifications should empower teachers to take new responsibility in the schools for performing normal duties and for managing variances in the linear and non-linear conversion processes.

Diagnostic Tasks. Prior to describing specific tasks for diagnosing the social sub-system, some important definitions are provided:[28]

- *Motivators*: Elements of work that induce people to learn and which compel them to achieve personal and organizational goals. Important motivators are autonomy, task variety, feedback, whole jobs, respect, and an opportunity to grow.
- *Satisfiers*: Elements of the work place that respond to people's basic psychological needs; e.g., conditions that respond to needs for security, health, safety, equity and fairness, and due process.
- *Quality of Work Life*: The degree to which existing motivators and satisfiers in the organization meet people's needs.
- *Skill*: A person's ability to use what he or she has learned to perform tasks essential to the functioning of an error-free conversion process.
- *Working Conditions*: The culture, safety, and physical appearance of the work place; and, the degree of physical and emotional effort required by the job

(e.g., the number of hours of work, take-home work, number of breaks, and planning time).

The specific diagnostic tasks are:

a. Identifying the skills teachers must have to function effectively in the linear and non-linear conversion processes and the skills needed to control variances. Teachers need to possess certain skills to perform effectively within the instructional program (i.e., the linear conversion process) and to teach (i.e., the non-linear conversion process). The skills needed for the linear conversion process are different from those needed for the non-linear conversion process. For example, to function effectively in the linear process teachers may need curriculum design skills; however, to function effectively in the classroom teachers need classroom management skills. The RMT and KWS assess which skills teachers need for both conversion processes.

b. Identifying skills needed to have effective relationships with co-workers, customers, and other stakeholders. Relationships are the glue that hold the social sub-system together. Effective relationships between teachers, among teachers, between groups, with customers, and with other stakeholders are necessary for maximizing the effectiveness of the technical and social sub-systems.

c. Identifying participants who collaborate on key deliberations in the non-linear conversion process. It is important to identify who actually participates in key deliberations as compared to who should participate. Because key players need to participate in key deliberations, they need to collaborate to achieve mutually agreeable outcomes. The expectation for collaboration requires the RMT and KWS to identify where there might be

conflicting values and beliefs among participants and, then, to create ways to manage the potential or actual conflict.

d. Determining the degree to which various roles meet psychological criteria that contribute to motivation (called *motivators*). Another important part of the analysis is the assessment of the degree to which organizational roles stimulate internal motivation in teachers. The psychological characteristics of a role that contribute to motivation are called *motivators*. Motivators, in conjunction with *satisfiers*, constitute what is called the *quality of work life* in an organization.

Important psychological job criteria (motivators) are:[29]

- Autonomy and discretion. Psychologically attractive work provides a good mix of opportunities for responsibility and exercising self-management in response to clear guidelines for behavior.
- Opportunity to learn and continue learning on the job. Psychologically attractive work provides many opportunities to learn new knowledge and skills, especially for improving on-the-job performance. However, these learning opportunities must offer reasonable challenges and timely feedback on the impact of one's learning.
- Optimal variety. Work that is psychologically attractive permits people to seek a reasonable amount of variety in their work activities. This opportunity helps reduce boredom and fatigue and simultaneously encourages the development of a satisfying rhythm (i.e., an alternating cycle of variety) in one's activities.

- Opportunity to exchange help and respect. Work that is psychologically attractive generates conditions under which colleagues can and do exchange help and respect. Building this feature into work requires making mutual help and assistance an intrinsic element of job expectations. It also requires encouraging recognition of individual capability and achievement.
- Sense of meaningful contribution. Psychologically attractive work provides members of the organization with a sense that their contributions are important and valued in the sense that they represent a challenge successfully met and they have contributed to society.
- Prospect of a meaningful future. Work that is psychologically attractive promises advancement, which fosters personal growth, and offers appropriately higher compensation.

e. Describing what it is like to work in the organization with respect to factors that contribute to job satisfaction (called satisfiers) and working conditions. Herzberg, Mausner, and Snyderman[30] explain the difference between motivators and satisfiers. Job satisfaction, they say, is affected by variables in the context of work. They call these hygienic factors--or satisfiers. Motivators, on the other hand, are inherent characteristics of the work itself. Some examples of satisfiers are those conditions that respond to needs for safety, security, health, and good communication. One way to collect data on the degree to which these variables exist is to conduct a survey of teachers and others in the target school.

f. Summarizing important learning from the analyses. After completing the analyses of the social sub-system, the RMT and KWS summarize the important learning that was gained.

h. Developing minimal specifications for redesigning the social sub-system. After summarizing and discussing the major learning from the analysis of the social sub-system, the RMT and KWS develop minimal specifications for redesigning the social sub-system. Later in the knowledge-work supervision process, this information is used to develop specific proposals for redesigning the social sub-system of the target school.

Develop Redesign Proposals and An Implementation Plan

After completing the diagnoses of the technical and social sub-systems, the KWS and the RMT develop proposals to make improvements in both systems. These proposals aim to increase the level of performance of the target school(s).

Proposals for improvements are submitted to the Steering Committee for their review and approval. Approved proposals are returned to the RMT and KWS who, then, develop an implementation plan that organizes the proposed changes in a logical, systematic, and systemic manner.

Implement and Evaluate Approved Proposals

Approved proposals for improving the performance of the target school(s) are implemented as planned. The KWS supervises the implementation phase. Formative and summative evaluation methods are used to keep the changes on track and to make final judgements about the overall success of the redesign effort.

PHASE 3: STABILIZATION AND DIFFUSION

Knowledge-work supervision begins with a target school or target organization. After the target school is redesigned, steps are taken to make the redesign improvements a permanent part of that school. Then, the knowledge-work supervision process, and the improvements that were made, are diffused to other schools in the system. This process of stabilization and diffusion continues until the entire school district has been redesigned for high performance.

PHASE 4: CONTINUOUS IMPROVEMENT

Supervising System Boundaries. One thing known about systems is that they are composed of sub-systems. There are boundaries between these sub-systems. Often these boundaries represent functional differences; e.g., 5th grade teachers don't teach 6th grade subject-matter and instruction in elementary schools is different than instruction in high schools. These boundaries must be managed to reduce variances and to ensure quality.

There is also a permeable and invisible boundary between the entire system and its environment. Since the boundary is permeable the system affects and is affected by the environment on a frequent basis thereby creating an autopoietic system. There is a critical organizational need to manage this boundary so that the social and technical sub-systems of the school system can be protected from unnecessary intrusions by elements of the environment. Knowledge-work supervision is the logical and natural process to use for managing system boundaries.

One of the new roles for a knowledge-work supervisor that is not associated with his or her work with an RMT is to supervise the boundaries between grades and between the

system and its environment. Supervision of boundaries would include, for example, developing information management procedures to control the quality and quantity of information passing through and coming into the system; assuring quality communication between and among sub-systems; and acting as a buffer to protect teachers from environmental stimuli that might hinder their efforts to teach.

Seeking Opportunities for Continuous Improvement. After the knowledge-work processes (linear and non-linear) for the entire school district have been redesigned for high performance, knowledge-work supervision shifts its focus to the process of continuous improvement (CI). CI is used to look for incremental ways to improve the work processes of an on-going basis.

During Phase 2 of the knowledge-work supervision process (i.e., Redesign for High Performance), the RMT and KWS engaged in a version of what the literature calls "reengineering"[31] and what is called "redesigning" in this article. The purpose of this phase of the knowledge-work supervision process is to seek significant ways to improve the technical and social sub-systems of the target school.

Once improvements have been completed in the target unit, these changes are stabilized and diffused to other schools in the district. The knowledge-work supervision process is used to diffuse the improvements throughout the school district.

Once the entire district has been redesigned for high performance through knowledge-work supervision, then the focus of supervision changes to continuous improvement. During this phase of the supervision process, the RMT and KWS look for opportunities to make incremental improvements in the technical and social sub-systems of the district.

After a pre-determined period of continuous improvement (e.g., at the end of three years), the RMT and KWS return to Phase 1 of the knowledge-work supervision process to seek new ways to significantly improve the district's technical and social sub-systems.

The knowledge-work supervision process--environmental scanning→→redesigning for high performance→→stabilizing and diffusing→→continuous improvement→→environmental scanning--continues for the life of the school district.

CONCLUSION

The argument for reconceptualizing instructional supervision as described in this article is based on the premise that school districts are *knowledge-organizations* and the work they perform is *knowledge-work*. Because knowledge-work is non-linear, non-routine and often chaotic, a different kind of supervision is required.

Socio-technical systems theory (and metaphors from the new sciences) suggests that supervisors cannot analyze and improve teaching one teacher at a time. Instead, groups of teachers and supervisors must examine the content of their deliberations, the forums within which they conduct their deliberations, the people who participate in the deliberations, and supporting work procedures and devices. These groups of teachers are called Redesign Management Teams and there is one team for each school (or network of schools) in the district. The RMTs collaborate with specially trained Knowledge-Work Supervisors who provide tactical guidance for the supervisory process. A district-wide Steering Committee provides strategic guidance for the entire knowledge-work supervision process.

School systems also have a linear and sequential work process called the instructional program, K - 12. This linear work process is delineated using a grade structure. There are

system boundaries between the grades and similar grades are clustered into units called elementary, middle/junior high, and high schools. There are also system boundaries between each school. Knowledge-work supervision analyzes this linear work process to identify and correct errors and manages the boundaries between systems.

A school system also has a social sub-system. This sub-system includes people, their roles, organizational culture, quality of work life, motivators, satisfiers, and so on. These variables interact with the technical sub-system to produce organizational outcomes. In high performing organizations, both sub-systems are maximized in relation to each other.

Given these systemic characteristics of a school district, the dominant orthodox paradigms of supervision (i.e., clinical supervision and supervision-as-performance-evaluation) seem inappropriate because they focus almost exclusively on what happens within individual teachers' classrooms. Even those supervision models that espouse the value of managing other aspects of schooling in addition to classroom teaching[32] do not focus on the variables that are part of the knowledge-work supervision paradigm. If a high performance school system is desired, it makes sense, then, to reconceptualize the supervision process to support this goal. Thus, it seems appropriate to shift paradigms so practitioners can focus on the supervision of deliberations and on supervising the boundaries between grades, between levels of schooling (i.e., elementary, middle, and high school), and between the school system and its environment. In the knowledge-work supervision paradigm, supervision would also focus on the quality and functioning of the social sub-system in relation to the technical sub-system.

If the proposed knowledge-work supervision paradigm replaces the dominant orthodox paradigms, then there may be a better fit between supervisory processes and the purpose, goals, and outcomes of a school system that desires to become increasingly effective. If supervision becomes a process to move school districts toward higher levels of organizational performance, it could finally become a process that makes a difference for an entire school system instead of for selected teachers. And, perhaps it could also respond effectively and simultaneously to teachers' needs and the needs of the entire school system; thereby, helping move groups of teachers and the whole organization toward higher levels of performance.

SOME FINAL THOUGHTS.

1. In this new paradigm it is believed that building principals, alone, cannot coordinate the work of the RMT, manage the system boundaries, and supervise deliberations as required by the tenets of the new paradigm. Although the literature on effective schools[33] points to the important role principals play in increasing the effectiveness of their individual schools, they cannot be expected to forego their administrative responsibilities to manage boundaries and supervise deliberations (although they can and should assist in this process). Instead, it is suggested that special supervisors, called Knowledge-Work Supervisors, be trained to perform these new critical supervisory roles (in the business world current supervisors are often retrained to perform the new responsibilities that result from the redesign of an organization's socio-technical system).

2. Socio-technical systems theory suggests that each school system and, in fact, each school within a school system has unique organizational characteristics that either constrain or enhance the effectiveness of supervision. One of the biggest mistakes

practitioners have made in the past in trying to improve supervision in schools was to apply directly to a school a theoretical model of supervision without considering the readiness and capacity of that organization to use that model. For example, many school systems have applied strictly the model of clinical supervision to their schools only to find that it did not work effectively. Some criticized the model for this consequence. The integrity of the model may not have been the problem; instead, it probably was the wholesale attempt to lay that model on a school without changing conditions within the school to accept the model. The unique characteristics of a school system may either support or constrain the implementation of any model of supervision. Thus, a school system must be redesigned to incorporate features that support the proposed new paradigm of instructional supervision. Knowledge-work supervision circumvents this problem because it is not force-fitted onto an existing system; instead it is used to redesign the system for high performance.

3. To assure the effectiveness of knowledge-work supervision it must be realized that it is not enough to change the attitudes, knowledge, and skills of individuals. Organizational structures must also be changed (through the redesign process). Examples of organizational structures that may need changing to support this new paradigm include policies, procedures, job descriptions, teaming arrangements, and reward systems. The redesign phase of knowledge-work supervision achieves this goal.

4. To assure the effectiveness of knowledge-work supervision, the process must be related to district-wide organizational goals. This way, knowledge-work supervision becomes a process that links individual schools, their leaders, and their faculty to the mission and vision of the entire school system and to the values embedded in the core of that vision.

The Steering Committee provides strategic guidance for the knowledge-work supervision process and creates desired linkages.

5. Problem-solving capacity must be built into each school within the school system. Although an external consultant is needed to facilitate problem-solving during the early stages of implementing knowledge-work supervision, the teachers, administrators, and knowledge-work supervisors in each school must learn to solve their own problems. This is a critical principle, for without problem-solving capacity within the schools improvements that are made may not be maintained; thereby, returning the schools to the same old ways of doing business.[34] In the proposed paradigm, problem-solving capacity is built into each school by instituting, training, and maintaining Redesign Management Teams that work in collaboration with Knowledge-Work Supervisors.

6. To ensure the effectiveness of supervision the process must be designed as a comprehensive, system-wide program of supervision.[35] A comprehensive program of supervision has a well-defined and easily recognizable structure that is used in all schools, although the specific supervisory activities within the program may vary from school to school. The process and structure of knowledge-work supervision is comprehensive and system-wide.

Within this framework for supervisory behavior, knowledge-work supervision becomes a proactive, innovative, and critical organizational function. KWSs work with groups of teachers (RMTs), monitor system boundaries, and lead the way toward higher and higher levels of group and organizational performance. Knowledge-Work Supervisors

become, in essence, the "drivers" of a school system's effort to improve on a continual basis the educational services it provides to children.

Shifting from the dominant paradigms of instructional supervision to the paradigm of knowledge-work supervision cuts the metaphorical Gordian Knot depicted at the beginning of this article. With its cutting, practitioners and supervision theorists are freed to explore new ways of working with teachers, new ways of organizing for instruction, and new ways of moving the school system and groups of teachers toward higher levels of performance. This proposition is not so farfetched because the new paradigm is derived from the field of socio-technical systems design which has many examples of high performance organizations that became that way through the application of redesign principles similar to the ones described above. It can be done.

Finally, it is important to reiterate that the proposed paradigm is not just another model of supervision couched in the orthodox paradigms of clinical supervision or supervision-as-performance-evaluation. It offers a completely different view of the world called supervision. As a completely different "world" view, it is sure to meet with resistance because it challenges established thinking, teaching, and practice. And it is sure to be resisted by those who have hardened cynicism about the proliferation of so-called "new models of supervision." This potential for resistance to new paradigms was noted by Nagatomo[36] when he said:

> "When the rise of a new theory suggests a change of direction in scholarship, history attests to a common pattern of reaction among the established intellectual community. There is often flat dismissal or at best vehement

attack in order to kill and bury the theory, especially if it signals an imminent as well as immanent possibility of shaking the secure and comfortable foundation upon which the existing paradigm of thinking rests." (pp ix - x)

Yet, there is no research evidence suggesting that the established paradigms make any difference in schools. Therefore, there seems to be a compelling need to reconceptualize the supervisory process so that it can become a truly effective means for improving instruction and promoting the professional growth of teachers. The literature on the application of ideas from the fields that underlie the proposed paradigm suggests that the paradigm of knowledge-work supervision described in this article has the potential to accomplish those two ends.

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