THE RELATIONSHIPS BETWEEN DEGREE OF IMPLEMENTATION AND PERCEPTIONS OF SECONDARY TEACHERS REGARDING MATHEMATICS STANDARDS

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DESIGN OF THE STUDY

> Most change initiatives fail. Two independent studies in the early 1990s found that of the hundreds of corporate Total Quality Management (TQM) programs studied, about two thirds grind to a halt because of their failure to produce hoped-for results. (Senge, 1999, p. 5)

Peter Senge, senior lecturer at the Massachusetts Institute of Technology (MIT) and theorist in the field of management innovation, further comments that "there is little to suggest that schools fare any better" (p. 5). Indeed, the notion of national standards, "the hottest item in education reform today" (Lewis, 1995, p. 745), may be headed for the list of failed initiatives (Howe, 1995).

Why do so many mandated change initiatives fail to accomplish their mission? The answer may be found, not solely in reexamining the change initiative, but also in considering fundamental, human reactions to the implementation of change (Hall & Hord, 1987).

"Implementation is critical for the simple reason that it is the means of accomplishing desired objectives" (Fullan, 1991, p. 66). Hord, Rutherford, Huling-Austin and Hall (1987) contend that:

> The key to successful implementation [of change] is to personalize one's interventions by focusing attention on the concerns of those engaged in the change process and accepting those concerns as legitimate reflections of changes in progress. This contrasts sharply with the more instinctive tendency of managers to direct change from the perspective of their own

> concerns and objectives. Policy makers as well are known to reach decisions and to direct actions based on policy-level concerns, and they should at the very least adjust their expectations for results to take into account the concerns of those affected by the change. (p. 90)

In Michael Fullan's words, "The old way of managing change, appropriate in more stable times, does not work anymore" (1999, p. 3).

Background of the Problem

The Department of Defense Dependent Schools (DoDDS) system educates students of American service members and Department of Defense (DoD) support personnel stationed in overseas assignments. Currently, there are 144 DoDDS schools in 11 districts including the United Kingdom, Brussels, Germany (four districts), Italy, Korea, Japan, and Okinawa. DoDDS also includes the Turkey District, which, for logistical purposes, encompasses Spain, the Azores, and Bahrain. Districts comprise a total of 74,000 students, 6,000 teachers, and 400 administrators.

Located in 15 foreign countries, DoDDS remains unique among American school districts. Despite the diverse cultural settings, DoDDS reflects a strong image of its American stateside counterparts. Certified teachers and administrators are products of accredited United States colleges and universities and students are, with few exceptions, products of the American public school system and the American cultural scene. The DoDDS curricula are representative of current educational trends in the United States. American-produced textbooks and programs are selected to support the curricula. Due to the isolation of DoDDS teachers, extensive professional development programs are

offered worldwide by the Department of Defense Education Activity (DoDEA) headquarters in Arlington, Virginia as well as area, district and local levels.

Although schools are scattered around the globe, they encounter many of the same problems and challenges as other American public schools. One such challenge is the successful implementation of new initiatives. There is a concern that, while some teachers implement initiatives with great enthusiasm, determination and accuracy, others elect to ignore them. This is a significant challenge for an organization whose goal is to assure a seamless education for all students throughout the DoDDS system.

In 1994, DoDEA published its version of the Mathematics Standards and Expectations based on standards developed by the National Council of Teachers of Mathematics (NCTM). The new standards required a major shift in instructional practices, instructional preparation, and assessment procedures. Based on a constructivist philosophy of learning, the standards moved classroom instruction from the traditional emphasis on rote memorization of procedures and facts to context-embedded, hands-on investigations (Brooks & Brooks, 1993). To implement the standards, it was necessary for teachers to orchestrate students working in cooperative groups using manipulatives extensively to promote concept attainment.

Concerned that this dramatic departure from traditional teaching might meet with resistance in the form of varying degrees of implementation by teachers, the superintendent of the Hessen, Germany, district devised a proactive plan. It included the creation of a research study designed to examine the effects of mathematics standards implementation on student performance with change theorist, Gene Hall, as consultant. Thus began the roots of this dissertation.

The possible implications of the Hessen, Germany, study enticed DoDEA Headquarters to replicate and expand the study to DoDDS teachers of mathematics in grades three, five, seven, and nine in Europe and the Pacific. During school year 1997-98, the Office of the Associate Director and the Branch Chief for Accountability, Assessment, Research and Evaluation (AARE) initiated a program entitled Systematic Linking of Instruction, Curriculum and Evaluation (SLICE). The primary purpose of SLICE was to identify components of the teaching of mathematics that related to differences in student success. One particularly important aspect of this research was focused on reducing the achievement gap between students of different gender and ethnicities. An expected outcome of the SLICE study is the identification of research-based content for professional development and support of teachers. Gene Hall also served as a consultant for the SLICE study. The inspiration to pursue the line of inquiry for this dissertation grew from affiliation with the SLICE project data.

Statement of the Problem

An historic and contemporary national trend in education is to adopt and attempt to implement curriculum standards to improve learning in schools throughout our nation's school districts (Berkson, 1997; Brearton & Shuttleworth, 1999; Cohen, 1995; Eisner, 1995; Foriska, 1998; Gandal, 1995; Jennings, 1995; Lewis, 1995; Ravitch, 1995; Tucker & Codding, 1998). These standards are designed by national professional and subject-matter organizations (e.g., American Association for the Advancement of Science [AAAS], Consortium of National Arts Education Associations [NAEA], International Reading Association [IRA], National Association for Sport and Physical Education

[NASPE], National Center for History in the Schools [NCHIS], National Council of Teachers of English [NCTE], National Council of Teachers of Mathematics [NCTM]), states, or district policy setting bodies such as state legislatures, state, or local school boards (Marzano & Kendall, 1997).

The responsibility for adoption is typically that of a school district's Board of Education, however, the responsibility of implementation of curriculum standards at the local level rests with classroom teachers (Hall & Hord, 1987; Fullan, 1991). These teachers are not involved in decisions about curriculum, but are nevertheless charged with the implementation of mandated initiatives (Hord et al., 1987). Because of this lack of involvement, teachers are reluctant to change current practices. This often results in failed implementation of curriculum standards (Hargreaves & Fullan, 1998; Hord et al., 1987).

Gene Hall's *Concerns Based Adoption Model* (CBAM) represents a conceptual framework for research and theory on change that explores this anomaly. CBAM is a unique lens for explaining the change process as it relates to the implementation of innovations. "All too frequently, innovations are 'laid on' teachers. . . . The teachers are then left to struggle and discover through trial and error what the innovation is about and how to use it effectively" (Hall & Hord, 1987, p. 17).

There are three components of the CBAM: *Stages of Concern About the Innovation, Levels of Use of the Innovation,* and *Innovation Configurations.* Hall posits that use of the three components of the CBAM markedly enhances the successful implementation of innovations (Hall & Hord, 1987).

> Because the CBAM model is client-centered, it can identify the special needs of individual users and enable the change facilitator to provide vital assistance through appropriate actions. This approach helps to maximize the prospects for successful school improvement projects while minimizing the innovation-related frustrations of individuals. (Hord et al., 1987, p. 7)

In order to achieve the objectives of this study, it will be necessary to apply two components of the CBAM. The *Levels of Use of the Innovation* (LoU) will be employed to serve two functions. The LoU interview and subsequent analysis will determine the degree of implementation of the mathematics standards for each participant in the study. In addition, the LoU will provide the framework for making sense of the data concerning teacher perceptions of the innovation. The *Stages of Concern of the Innovation* (SoC) will provide an additional lens for explaining the interview data.

Purpose of the Study

Through the lens of Hall's CBAM, the purpose of the study is to explore implementation of mandated change by classroom teachers. Specifically, this study will examine the degree of implementation of the DoDEA mathematics standards and perceptions of secondary teachers regarding the use of the standards. This purpose will be accomplished by the following:

- Documentation of classroom teachers' perceptions and activities in support of the implementation of DoDEA mathematics standards;
- Analysis of these perceptions and activities through Hall's CBAM lens;
- Reporting of other realities that may be revealed; and
- Given this research, assessing the usefulness of the CBAM lens for exploring this phenomenon.

Orienting Theoretical and Conceptual Framework

CBAM is an empirically-based conceptual framework (Hord, 1986) which describes the developmental process that individuals experience as they implement new innovations. An outgrowth of ten years of research conducted at the Research and Development Center for Teacher Education (R&DCTE) at the University of Texas at Austin, CBAM is predicated upon six basic assumptions about the change process (Hord et al., 1987):

1. Change is a process, not an event. A persistent and prevailing tendency in education is to expect change by mandating a program (an event). The recognition that change takes place over time – often years – is a significant step toward the successful implementation of an innovation.
2. Change is accomplished by individuals first, then institutions. Because change affects people, individuals must be considered if their role in the implementation is critical to its desired outcome. "Only when each (or almost each) individual in the school has absorbed the improved practice can we say that the school has changed" (Hord et al., 1987, p. 6).
3. Change is a highly personal experience. Individuals react differently to change and, to promote a positive and productive implementation, their individual reactions must be taken into account. "Change will be most successful when its support is geared to the diagnosed needs of the individual users" (Hord et al., 1987, p. 6).

4. Change involves developmental growth. As teachers progress through the change experience, they are likely to express their progress in terms of feelings and skills that fall into predictable stages commensurate with the degree of change.
5. Change is best understood in operational terms. Teachers relate to the demands of change in terms of what it will mean to them and how it will affect current conditions. By addressing these concerns in concrete, up-front terms, resistance can be reduced.
6. The focus of facilitation should be on individuals, innovations, and the context. The degree of implementation of any change initiative depends on the human element. For this reason, it is imperative that the emphasis on programs and materials does not overshadow the significance of the implementers.

The CBAM framework provides a comprehensive method of assessing the implementation of the change process through three separate but related dimensions:

1. *Stages of Concern About the Innovation*,
2. *Levels of Use of the Innovation*, and
3. *Innovation Configurations*.

"These dimensions represent a conceptualization of the way the concerns and behaviors of individual teachers change as they become familiar with and involved with these innovations (Hord, 1986, p. 13).

Two dimensions of CBAM are designed to describe teachers as they first implement the change and then again as they gain experience with the innovation. These

two dimensions, *Stages of Concern About the Innovation* (Hall, George & Rutherford, 1998) and *Levels of Use* (Hall, Loucks, Rutherford & Newlove, 1975), focus on the individual users of an innovation. *Stages of Concern About the Innovation* addresses teachers' perceptions, feelings and motivations relative to the innovation. *Levels of Use* describes, behaviorally, how teachers are approaching use of the innovation (Hall & Hord, 1984).

Since neither of these concepts is designed to specifically define the innovation, a third dimension, *Innovation Configurations*, was conceptualized (Newlove & Hall, 1998). The *Innovation Configurations* is a detailed description of the attributes of the innovation being studied in order to determine to what degree the innovation is implemented (Hall & Hord, 1987).

> Neither [of] these particular [three] dimensions... can make the extremely complex phenomenon of change clear and simple. Yet, the concepts and dimensions have proven to be of assistance to change facilitators, have offered a viable framework for understanding, facilitating and evaluating change efforts, and have made possible the posing of new types of research questions and examinations of policy. (Heck, Stiegelbauer, Hall, Loucks, 1984, p. 7)

Procedures

This study explores the degree of implementation of mandated mathematics standards and the perceptions of teachers regarding the implementation. The nature of the problem lends itself to the design of the qualitative research method that assumes there are "multiple realities that are a function of personal interaction and perception" (Merriam, 1998, p. 17). Merriam believes that "research focused on discovery, insight, and

understanding from the perspectives of those being studied offers the greatest promise of making significant contributions to the knowledge base and practice of education" (p. 1).

The explanatory case study method of inquiry (Yin, 1989) was employed to gather data for this study. Seeking explanations for why and how events occur is "an ideal design for understanding and interpreting observations of educational phenomena" (Merriam, 1998, p. 2). The case study process promotes the development of a thick description (Creswell, 1994; Lincoln & Guba, 1985) as the vehicle for communicating experiences of teachers involved in implementing an innovation.

Researcher

I have always loved learning. My parents tell me that I announced that I would be a teacher at age four and never considered another vocation. I acquired my first paid teaching position as a Red Cross swimming instructor at age 16 and earned the respect of those much older than myself when I was able to teach even the most traumatized adults to swim. At 20, I acquired my first official teaching position instructing students in seventh grade aquatics, eighth grade co-educational health, and ninth grade physical education. I was addicted.

In the subsequent 30 years, I have taught every grade level from kindergarten through grade twelve. I have experienced many dimensions of education from Learning Impaired to Gifted Education, from Compensatory Education to advanced high school English, from lab school demonstration teacher to instructional coach for teachers placed on Personal Improvement Plans by their evaluators.

After intensive study and years of practical application, I became a specialist in gifted education and was selected as special advisor to the Commissioner of Education for New York State. For the first time, I was in a position to politically influence education. Winning and implementing state and national grants, working as a free-lance consultant, creating publications for the New York State Education Department, teaching graduate school, and directing district programs for gifted education, melded into an incredibly rewarding era of my career.

I chose to expand my experiences worldwide. I taught in Iran for three years and was later hired by DoDDS to work in Italy, Germany and the United Kingdom. I was an elementary, middle level, and high school administrator; became a staff developer for The Study of Teaching; served as the staff development specialist for the United Kingdom District Superintendent's Office; and am currently the Staff Development and Education Equity Specialist for DoDEA at the Arlington, Virginia, headquarters.

My formal education includes an undergraduate degree in education, a Masters in Arts and the Social Sciences in Gifted Education, a Masters of Science in Elementary Administration and Curriculum, and a Masters of Science in Secondary Administration and Supervision. While in England, I was privileged to join a cohort group sponsored by Oklahoma State University and have been most grateful for the opportunity to work toward a Doctorate in Education Administration.

The study of change is my passion and my life has been its testing ground. Despite the broad horizons that life has afforded me, I bring to this study biases that affect how I view, experience and translate the world of change. These biases represent my beliefs about the implementation and adoption of change:

- I believe that change is a perception and that all perception is reality to the owner.
- I believe that all human beings resist change. Some change evokes such minimal resistance that one is not conscious of the happening. Some change breeds resistance experienced for a lifetime.
- I believe that the degree of difficulty, dedication, and emotion experienced with change is in direct proportion to "What's in it for me?"
- I believe that everyone has the potential to change any attitude if they perceive that it benefits them.
- I believe that resistance to change can have positive results, that it can act as a sensor for over-exuberance or misguided positive intent.
- I believe that some forms of negative resistance to change can be dangerous and infectious. I believe it feeds a need in certain persons.
- I believe that if administrators and teachers understood and applied theories of change, many of the frustrations we experience could be avoided.
- I believe that there are ways (some known and others yet to be discovered) that permit human beings to move through the stages of change in a less painful manner; and
- I believe that it is our duty as educators to find out what those methods might be and employ them for the betterment of all.

Methodological Implications

The biases expressed will affect the collection and analysis of the data. For this reason, throughout the study, it was necessary to implement various checks for validity and reliability (Merriam, 1998). I attempted, at all times, to have proper qualitative procedures guide my decisions and actions. The purposive sample (Erlandson, Harris, Skipper & Allen, 1993), for instance, is designed to assure that participants represent a cross-section of the implementation continuum as determined by the LoU ratings.

Triangulation in the form of multiple sources of data (Denzin, 1970) provide a second source for validity check. The analysis of multiple interviewees will reinforce patterns and eventual findings. As suggested by McCracken (1988, p. 41), a verbatim transcript of the interview was prepared by a professional in order to "eliminate familiarity with the data that does not serve the process of analysis" (p. 42). Moreover, because of my biases, I further strengthened the validity and reliability with peer review from a research associate as well as frequent consults with my adviser.

Data Needs and Data Sources

The purpose of this study is to explore the implementation of mandated change by classroom teachers using the conceptual framework of Hall's CBAM. To determine the degree of implementation and teachers' perceptions of mandated standards, data was needed from classroom teachers tasked with the responsibility for implementing standards. This information was provided through qualitative methods of research employing the focused interview process (Merton, Fiske & Kendall, 1956). Prescribed questions from the

LoU interview, required to preserve the integrity of the research-based model, provided the basis of inquiry for respondents. Transcriptions of recorded interviews furnished data for later analysis.

Selection of participants was conducted through a random systematic selection (Creswell, 1994) of seventh and ninth grade mathematics teachers from DoDDS schools in the European and Pacific regions. All teachers in the study work directly with students on a daily basis in a classroom setting. After the initial selection, all participants were assigned an LoU rating commensurate with their degree of math standards implementation by certified CBAM raters. From this list, a purposive sample (Patton, 1990) of 11 teachers was chosen to ensure representation of varying degrees of standards implementation.

Data Collection

The research is based on data gathered from focused interviews (Merton, Fiske & Kendall, 1956) conducted with a selected group of DoDDS teachers responsible for the implementation of DoDEA mathematics standards. The data collection provided information that allowed for a rich, thick description (Erlandson et al., 1993) to permit possible application, dependability and transferability of the research findings (Lincoln & Guba, 1985). Multiple sources of data were provided by the interviews of 11 secondary mathematics teachers. The 11 interviews provided the triangulation necessary to enhance internal validity and neutralize any bias inherent in the data, thereby seeking a convergence of results and adding to the trustworthiness of the study (Creswell, 1994; Lincoln & Guba, 1985; Merriam, 1998). Further triangulation and confirmability (Erlandson et al., 1993)

was sought by having another researcher provide an "audit" trail of important decisions made during the course of the research (Creswell, 1994, Lincoln & Guba, 1985).

At the Arlington headquarters level, management and union officials held discussions concerning the worldwide research design. Agreement regarding the purpose of the study and the participation of teachers was reached between administrative officials and the teachers' association. This binding agreement served as both explanation and consent for the study (Appendix A). In addition, interviewees were informed in writing in advance of their interview (Appendix B). Prior to each recorded session, respondents were assured that their interviews would be kept confidential and appropriately secured. Participants were also informed that there would be no penalty for refusing to participate in the study.

Each respondent was involved in an interview that lasted approximately 30 minutes. Interview questions were general and non-directive, permitting participants to freely state their responses. To protect the integrity of the model, questions asked of the respondents were based on the original theoretical framework from the CBAM LoU construct (Appendix C).

DoDDS official certification for permission to collect and analyze data was issued from the Accountability, Assessment, Research and Evaluation (AARE) branch of DoDEA (Appendix D). Oklahoma State University (OSU) Institutional Review Board (IRB) exception has also been granted (Appendix E).

Data Analyses

The literature review was conducted prior to and during the study. A comparison was created from emerging themes and issues in the literature and data generated from focused interviews (Merton, Fiske & Kendall, 1956). If discrepancies occurred between the literature review and the themes and issues emerging from the data, further research was conducted to clarify and interpret the incongruency.

Inductive analysis was used to interpret the research data. No hypotheses were formulated, tested or proven in this explanatory case study (Yin, 1994). Through the process of constant comparison (Glaser & Strauss, 1967), categories emerged and were sorted from the data according to their salient properties to provide descriptive, inferential information that could be compared to formulate propositions (Lincoln & Guba, 1985). Relational statements from the respondents were categorized from the data in an attempt to provide a meaningful and relevant explanation.

Significance of the Study

An extensive volume of research exists on the issue of change as it relates to implementation. There is a much more limited amount of research available on the topic of standards implementation. Even less is available concerning teachers' perceptions of mathematics standards and the degree of standards implementation in DoDDS. This research study is designed to contribute to the knowledge base regarding mathematics standards implementation in DoDDS schools.

The findings of this study have the potential for impacting educational practices in the arenas of curriculum, staff development, and school improvement. Culling teachers' perceptions for clues regarding standards-based teaching provides valuable information for curriculum coordinators and staff developers hired to implement innovations. Principals held accountable for successful school-level implementation may also benefit from the implications of the study. Efforts of local school improvement teams, composed of educators and community members, may be enhanced by the knowledge this research provides. Lastly, and most importantly, knowledge of teacher implementation, when taken into account at the higher levels, may enable teachers to implement innovations more successfully.

Research using CBAM has focused on developing procedures and studies that would lead to initial verification of various aspects of the model and on increasing the utility of the model for change facilitators (Hall & Hord, 1987). The results of this study may further serve to clarify and validate the usefulness of CBAM's conceptual framework on change. Significant findings and implications may emerge through the application of Hall's framework that will reinforce its significance as a lens for the examination of the impact of change. However, the research process may indicate that an alternative framework or combination of frameworks may prove more useful in examining the data and the literature on change as it relates to math standards implementation in DoDEA.

Summary

In this chapter, readers have been presented with an overview of the national trend for implementing standards-based education in the public schools. The responsibility for

the adoption of such changes in educational practice generally comes from the school district's Board of Education and upper-level administration. However, the responsibility for the actual change implementation rests with classroom teachers who are not involved in the creation of the initiative. This results in failed implementation of curriculum standards.

In planning for the success of change initiatives, it is essential to consider that "change is a process, not an event" (Hord et al., 1987, p. 5). According to Hall's CBAM model, the focus must remain on the needs of teachers in order to improve the degree to which the innovation is implemented (Hord & Hall, 1987).

Specifically, this study focused on the implementation of DoDEA mathematics standards by secondary teachers in DoDDS schools located in the Europe and the Pacific regions. Data gathered from the LoU interviews of selected seventh and ninth grade teachers involved in the implementation were examined through the lens of the CBAM model of change. With the aid of this framework, the impact of the implementation of the DoDEA mathematics standards was analyzed.

Reporting

Chapter II reviews the literature of relevant research on change implementation and literature concerning the standards movement. Data obtained through interviews will be presented in Chapter III. Chapter IV will discuss an analysis of the data gathered. The final chapter, Chapter V, will present the summary, conclusions, implications, commentary, and recommendations for further research, as well as an interpretation of the findings.

CHAPTER II

REVIEW OF RELATED LITERATURE

> A significant body of circumstantial evidence points to a deep, systemic incapacity of US schools and the practitioners in them, to develop, incorporate, and extend new ideas for teaching and learning in anything but a small fraction of schools and classrooms. (Elmore, 1995, p. 1)

More specifically, helping experienced teachers change the mathematics they teach and the ways in which they teach it is extremely difficult (Cohen et al., 1990; Schifter & Fosnot, 1993). Why is there such a strong aversion to implementing new innovations? The literature on change is replete with studies and theories that support the basic belief that human beings resist change.

Chapter II is designed to present a representative view of the research and literature that provides the foundation for this study. To establish a basis for discussion concerning the implementation of standards, a review of the literature on the standards movement is presented. The thinking of noted educators and researchers is consulted to determine the significance of the movement and its implications for implementation. In addition, a review of current literature and research concerning implementation of mandated initiatives is presented. Change theorists and researchers provide insight into teachers' resistance to change as it relates to implementing innovations.

Chapter II also includes a literature review of the *Concerns Based Adoption Model* (CBAM). It is intended that the presentation of pertinent literature concerning the CBAM model will demonstrate its relevance as the lens for examining the implementation of mathematics standards in this study.

Standards

In the last two decades of the twentieth century, dissatisfaction with the performance of U.S. schools grew strong enough to permit serious consideration of major structural changes in American education. Perhaps the most striking initiative, because it departed so dramatically from tradition, was the bipartisan effort to create a national system of standards (Ravitch, 1995, p. 1).

Definition

"It is important for each nation to consider, and periodically reconsider, what it values in education" (Vukelich, 1993, p. 96). Standards are statements about what we value by defining the valued outcomes of the system (Bybee, Ferrini-Mundy & Loucks-Horsley, 1997). They identify what we expect students to know and be able to do, the content we expect students to acquire, the skills we expect them to attain, and the intellectual qualities and habits of mind we expect them to develop. Standards set clear, visible target goals for performance and provide models of what good performance looks like (Albert & Jones, 1997; Burrill, 1997; Bybee et al., 1997; Darling-Hammond, 1994; Foriska, 1998; Kirst, 1994; Lippan, 1997; Porter, 1994; Ravitch, 1995; St. John & Pratt, 1997). Foriska (1998) refers to standards as a "preferred vision" of what is desirable in

educational organizations. "For educators, standards represent the highest vision of effective teaching and learning" (St. John & Pratt, 1997, p. 318).

History

"American education has a long history of standard-setting activity, sometimes overt and purposeful, at other times implicit and haphazard" (Ravitch, 1995, p. 33). However, in 1983, the publication of The Nation at Risk propelled the national standards movement into unprecedented action. "In concluding that education in the United States was unacceptably weak, the authors . . . identified the primary cause as low standards. It is not surprising, then, that their recommended solutions had first and foremost to do with raising standards" (Porter, 1994, p. 421).

States and districts, colleges and universities, as well as professional organizations were quick to heed the standard-setting recommendations of A Nation at Risk (Foriska, 1998). The most visible example of content standards is the National Council of Teachers of Mathematics' (NCTM) Curriculum and Evaluation Standards for School Mathematics (1989). The NCTM standards became the benchmark for other standards-setting commissions and projects (Lewis, 1995; Marzanno & Kendall, 1996). According to a survey conducted by the Council of Chief State School Officers in 1997, 46 of 50 states have created their own standards and indicate that these standards are aligned with the NCTM standards (Burrill, 1997).

In the same year that the NCTM mathematics standards appeared, President Bush held an education summit with the nation's governors, which led to the adoption of six

national education goals with the target date of the year 2000. Goal three, which has received the greatest attention, captures the essence of the content standards movement:

> American students will leave grades 4, 8, and 12 having demonstrated competence in challenging subject matter including English, mathematics, science, history, and geography; and every school in America will ensure that all students learn to use their minds well so they may be prepared for responsible citizenship, further learning, and productive employment in our modern economy. (Ravitch, 1995, p. 2)

In 1992, the National Council on Education Standards and Testing (NCEST), created by Congress, issued an influential report entitled Raising Standards for American Education. The 32-member bipartisan council registered their belief in the promise of high national standards:

> They are critical to the nation in three primary ways: to promote educational equity,to preserve democracy and enhance the civic culture, and to improve economic competitiveness. Further, national education standards would help to provide an increasingly diverse and mobile population with shared values and knowledge. (National Council on Education Standards and Testing, 1992, p. 27)

The Clinton administration Goals 2000 program was enacted into law in1994 (Ravitch, 1995). An outgrowth of the Bush consortium, it required states to establish clear standards for student achievement and to refocus their educational efforts around these world-class standards (Gandal, 1995). Clinton's vision of systemic reform includes national curricular standards as a crucial component. In his February 1997 State of the Union Address, President Clinton's GOALS 2000, a call for standards-based education, further heightened interest in the subject and spread it from the White House to virtually every home in the nation (Foriska, 1998). "Never before has the federal government attempted to establish explicit national standards for what American children should learn in school" (Ravitch, 1995, p. 33).

Benefits

Advocates sight numerous benefits of standards implementation. Higher standards are driven by "what we have learned about children's cognitive growth and by what we know of the curriculum in other countries" (Lewis, 1995, p. 746) and therefore serve as an instructional update. Standards promote equity by setting high expectations, providing a "visible target toward which all students can aim" (Rothman, 1997, p. 4). "To expect students to reach high standards is a vote of confidence in their capacity for hard work and enterprise, the two traits most in demand in the bigger world beyond school" (Murphy & Doyle, 1999, p. 15).

Perhaps the best evidence of the positive effects of standards-driven instruction is in Kentucky. Under the 1991 Kentucky Reform Act, the state adopted the most comprehensive systemic effort to design education around student performance. Clear standards were developed and implemented throughout the state. After five years, significant improvements in student overall performance with gains of as much as 19 percent were seen (Rothman, 1997).

Standards proponents believe that there are issues related specifically to mathematics that can be remedied through the adoption of standards. The fundamental assumptions that underlie the NCTM standards include connecting mathematics to the real world by allowing students to apply mathematics to real-life situations, and by connecting mathematics to other disciplines to demonstrate their interrelationship and reliance on mathematics (National Council of Teachers of Mathematics, 1989). According to the NCTM (1989), there are three reasons for groups to formally adopt a set of standards: to

ensure quality, to indicate goals, and to promote change. "The standards seek to change how students are taught mathematics so that they will, in turn, be provided a strong mathematics foundation that will enable them to meet the challenges of the future" (Price, 1996, p. 49).

Studies on the impact of the NCTM standards-based curricula have consistently demonstrated that students using these curricula significantly outperform students who do not on measures of problem solving and reasoning. Teachers implementing the NCTM standards report numerous instances of students' growth in mathematical learning (Reys, Robinson, Sconiers & Mark, 1999).

Public Opinion

The American public supports change in education when that change will make teaching and learning clearer in United States schools. Every Phi Delta Kappa-Gallup poll of the public since 1989 has found an overwhelming majority of citizens in favor of a "national curriculum." Some 69% favored a standardized national curriculum in the local public school in 1989 and by 1994 this percentage had increased to 83%. The polls indicate the public's desire for changes in education that they believe can be achieved by implementing standards in their schools (Jennings, 1995).

The 1999 release of The International Mathematics and Science Study (TIMSS) has focused national attention on the relative standings of nations. Highlighted is the fact that the United States lags behind many higher-achieving countries in the field of mathematics. The data supports previous findings that our overall level of student achievement remains low to mediocre when compared with that of other developed

nations (National Educational Goals Panel, 1996). Foreign countries such as Japan, France, Sweden and the Netherlands are known for their outstanding math students and have several practices in common. Studies reveal that clear, consistent and demanding standards head the list (Resnick & Nolan, 1995). "Both for reasons of international competitiveness and scientific leadership, the U.S. must move quickly to effect changes to improve the state of mathematics education. It takes a generation to complete the mathematical education of a single individual" (National Research Council, 1989, p. 96).

Summary

"The implications of standards for student learning are profound" (Sparks, 1999, p. 3). Despite their positive potential, "the national standards, however clear and motivating they may be, do not automatically get implemented. Rather they become the center of a set of policies and processes. Policy does not always give rise to practice" (St. John & Pratt, 1997, p. 316). The issue has moved "beyond standard-setting to knowing what to do with standards once you have them" (Murphy & Doyle, 1999, p. 17). If standards are to provide the impetus for improved teaching and learning, the implementation must be carefully crafted. For this reason, studying the implementation of innovations and teachers' reaction to change will be highly significant.

Teacher Implementation of Innovations

"Responsibility and authority for implementation do not necessarily lie with the organizations that developed standards. Teachers assume major responsibility for implementation" (Bybee et al., 1997, p. 328).

History of Top-Down, Mandated Change Implementation

In the 1960s, untold amounts of money were poured into large-scale efforts such as national curriculum and individualized instruction. The assumption that these efforts would take hold without planning was dashed by the stark realities of implementation. Amazingly, the word "implementation" was not even in use as an educational term in the 1960's nor was it ever considered a problem to surmount (Fullan, 1993, pp. 1-2).

The 1970s witnessed the first major studies of failed implementation (Goodlad & Klein, 1970; Gross, Giacquinta, & Bernstein, 1971; Sarason, 1971). The effective schools movement at the end of the decade, which accumulated some evidence that schools can make a difference, followed this attention-grabbing era. By 1980, education had amassed a fair amount of knowledge concerning the implementation of innovations. However, this knowledge came too late for a society who witnessed few large scale, transferable successes. In 1983, A Nation at Risk ushered in the era of large-scale governmental action in the form of top-down regulations including mandated state curricula. In the mid-1980s, restructuring (Elmore, 1995; Murphy, 1991) emphasized decentralization and has contributed to a "combination of bifurcation and confusion" (Fullan, 1993, p. 2). Two camps now exist: centralists who promote greater top-down regulation, accountability and control as the answer, and the restructionists who advocate greater control by school-based educators as the basic solution (Fullan, 1993).

In the new millennium, reform is seen as "too important to leave to educators" (Fullan, 1993, p. 3). Government and business are now major players. The 21st century brought never-ending and complex change, endemic to post-modern society.

Superimposing the notion of the complexity of change onto a highly conservative educational system results in an organization most likely to champion the status quo and shun change.

> When change is attempted under such circumstances it results in defensiveness, superficiality, or, at best, short-lived pockets of success. . . . You cannot have an educational environment in which change is continuously expected, alongside a conservative system and expect anything but constant aggravation. (Fullan, 1993, p. 3)

Never-the-less, "the 'command and control' notion of leadership seems to live on as school leaders too often assume that it's sufficient to hand out standards and tell teachers to implement them" (Sparks, 1999, p. 3).

Resistance to Change Implementation

"Teachers see standards as additional top-down and mandated constraints. . . . The teachers we interviewed scoffed at the general notion that it is their job to implement standards" (St. John & Pratt, 1997, pp. 319-320). Although desire for change varies dramatically among teachers, top-down mandated change is rarely well-received (Ashton & Webb, 1986; Hopkins, 1990; McKibbin & Joyce, 1980; Rosenholtz, 1989). Policymakers have lost sight of the fact that "the teacher is mediator between the knower and the known, between the learner and the subject to be learned. A teacher is the living link in the epistological chain" (Palmer, 1983, pp. 29-30).

Protheroe (1990) believes teacher commitment is one of the most significant barriers to reform that can weaken or destroy implementation efforts. He further observed that a large part of the effectiveness of a program was determined by the willingness of members of the school to undertake the particular reform. "A faculty member's refusal to

pay more than lip-service to any promising initiative . . . affects the level of implementation of the entire program" (p. 99).

Resistance is a natural condition of life in an organization. New approaches and different ways of thinking can be perceived as a loss of control or as a concern for more work. Change can also bring with it excess uncertainty, the memory of past resentments, and concerns about future competence. The natural tendency is for the organizational culture to dismiss approaches that will change the status quo. There is little tolerance for actions that attempt to demand change (Foriska, 1998).

In a 1990 speech, Champlin challenged educators with his belief that, "We must always understand that vision is made into reality through people. If the vision for an organization is to become a reality, all organization members must share in it (p. 2)." If teachers are expected to change their practice, then it makes sense to involve them from the onset and to encourage teachers to lead the project (Wilcoxson, 1997). Local capacity has long been recognized as central to the implementation of instructional reforms (McKaughlin, 1987). In particular, teachers of mathematics must perceive that they are key factors in the effort to reform mathematics (Blosser, 1984; Fullan, 1982; Koballa & Crawley, 1985). "School communities must undertake their own hard work on standard setting and consensus development if they are to become committed to and knowledgeable about change" (Darling-Hammond, 1994, p. 478). It occurs when staff members develop a sense of ownership in improvement efforts, when there are collaboration and shared decision making. "Staff ownership of new programs and new ways of thinking about education result in institutionalized changes that can lead to improved services for students" (Foriska, 1998, p. 10).

Barriers

At a summer 1997 Benjamin Banneker Association leadership conference funded by the National Science Foundation (NSF), one of the working groups identified the barriers they saw for standards-based education. Lack of teacher preparation, poorly prepared preservice teachers, financial inequities, lack of necessary materials, lack of access for students (tracking), unqualified and minimally qualified teachers in mathematics classes, lack of access to technology, labeling products "standards based" when in fact they are not, lack of understanding on the part of politicians, and teachers not held accountable for making changes were all listed as impediments to real change (Burrill, 1997). "To have real change for all students, we must look for ways to eliminate these barriers. . . . Change takes time, resources and support" (1997, p. 339).

Time. Given the amount of learning required of most educators to implement mathematics standards, Lappan (1997) was not surprised to find that time was a crucial resource in Local Education Authority (LEA) mathematics and science reforms. Lappan believes that most educators will need extraordinary amounts of time:

- Time to learn the knowledge required to enact these reforms;
- Time for local reformers to understand the reform ideas and figure out what they might mean for their existing practice;
- Time for local reformers to create opportunities of administrators and teachers to learn about the ideas;
- Time for teachers to grapple with the reform ideas and come to understand how they might reshape their existing practice around these ideas; and
- Time for educators to reflect on their attempts at carrying out these reforms. (Lappan, 1997, p. 225)

Protheroe refers to this phenomenon as "adequate time to learn new roles (1990, p. 106)." Even new resources require that long-standing practices be adjusted. "These changes can be disconcerting or overwhelming to some members of the school community; even with broad support, new initiatives can be tricky to coordinate smoothly" (p. 107).

Support. "The introduction of standards without accompanying support is a sure sign that the reform process underway is political, not educational" (St. John, & Pratt, 1997, p. 320). This is particularly true in the area of staff development. The changes demanded in teaching a standards-based classroom are not trivial. They require a fundamental shift in what it means to teach, to enable students to learn and not just to present information (Ravitch, 1995). "Teachers will have to change their definition of 'good class,' their teaching philosophy, classroom management skills, lesson planning, preparation, and assessment procedures" (Gibbons, Kimmel & O'Shea, 1997, p. 303). "In order to adjust, teachers need long-term support, more intense content preparation, and professional development that is tied to their teaching" (Burrill, 1997, p. 336).

The implications of new forms of discourse in the classroom pose a considerable challenge for professional development. "There is a need to begin at ground level and build teacher support systems that can educate and assist teachers in changing their minds and their practice to encourage more powerful mathematics and mathematical thinking for students" (Lappan, 1997, p. 230).

> Many teachers have never experienced learning mathematics in situations where value is placed on the quality of the thinking, the quality of explanation or argument, and the quality of decisions made based on the evidence. In addition, many teachers have little experience using tools –

> intellectual as well as physical tools – as ways of modeling, exploring, or representing ideas in mathematics. (p. 230)

The team concept, for example, can have a tremendous impact. According to Schmoker (1996), schools increase student performance when teachers work in focused, supportive teams. More could be accomplished through team problem solving than by individuals working in isolation. Plans for implementation should evolve from a team. The team concept allows educators to develop ownership for the change process. The team concept also delivers the message that they are not working alone. This is a vital element because successful implementation of the innovation depends on what happens at the classroom level (Foriska, 1998).

Summary

Why is it important that education develop a capacity for change? Wilcoxson (1997) believes that reform will not occur unless teachers are willing to change what happens in the classroom. Fullan (1993) argues that there exists an even deeper reason to build capacity for change in educators. It is a moral purpose, a purpose that aspires to make a difference in the lives of all students, to enable them to live and work productively within the demands of an increasingly complex society.

> What is new . . . is the realization that to do this puts teachers precisely in the business of continuous innovation and change. They are, in other words, in the business of making improvements, and to make improvements in an ever-changing world is to contend with and manage the forces of change on an ongoing basis. (Fullan, 1993, p. 4)

"Continuous innovation and change" – precisely the dilemma of the teachers implementing mathematics standards in this study.

Research reminds us that time and professional development are keys to promoting successful implementation. Significant staff development reduces resistance by involving teachers in the analysis, collaboration, and conflict resolution as decisions are made and innovations are being created and implemented (Foriska, 1998). CBAM provides staff developers with the information necessary to support teachers as they implement innovations.

The Concerns Based Adoption Model (CBAM)

> Change is a highly personal experience – each and every one of the teachers who will be affected by change must have the opportunity to work through this experience in a way in which the rewards at least equal the cost. (Fullan, 1991, p. 127)

> In the 1970s, early CBAM innovators attempted to define the simple yet complex notion of change implementation by examining the educational innovations whose value was in question at the time. It became increasingly apparent that the post hoc evaluations of the many educational innovations were only half-correct. Evaluators were right to report "no significant difference" related to the innovations, but incorrect to conclude that the innovations were at fault; rather, we believe that the process of implementing these innovations had gone awry or was not fully addressed. Consequently, innovations were frequently not fully implemented and therefore not fairly tested. (Hall & Hord, 1987, p. 7)

The CBAM model supplies a framework for examining change as it relates to those who are making the changes. In particular, it has been selected as the lens from which to examine the implementation of DoDEA mathematics standards. Two dimensions of the conceptual model are particularly relevant to this study. The *Levels of Use of the Innovation* (LoU) research provides the structure for the standardized interview process. It also offers an analysis of the interview to determine the degree of standards-based

curriculum implementation of each teacher. The *Stages of Concern About the Innovation* (SoC) furnished an additional lens for examination of the interviews.

Stages of Concern (SoC) about the Innovation

Hall and Hord (1987) hypothesized that there is a set of developmental stages teachers move through, as they became increasingly sophisticated and skilled in using new programs and procedures. The SoC dimension focuses on "the feelings, thoughts and information needs of the innovation user" (Loucks et al., 1998, p. 1). It addresses the notion that teachers located in the "I"-centered stages are not able to concentrate their efforts on students' needs through innovation modification. When individuals are introduced to an innovation, they are preoccupied with wondering what it will require of them and how their roles will change. "As these concerns are resolved, more task-oriented concerns emerge. Questions about what materials are needed daily and how to schedule time more effectively are typical" (p. 1). In the later stages, concerns focus on how the innovation affects students, how to collaborate efforts or even to enhance student learning by replacing the innovation (Hall et al., 1998). CBAM describes seven stages that reflect a progression of concern.

The following is a brief description of the seven *Stages of Concern* divided into three main categories as outlined by Hord et al. (1987):

Self Concerns

0. Awareness: Little concern about or involvement with the innovation is indicated.

1. Informational: A general awareness of the innovation and interest in learning more detail about it is indicated. The person seems to be unworried about herself in relation to the innovation. She is interested in substantive aspects of the innovation in a selfless manner such as general characteristics, effects, and requirements for use.
2. Personal: The teacher is uncertain about the demands of the innovation, her inadequacy to meet those demands, and her role with the innovation. This includes analysis of her role in relation to the reward structure of the organization, decision making, and consideration of potential conflicts with existing structures or personal commitment. Financial or status implications of the program for self and colleagues may also be reflected.

Task-Oriented Concerns

3. Management: Attention is focused on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are paramount.

Impact Oriented Concerns

4. Consequence: Attention focuses on impact of the innovation on students in the teacher's immediate sphere of influence. The focus is on relevance of the innovation for students, evaluation of student outcomes, and changes needed to increase student outcomes.

5. Collaboration: The emphasis is on coordination and cooperation with others regarding use of the innovation.
6. Refocusing: The focus is on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative. The teacher has definite ideas about alternatives or the proposed or existing form of the innovation.

The first stage characterizes a person who has little, if any, knowledge about the new innovation. The remaining six stages represent three general categories of concerns:

1. Self Concerns (stages 1 and 2) are reflective of teachers who are asking, What is this new change and how will it affect me?
2. Task-Oriented Concerns (stage 3) are representative of teacher queries such as, How do I implement this change? What do I need to do to make this change happen with my students?
3. Impact-Oriented Concerns (stages 4-6) are composed of teachers who are asking, How are my students learning? Are they learning more and are they learning better? How do I work with others who are also implementing these new ideas? (Gann, 1993, p. 289)

The process appears to be developmental because earlier concerns must first be resolved or lowered in intensity before one moves on to another level. Research suggests that this developmental pattern is applicable for most process and product innovations (Hall et al., 1998). It is also significant to note that the advancement of teachers to a higher level of concern is not simply engineered by an outside force. The individual owns the stage of concern and therefore the change comes from within (1998).

> There is no guarantee that arousal of higher stage concerns will follow the reduction of lower stage concerns. . . . Whether and with what speed higher level concerns develop will depend on the person as well as the innovation and the environmental context. (p. 6)

Levels of Use (LoU) of the Innovation

The concept of the Levels of Use (LoU) dimension of the CBAM model allows us to examine implementation not as an "either-or" phenomenon, but as a continuum of defined stages. Data collection is accomplished through a structured interview (Appendix C) that determines individual levels of implementation of the innovation from non-use, through mechanical, to refinement (Loucks et al., 1998). It is significant to know a teacher's level of use of an innovation since it is not until the teacher advances into the refinement level, that she makes adaptations in the innovation that positively affect student achievement (Borchardt, Hall & Hord, 1996).

The LoU describes the behavior of individuals as they become more familiar with and more skilled in using an innovation. Each of the eight identified levels focuses on behavior that is characteristic of the innovation user at a particular stage of development. The model proposes eight discrete levels of use of an innovation that an individual may demonstrate. Levels range from lack of knowing that the innovation exists to an active searching for a superseding innovation (Hord et al., 1987). CBAM researchers hypothesized:

> Growth in quality of use of an innovation (movement toward higher levels) by most individuals is developmental. Normally, individuals do not use an innovation for the first or even the second time as effectively and efficiently as they do after four or five cycles of use. Each level encompasses a range of behaviors, but is limited by a decision point that denotes actions that move the individual to the next level. For example, when a person

experiences some initiative to learn about an innovation, he or she has reached decision point A and moves from level 0 to 1. (p. 56)

The following is a brief description of the eight Levels of Use About the Innovation as described by Hord et al. (1987):

- LoU 0: Non-User of the Innovation. The teacher may know something about the innovation but is making no effort to learn more and does not plan to use the innovation. This absence of any action toward use of the innovation signals level zero.

- LoU I: Orientation. Teachers on the orientation level of implementation are definitely taking the initiative to learn more about the innovation and indicate that they will probably use it in the future. No time has been established for beginning the use.

- LoU II: Preparation. A definite time for beginning use has been established on the preparation level. Teachers are taking steps to get ready to begin use but have not actually started to implement the innovation.

- LoU III: Mechanical Use. Teachers involved in the mechanical use level are struggling with the management of materials and time factors involved in implementing a new innovation. They are aware of how the program should ideally work but are not able to use it in that way. It is not atypical for teachers to remain at this level for quite some time as they struggle with the logistics of a new program.

- LoU IVA: Routine. Teachers on this level have reached routine use and do not intend to make changes. Once a teacher reaches the routine LoU it is not uncommon to remain there for an extended time, making only minor adjustments in patterns of use.

- LoU IVB: Refinement. When teachers begin to modify the program for the benefit of students, they are functioning on the refinement level. If, however, changes were made to accommodate a management problem or make the teaching day less hectic, it would reflect LoU III.

- LoU V: Integration. Teachers who reach the integration level have decided on their own to collaborate because they believe that by so doing, they can provide better learning experiences for their students. LoU V is determined by two key variables: collaboration

between two or more persons and changes in use of the innovation for the benefit of students. The collaboration must be regular, not causal conversation every couple of weeks. Because most teachers tend to work as solitary craftspersons, the number of persons at LoU V is typically small.

- LoU VI: Renewal. Ideas for major changes in the use of the innovation are characteristic of the renewal level. Reasons for the changes are focused on students and what the teacher feels they need to improve learning. It is important to note that although the teacher is thinking about, talking about, and planning these changes, they have not occurred. "Once the teacher actually makes the proposed changes, he will probably be dealing with another innovation and his LoU will recycle based on that innovation" (Hord et al., 1987, p. 62).

The LoU dimension of the CBAM describes the various behaviors of the innovation user throughout the eight developmental stages of implementation; from spending most of the implementor's time and effort orienting, then managing, integrating, and finally superseding the use of the innovation.

Before actual use, individuals become familiar with and increasingly knowledgeable about the innovation. The first use is typically disjointed and management problems are quite common. With continued use, management becomes routine. The teacher is able to direct more effort toward increased effectiveness for the students and to integrate what she is doing with what others are doing. Obviously, these advanced levels of use are not attained merely by use of the innovation through several cycles. Experience is essential but not sufficient to insure that a given individual will develop high-quality use of an innovation (Hall & Hord, 1987).

The LoU dimension is targeted toward describing behaviors of innovation users and does not focus on attitude, motivation, or other affective aspects of the user. "The dimension does not attempt to explain causality. Instead, the LoU dimension is an attempt

to operationally define various states of innovation user behavior, i.e., what the user is doing" (Hall et al., 1975, pp. 5-6).

LoU Interview

The procedure chosen to measure an individual's LoU is the focused interview. According to Merton, Fiske and Kendall (1956), the focused interview employs an interview guide with a list of questions but gives the interviewer latitude within the framework of the interview guide. Certain specific questions are required since they are effective and efficient in eliciting the necessary information. The interviewer must be intimately knowledgeable concerning the objectives of the interview and is often required to use judgment in sequencing these questions, as well as pursuing insufficient responses with further probing.

The selection of a focused interview rather than a highly structured interview (one that requires standardized questions, probes and procedures) is based on several considerations. Although the LoU interview does require certain questions, the LoU concept is too complex to expect that probes and follow-up questions can be completely standardized and still be appropriate for every situation. As MacCoby and MacCoby (1954) note, less structured interviews allow for standardization of meaning rather than relying on the same words to mean the same thing to each interviewee. Interviewers respond differently in extent, as well as content. For the objectives of the interview to be met, follow-up responses must be individualized. Less rigidity also encourages more true-to-life responses since the interviewee can follow a natural train of thought. Thus, more complete and detailed responses are obtained. "The amount of freely provided and

important information that has been obtained through over 1,680 LoU interviews supports the belief that the selection of this interview procedure was well made" (Loucks et al., 1998, p. 2).

The problem remains that relying chiefly on the self-report of an individual may not give a full, true picture of that individual's behavior. To compensate for this potential weakness, the LoU interview has been developed in such detail that questions can be asked about various independent yet related behaviors that contribute to establishing an individual's overall LoU. MacCoby and MacCoby (1954) point out that if a number of questions are asked that differ in form and content but are related in a predicted meaningful or logical fashion (as they are through operational definitions of LoU), then a high correlation between responses to these questions indicates that they tap a common characteristic of the individual.

> It has been found in LoU research that an individual's responses to the interview questions are highly correlated, and therefore, it can be assumed with a high degree of certainty that they measure what they purport to measure, Level of Use of the Innovation. (Loucks et al., 1998, p. 3)

CBAM research indicates that change does not occur easily or quickly. As a general rule, 60 to 70 percent of the first-year users of an innovation will be at the mechanical level. "Unless the innovation itself calls for collaboration among users, few will reach the integration level" (Hord et al., 1987, p. 66). Fullan agrees. "People need each other's knowledge to solve problems. The motivation to share and the opportunity to access information requires ongoing interaction" (1999, p. 3). Even fewer reach the renewal level. Those who do may not remain there long. "When they act on their ideas,

they usually create a new innovation for themselves and their LoU will recycle [to a lower LoU] based on that innovation" (Hord et al., 1987, p. 66).

> We cannot assume that people will adopt an innovation just because it has been introduced. Research conducted in hundreds of schools and involving many innovations has revealed that it is quite common to find at least 20 percent of the teachers in any school who are non-users even in the second and third years of implementation. Often the percentage of nonusers is much higher. (p. 66)

Bybee and Ferrini-Mundy applied the change theory to mathematics standards implementation and agree that, "It is unlikely that all professionals in mathematics education will be uniformly committed to every word and idea present in the national standards" (1997, p. 281).

Summary

"Despite the seemingly widespread awareness of the standards, it is also clear that teachers have not yet translated the words into practice" (Burrill, 1997, p. 336). This phenomena is precisely what CBAM claims to measure. The various stages of concern that teachers move through in response to the implementation of an innovation and the degree to which they choose to implement that innovation is documented and examined through the CBAM process. It attempts to explain why Wertheimer's claim that "Change needs to be measured over years and possibly decades" (1995, p. 87) is a reality in education.

Summary

Three interrelated topics have been addressed in the search of the literature in order to provide a basis for this study. The literature concerning issues around standards provides the backdrop for understanding that educating students in a "planned and systematic fashion begins with the identification of standards. [And, that] we use standards to help structure the blueprint for developing a system capable of excellence" (Foriska, 1998, p. 6).

The second related issue addresses top-down mandated change and its effects on teachers' implementation of the innovation. If, indeed, standards are a necessary part of student success, then "teachers must be the cornerstone of any systemic reform directed at improving our schools" (Darling-Hammond, 1994, p. 482). Understanding and acknowledging that resistance is an inevitable human reaction to change allows us to be proactive when planning and supporting implementation.

Most previous reform attempts in mathematics education are now judged to have failed primarily because "researchers and curriculum developers failed to take into account the existing knowledge, beliefs, values and purposes of teachers . . . and of the cultures and contexts in which teachers work" (Knapp & Peterson, 1991, p. 2). For this reason, the search of the literature explores a third issue: the concept of CBAM and its contributions to the research regarding change implementation.

> In the last couple of decades, the most predictable characteristic of education has been change. . . . Although innovations have been very common, their success has been limited . . . Many educators feel it is not the quality of the innovation that is lacking; rather, this failure is due to our lack of knowledge about and attention to the process of change and the requirements for successful change. (Loucks et al.,1998, p.1)

The literature search helps to validate the notions that standards are an essential part of what and how we teach, and that the degree of standards implementation is directly linked to teachers' stages of concerns regarding the mandate. The research demonstrates that "change is not easy even when those involved are committed to making the effort" (Protheroe, 1990, p. 107).

CHAPTER III

DATA PRESENTATION

The purpose of this study was to explain the implementation of mandated change by classroom teachers through the lens of the *Concerns Based Adoption Model* (CBAM). Specifically, this study examined the degree of implementation of the Department of Defense Education Activity (DoDEA) mathematics standards and perceptions of secondary teachers regarding the use of the standards. Eleven secondary mathematics teachers were selected for the study from a representative sampling of teachers in the Department of Defense Schools (DoDDS) in the European and Pacific regions.

The empirical information collected from each teacher is presented in this chapter. Teachers' comments were collected through the administration of the *Levels of Use* (LoU) interview. Extracted from the interviews were the teachers' perceptions and activities in support of the implementation of the DoDEA mathematics standards. The purpose of this study was further accomplished by analyzing these perceptions and activities through the CBAM lens; reporting other realities revealed; and assessing the usefulness of the CBAM lens for theory, research, and practice. The findings were cast against the literature on the current standards movement, the literature on the implementation of change, and the conceptual framework of CBAM.

Level of Use (LoU) Interviews

The administration of the LoU interview provided data concerning the degree of implementation of the DoDEA mathematics standards and the data for analyzing teachers' perceptions and actions regarding the implementation.

Certification of Interviewers

During the summer of 1998, Gene Hall, one of the original designers of the CBAM, trained selected DoDEA educators as interviewers for the LoU process. Several months after the training, to insure reliability, all trainees submitted taped interviews accompanied by written analyses to be evaluated for accuracy by Hall and associates. Those who demonstrated proficiency in the use of the LoU interview process, including the ability to assess and accurately rate the LoUs, were certified and assigned to the DoDEA research project, Systematic Linking of Instruction, Curriculum and Evaluation (SLICE). The taped interviews and the assigned LoU ratings used in this study were products of these certified evaluators.

Participants

The initial pool of participants was generated through a random systematic selection (Creswell, 1994) of seventh and ninth grade mathematics teachers from DoDDS schools in the European and Pacific regions. Each of these teachers became involved in the DoDEA SLICE project and were administered an LoU interview by certified CBAM

raters and an LoU rating indicating their degree of mathematics standards implementation. From this list of initial SLICE participants, a purposive sample (Erlandson, Harris, Skipper & Allen, 1993) of 11 teachers was chosen to ensure representation of varying levels of standards implementation for this study.

Procedure

The procedure chosen to measure an individual's Level of Use (LoU) of an innovation was the focused interview (Merton, Fiske & Kendall, 1956). The interview, designed by the developers of CBAM, requires extensive training to assure that design objectives are reached (Loucks, Newlove & Hall, 1998). In the administration of the LoU, specific questions are required since they have been found to be effective and efficient in eliciting the necessary information. However, an intimate knowledge of the interview objectives is required to properly pose and sequence questions as well as follow up on insufficient responses with further probes (1998).

Although the LoU interview requires prescribed questions, the concept is too complex to expect that probes and follow-up questions can be completely standardized and still be appropriate for every situation. For this reason, flexibility is built into the interview. Another important characteristic is that it is not specific to any one innovation: it is generic. The LoU concept and the recommended interviewing procedure may be used for any innovation. Different questions are not required for different innovations (Hall, Loucks, Rutherford & Newlove, 1975).

To account for individual variation in use of an innovation, the LoU standardized process analyzes eight discrete levels of implementation that an individual may demonstrate. The range includes: Level 0, lack of knowledge that the innovation exists; Level I, orientation; Level II, preparation for implementation; Level III, mechanical use; Level IVA, routine use; Level IVB, refinement; Level V, an active, sophisticated and highly effective use; and Level VI, actively searching for a superseding innovation (Loucks, Newlove & Hall, 1998). Each LoU dimension describes the various behaviors of the innovation user during that particular stage of implementation. Behaviors range from spending most efforts orienting, managing, and finally integrating the use of the innovation (1998). Because the mathematics standards were mandated several years prior to this study, no teacher was found at Level 0, I, or II. It would also stand to reason, however, that few, if any, teachers would have reached the renewal or highest Level VI within these few years.

LoU Implementation Ratings

Based on the analysis of the LoU interviews, the following LoU ratings were ascribed to the teachers involved in this study. A letter of the alphabet from A through K identifies each teacher (see Table I).

TABLE I

LEVEL OF USE IMPLEMENTATION RATING

Teacher Indentifier	Level of Use (LoU) Rating							
	0 Non-Use	I Orientation	II Preparation	III Mechanical Use	IVA Routine	IVB Refinement	V Integration	VI Renewal
A							X	
B					X			
C				X				
D						X		
E				X				
F					X			
G					X			
H							X	
I					X			
J						X		
K					X			

Note: X=rating assigned to teacher.

Reporting

Empirical information, in the form of teacher perceptions, was collected from the LoU interview comments from 11 DoDDS secondary mathematics teachers. Using the process of constant comparison (Glaser & Strauss, 1967), seven categories emerged and were sorted from the data according to their salient properties to provide descriptive, inferential information that could later be compared to formulate propositions (Lincoln &

Guba, 1985). Relational statements from the respondents were categorized from the data in an attempt to provide a meaningful and relevant explanation of the data (Glaser & Strauss, 1967). The following are the seven categories under which the teacher data has been organized and presented in this chapter:

1. Reaction to Mandated Change: Teacher perceptions regarding top-down mandated standards implementation, local-level input, and teacher involvement in decision-making.
2. Commentary on Mathematics Standards: Teacher remarks regarding the standards, standards implementation, and standards-based instruction.
3. Sharing of Ideas and Materials: Teachers meeting, sharing and working together.
4. Modifications of Standards Implementation: Teacher-generated adaptations to mandated standards-based instruction.
5. Effects on Students: Teachers' perceptions of the impact of the standards implementation on students and student achievement.
6. Impact of Institutional Support: Teacher readiness for implementation of new standards and the concomitant teacher expressions of certainty, adequacy and confidence regarding the support.
7. Logistical Issues: Time, resources, supplies, and supplementary materials.

Teacher Interview Data

This section reports the empirical information from the 11 secondary DoDDS mathematics teachers involved in the study. Each of the seven categories mentioned above

provides a window from which to observe the perceptions of teachers relative to the implementation of mathematics standards. It is the intent of each category to provide an accurate view of teachers' beliefs and feelings. Data organized by the number of teachers who expressed similar outlooks created the basic outline. The picture comes alive however, through the words of the teachers. Their commentary adds color and perspective to the view afforded by each category. It is hoped that as the reader progresses through the categories, a more complete picture of teachers' perceptions will emerge.

Each of the seven categories is divided into three sections. The first section, the introduction, defines the category. The second section contains the data in the form of teacher comments. In order to make the data more meaningful to the reader, a number of subcategories have been created. The final section in each category is the summary. Throughout the chapter, I have taken the liberty to bold certain words and phrases. The intent is to highlight specific concepts that will aid the reader in observing patterns and intensity of feelings.

Mandated Change

Teachers' perceptions of imposed standards are found under the category of mandated change. This category involves comments that reflect teachers' thinking concerning top-down mandates and teacher involvement in decision-making.

Language of Mandated Change

Six of the 11 teachers - more than half - commented about mandated change even though none of the interview questions solicited such remarks. Statements regarding

mandates were replete with words such as "forced," "required," "make you," "I can't," and "no choice." Teacher perceptions fell dramatically into two groups.

The first group of four teachers felt forced to implement standards and expressed negative feelings regarding a variety of issues, which, they believed, were a byproduct of the innovation. Two teachers blamed the text: "It is the text I am *required* to use," and "Well, I *can't* use another textbook until a new one is adopted." Others were more blatant, "Well, I *don't have a choice*!" and, "We have a monthly math department meeting. Every subject area does. It's *prescribed by the boss*."

There is irony in the reactions of the second group. Of the six teachers that believed they had "no say" in the implementation process, four actually used the word "force." Others used synonyms such as "made me," "didn't have a choice," and "required." In almost every case, although the teachers intended their comments to be negative criticism, they reflected positive changes that came as a result of the mandate. One teacher reported, "The standards *force* us to teach communication." Two teachers had similar thoughts: "When I was *made* to do the book [based on the standards], I started doing groups," and

> When we first started this text, I've always been a person who would say, "Don't say it's bad until you've tried it." I've tried it now, this is the third year and I am firmly convinced that it has *forced* a lot of people to do more group work with the children.

Teacher C felt compelled to comment this way:

> The strengths of the book are probably the fact that it *forces* not only the students, but the teachers, to use the word problems. I think many, many, many teachers avoid them because it's very hard to teach them to students because there's no a, b, c, d method of doing it. Many teachers are used to that. They like their lives compartmentalized and all straightened out and because the book is not like that, it is very difficult for you to teach these

> systems because you fall back on trying to make it all work out a, b, c, d or 1, 2 3, 4. This book *forces* you to teach it. It can be done in a better way, but that's one of the things that I see, if there are good things to it. And, there are some good things to it. It *forces* you to make kids interact with each other in a different way.

Through Teacher D's lament, there is an indication of change, "We *don't have a choice* with the standards. A lot more English has come in using actual paragraphs and sentences. And, the communication mode at the same time, even in the non-written work." Another positive effect, stated in the negative, included Teacher D:

> The standards *make you* have to learn to work well in groups. Sometimes those groups are the entire class or a large part of the class, so you will have to come up and present your "record of thinking." That's a big thing in the seventh grade in the standards.

The language of the interviewees yielded further clues reflecting feelings of mandated change. More than one-third of the responders expressed a belief that an external power imposed the standards onto teachers who had no recourse. Four persons used language that suggested the existence of an external power. The highlighted words and phrases are my attempt to designate indicators of external control. "We are *just waiting* for the next series of textbooks to come in," or "Anxious to see what *they* are going to come up with next," or "Our textbooks are *selected by DoDDS* periodically, every five or six years. Our textbooks *are set*."

Others indicated that much of what happens is a mystery. Teacher F relates that, "I understand the standards are undergoing some rewriting and rethinking and I'll be anxious to see what *people* come up with." Those "people" referred to by Teacher F are from Washington, according to Teacher H, who emphatically stated, "If I have one frustration, it seems that *people in Washington* take our time instead of helping us protect it. They

take it away from us so we can generate pretty useless paperwork that I guess justifies jobs someplace." In the case of Teacher F, he was unable to tell us who was forcing him, but "they" were making him feel that, "If there is any one weakness, I think, it is the feeling that if technology isn't used at every turn, every day, at every minute, there is *something wrong with the individual in charge* of the classroom."

Conforming and Resisting

Two educators, B and G, demonstrated degrees of non-support of the standards. They represent educators who are aware of the requirement to implement standards-based instruction but are not convinced that standards have merit. Their comments illustrate support ranging from token or passive behavior to out-right defiance and have been highlighted in hopes that the reason for selecting these particular quotes would become more clear to the reader.

Teacher G expressed his degree of support using these tentative words: "I *probably try* to address the standards *without actually doing exactly what it says*," as well as, "I'm *probably pretty close to 50%* of them [standards] being covered. Well, *enough to say they're covered.*" The sentiments of teacher B are a bit stronger:

> We use a math program here at the school that basically conforms to what DoDDS wants us to use. . . . We teachers are pretty independent. A teacher can teach his course or her course almost any way he or she wants to.

As the mathematics chairperson for the school, he expressed his views on cooperative learning and its place in a standards-driven program when he commented, "My math

teachers have gone to cooperative learning. . . . [but], it's just *not a math thing*." To teacher B, the final statement of his interview justified his reluctance:

> You got to understand that I've been teaching math for almost 30 years, 35 years, and I'm an old timer. New teachers, new teachers in the program, are going to adjust to a radically different kind of textbook better than some of the older teachers.

Top-Down Mandates Override Teacher Judgment

In three cases, teachers felt that they were never part of the decision-making process and, even when they registered their concerns, they were overridden in deference to parents. Two of the three concerns have no relationship to mathematics standards and were never solicited by the interviewer. However, the passion was so intense that all three felt a need to express concerns that left them feeling powerless.

Implementing the standards despite the resistance of parents, Teacher D exemplified those who encounter roadblocks when delivering the standards.

> The parents would like a lot of standard worksheet kinds of math, standardized tests; they want lots of grades. They want it the old way. . . . And therefore, there is kind of a knee-jerk reaction that is like, "Yes, go back and teach all those basic fundamentals. The kids aren't going to learn anything." The technology, of course, I think I haven't mentioned it before, but the use of the hand calculator. It takes a certain amount of education with the parents to get them to realize that it's a very crucial tool in the learning process.

The effects of standardized testing and how it altered what and when he taught was a concern of Teacher G. He was aware of the expectations of parents and their belief that student performance on the test reflected his teaching abilities. "I always try to do as much as I can before a testing, the Terra Nova testing. We want to try to get as much done by then."

Teacher B experienced similar frustrations when determining the sequence of mathematics classes.

> Because parents will override teacher recommendations, you get those kids into Algebra I. Those kids aren't going to do well, so at the end of the first semester, at the end of the year, they're making D's and F's. The teachers are going to recommend they go into Intro-Algebra or retake Algebra I or go into Intro-Geometry. But again, it's because they haven't gotten the first fundamentals down. If they were to take Intro-Algebra, as recommended, as a ninth grader, and the next year possibly Algebra, and the next year possibly Geometry. . . . We ten math teachers know that and we spend a lot of time in the spring with the guidance department making recommendations for each student. We do that individually. . . . It's written down, submitted to the guidance office that you should be taking this course next year. All the parent has to do is write a note saying they're putting them in that class. So there is a weakness in that system somewhere!

Summary

Although the question of mandated standards implementation was never posed during any teacher interview, many responders found an opportunity to share frustrations. Their words expressed a belief that they were forced into mandated change. Responses ranged from passive to defiant. Most fascinating was the number of teacher comments concerning issues that were unrelated to the implementation of standards-based instruction. Such discussions were often lengthy and passionate, suggesting the belief that standards were the source of all mandates gone awry. It is important to note that, because none of these comments were solicited in the interview, teachers who felt positively about mandated change may not have felt the need or taken the same opportunity to voice their thoughts.

Commentary on Mathematics Standards

Comments assigned to this category expressed the thoughts and feelings of interviewed teachers regarding the need to teach to the standards. Categories include: Defining Standards, Misconceptions, Use of the Standards in the Classroom, and Additional Information Requested.

Defining Standards

Five teachers provided comments that demonstrate their belief in the potential of standards-based mathematics. Teacher A stated,

> I think the strength it provides is a unified curriculum in mathematics throughout the United States. It lets everybody know that in the seventh grade these kids should know this, not necessarily that they should have mastered it but they should have been exposed to these certain skills. And in that way in the sixth grade, seventh grade, eighth grade, all up and down the spectrum, you're not teaching the same fractions and decimals every single year the same way, you know, the same old stuff.

Teacher A continued,

> I tell people that the standards are the framework for teaching mathematics. They provide, again with the curriculum, so a kid can move from one school to another school and they're going to get the same math regardless. And I think that's great, the key thing in our mobile population, that when a kid moves from one school to another, they know what math they're going to get in the seventh grade. That's a standard.

Teacher F added a critique: "Well, I think, generally speaking, the guidelines are really, really good. These last five or six years or eight years the standards have given us some new direction." An obvious advantage for the student was seen by Teacher D: "The strength is that you have a student who has a little bit better idea about exactly why they're trying to study. They have an objective, they have a purpose, so they have a better

overall view." Teacher E represented many of the remaining teachers who believe "the standards don't need to be ditched *totally*."

Misconceptions

As Teacher A reflected on the standards and their implementation, she led us into the next phase of our commentary: misconceptions.

> The thing I found when I got here was [that] people were not real familiar with the standards. They had been teaching a certain way for their teaching career and were not familiar with standards. They knew they existed, but they didn't have a firm grasp of what they were.

Not having a firm grasp of the concept of standards was evident in many of the comments.

The teachers' belief that "the textbook is the standards" was the most common misperception. When asked, "Are you currently using standards-based instruction in your mathematics classroom," more than half gave an answer that reflected this thinking. Comments such as, "Well, I think the book has some very good points but I honestly think it's a bad book," by Teacher C, or Teacher I, "Yes. The textbook we're using has a guide in it and that's how I choose my activities, based on how they are listed in the textbook." Teacher B answered,

> Basically we have the guidelines that come out of these books and they're sort of lengthy and we certainly don't go over them one by one but we do have objectives that we try to adhere to in teaching the program that we teach.

When asked, "Do you match the objectives to the standards," Teacher B replied, "We don't try to do that in this school, no."

The prompt, "Are you currently using standards-based instruction in your mathematics classroom," continued to elicit textbook reactions from Teacher I, "I feel like

this would have been great combined with a more traditional type of mathematics text, taking the best of both worlds."

Other misconceptions regarding the standards surfaced in the interviews. Teacher D related, "In my class, two-thirds of their grade is what they do for homework and classwork. I think maybe that is a standards thing as well," or Teacher F who indicated, "They may have a little bit of math standards in the early part [of the unit], but then they love the problem solving section." The back-to-basics issue was reflected in a comment from Teacher G:

> I think a lot of times the standards don't address the basic skills as much as they need to. I think they get off into more theory and things like that in basic courses like Introductory Algebra and even Algebra I. Sometimes I think more skill work is what needs to be done. We spend more time on the skill, which means that we've covered the standard over and over. The same standard repeats itself and we don't get into some of the more difficult ones.

Use of Standards in the Classroom

"Describe how you teach the mathematics standards," was the interview prompt to which six teachers responded. Four contrasting styles were illustrated by Teacher J (a first-year teacher) and later by Teachers H, A, and C.

> Basically, in seventh grade, we went through section seven. We finished section seven up and then we went into section eight. We jumped around a little bit in the early part of the fall and I went a little bit into section nine. But, right now, we are working on the latter part of unit eight. In eighth grade, we started in the beginning of the book. We covered the first section, section 13. Then, we went into unit 15, we touched on unit 14, and now we are back up to finishing 14.

"I don't feel like that I'm teaching specifically to the standards," commented Teacher H.

> I don't try to plan my lesson around, "Are we going to cover 1, 2, 3, and 4 today?" I just try to cover the material without making the kids feel like they're being dictated to. "You need to do this, this, this, and this." And, try to let them come up with it on their own.

Teacher A talked about "preparing to do a unit by looking at what standards fit with whatever unit I'm getting ready to teach in my curriculum and I mess all those things together to make sure I'm touching on all the areas possible." Teacher C responded, "I probably don't know how to answer that. I just teach."

Additional Information Requested

Nine teachers reacted to the question, "Are you currently looking for any new information about the standards and standards-based mathematics?" Six teachers answered "No," and one teacher responded, "If I do, I'll look on the Internet." Two are always searching. Said Teacher C; "I am looking for information everywhere all the time to supplement," and Teacher A, "I keep updated all the time. I get the NCTM publications. I get the new standards when they come out."

Summary

The sundry comments that comprise this category painted a picture of extremes and confusion. The breadth of commentary ranged from several teachers who believed standards were a key to student success, to a few teachers who expresses dissatisfaction. Teachers' perceptions and misperceptions about standards-based instruction further clouded the picture. Despite the confusion and frustration, however, only two of the nine responders were interested in furthering their understanding. Perhaps Teacher E

summarized the thinking of many when asked, "Can you summarize for me where you see yourself right now in relation to the use of standards-based education," by responding, "Sometimes struggling with it and sometimes pleased with it."

Sharing of Ideas and Materials

Under the category of sharing were comments from teacher interviews that reflected opportunities for teachers to meet, share ideas and materials, and work together. Upon examining the data, it was determined that the comments fell into categories denoting Who, What, Frequency, and Effects of Sharing.

Who

The following graphic representation (Table II) demonstrates the types of persons with whom interviewees share. Seven teachers share with colleagues. Of those seven, three participants also share with persons outside the mathematics department. Of those three, only one shares with educators outside of the school.

Eight of the 11 teachers indicated that they were involved in sharing. With the exception of Teachers D and H, their sharing was limited to peers who taught math in their building. Teacher I offers a typical example: "Ms. Jones and I worked together because we were the ones teaching seventh grade math. But, that was really it." Teacher H was an exception. In addition to sharing with coworkers, Teacher H was the only interviewee "on cc:Mail with about half a dozen teachers from Korea to Turkey. I listen carefully, I read carefully. . . . There are a lot of things happening in a lot of places. A lot of trading of ideas goes back and forth."

TABLE II

TYPES OF PEOPLE WITH WHOM INTERVIEWEES SHARE INFORMATION

Teacher	Categories			Comments
	1	2	3	
A	X			Formal meetings only. "We share what we are doing."
B				"Mainly we just stop in to socialize."
C	X			"You just go by a room and say, 'Look, I found this to be helpful,' and that's it."
D	X	X		"Formal multi-subject team meetings. "But that has nothing to do with standards."
E				No communication.
F	X			Informal. "We share a lot when we can." Help new teachers.
G				No communication.
H	X	X	X	Daily communication with several subject teachers. Also in contact with teachers in other countries.
I	X			"The other seventh grade math teacher and I talk but that's about it."
J	X			First year teacher. "Just Ms. _____ helps. No one else."
K	X	*		Works with the other math teacher "once in a while to swap materials" and with the media specialist.

Note: 1 = I share with math teachers in my school; 2 = I share with teachers in other disciplines within my school; 3 = I share with educators outside of my school; * = Media specialist only.

What

There are six types of sharing described by teachers in the study. In order of frequency, the six types are: 1) sharing of materials and ideas, 2) sharing curriculum and

standards implementation information, 3) intra-grade articulation, 4) integration of subjects, 5) inter-grade articulation, and 6) peer support.

The following comments illustrate each of the six arenas for sharing. Offering an example of the type most often cited, Teacher J related a conversation with a mathematics peer regarding the swapping of ideas and materials:

> Okay, they give me an answer and I understand how to work it out, but could you help me to deliver this message to the students so they can understand it in a simple way other than what the book is saying?' And a lot of times she helps me with that. And also, she has all this supplemental material too, such as different types of workbooks she picked up when she was in the States and things like that that I can use for drill and practice.

Three-fourths of all teachers who reported that they were involved in sharing were involved in sharing materials and ideas with co-workers. In commenting about what mathematics teachers in his building shared when they met, Teacher G represented more than half of all of the teachers involved in sharing with peers:

> From time to time, when we do get together, we discuss curriculum, we discuss the standards and whether we're trying to reach them through methods that are directed away from skills and drills and kills and more into discussion of ideas.

Teacher B discussed inter-grade articulation among his mathematics peers:

> We talk about a prior [prerequisite] subject and get those teachers in, especially the new teachers. A set of teachers, say from Algebra II will talk to the Geometry teachers that are new and to the Algebra I teachers that are new and make sure they are teaching everything they should prior to the students coming into Algebra II.

Teacher A, the only other teacher who discussed this type of sharing, offered details regarding intra-grade articulation.

> We share what we're doing. So, I teach four seventh grade sessions and one eighth grade session. Another one of my math teachers teaches three algebra sessions, one seventh grade and one eighth grade session. And

> another gal teaches four sixth grade sessions, and one seventh grade session. We coordinate. The three of us coordinate what we're doing with the seventh grade. We may not all be teaching the same page on the same day, but we are teaching the same general topics at the same time. Because we have students that occasionally move from class to class as the schedule changes, we need a fluid curriculum so that they can move from teacher A to teacher B and still be in the same area, not doing something totally different. And then, with the other teacher also teaching eighth grade, we also do the same thing: we coordinate together.

Teacher H was the only person who shared an integrated experience that occurred on a regular basis.

> The chemistry teacher who is new to chemistry is beginning to get in on the act. When I do projects, not in this class, but just before Christmas and between Thanksgiving and Christmas break, we roped in the social studies people, we roped in the English department and we did a lot of dramatic video presentations of historical math. So I would say if you count one person as doing the department, I've been working with many, most of the departments.

The final type of sharing involves support of each other. Only two participants addressed this area. Teacher B discussed support of colleagues with words that relayed a belief in the significant service that this type of sharing provided.

> Even just being together talking about things, you know, is important. . . . We visit each other's classrooms sometimes for particular lessons. Mainly just to drop in socially. We work well together. We do a lot of communicating outside of the classroom but it's really informal. We do a lot of communicating about what we're teaching and about what should be done.

Teacher H provided an account of what appears to be a cultural norm among some of the teachers in the school.

> We pretty much have a lunch time group that meets in the media center - a couple of language arts/English teachers, a couple of social studies teachers, the physics guy comes in, the computer science guy comes in. It's not like we close the door. Students wandering in and get help and sometimes sit down and join in. Which is sort of nice to see that someone has the self-confidence to sit down at a table full of faculty people and say,

> "Hey, my opinion is . . . ." I have to admit that knowing that students are around, you tend to be more careful than you might otherwise be and you tend to be a lot more professional. And it's nice to have somebody that has just come from a literature class listen to what you just said and say; "Boy is there a quotation that fits that situation." And the next thing, you go in and say, "Okay guys, here a little poem for us to do." It's informal, it's not planned, but it happens. And people come in because they want to be there.

The following is a visual representation (Table III) of the types of sharing in which each teacher participated. It is interesting to observe that teachers A and H were rated as LoU V implementation participants.

TABLE III

TYPES OF SHARING IN WHICH INTERVIEWEES PARTICIPATED

Teacher	1	2	3	4	5	6
A	X	X	X		X	
B	X		X		X	
C						
D				X		
E						
F	X	X	X			X
G		X				
H	X	X	X	X		X
I	X					
J						
K	X					
Totals/N	6/11	4/11	4/11	2/11	2/11	2/11

Note: 1 = Sharing materials and ideas; 2 = Sharing curriculum & standards implementation information; 3 = Intra-grade articulation; 4 = Integration of subjects; 5 = Inter-grade articulation; 6 = Peer support.

Frequency

"Do you meet with math peers on a regular basis," was the question posed to the interviewees. Of the 11 teachers, only four met on a regular basis. However, even the use of the word "regular" was significant. Teacher H met nearly every day while Teacher A considered once every 2 months to be a routine procedure. "As Math Department Chair, I have regular quarterly math department meetings where we talk about what's going on in the classrooms, what standards are we doing, what we are teaching."

The following (Table IV) is a summary of the data regarding the frequency of mathematics department meetings based on the individual participants.

Comments indicated that most attempts at communication are comprised of informal chats in the hall. An exchange of ideas is actually quite rare and a serious discussion about the implementation of standards is even more elusive. Instead, exchanges are usually limited to survival needs: swapping tests, worksheets, and teachers' manuals. Says Teacher C; "Mainly it's an informal sort of thing. You know, you go by the room and say, 'Look, when I was doing this section on fractions, I found such and such to be helpful,' and things like that."

There were indications that new teachers were helped on occasion by useful suggestions, supplementary materials, and instruction on graphing calculators. Otherwise, as related by Teacher J, first year teachers were "on their own." When asked if she shared anything besides materials, Teacher J responded,

> No. No. This is my first year of teaching ever and I've found that once teachers get into their classrooms, they're in their own little zone. And, we're like isolated from the world. Sometimes I feel like I am very isolated from everybody. I just find that. We don't have a lot of chance to get

> together and chit chat about what we're doing in the classroom or what types of projects we are working on and things like that.

TABLE IV

FREQUENCY OF MATHEMATICS DEPARTMENT MEETINGS

Teacher	1	2	Comments
A	X		Every 2 months
B	X		Monthly
C	X		–No mention of frequency–
D		X	
E		X	
F		X	
G		X	
H	X		Daily shared preparation period. Weekly inter-disciplinary lunch meetings.
I		X	
J		X	
K		X	

Note: 1 = Yes, we meet on a regular basis; 2 = No, we do not meet on a regular basis.

Seasoned veterans did not appear to fair any better. Teacher G represented the typical response when asked if he ever talked with others about the use of standards:

> Very little. If I was going to say we talk about it, it would be probably maybe once a year at an in-service or something, or maybe at a math department meeting where we try to coordinate what were doing from one year to the next and what standards we've covered. But it's very limited.

Teacher H, however, seemed to have found a combination that worked, as well as an attitude that assumed that collegiality would bloom.

> I can't imagine a math department where four or five people walk in the classroom close the door and don't talk. That is so incredible to believe, but I'm told that it happens. If you can't meet for a few minutes in the morning and sort of swap tails about what happened and what you're going to plan, then its wrong, or, there are reasons that I don't want to know about.

Affects of Sharing

An interview question was posed to all teachers: "Have you made any changes in the way you use the standards based on meeting together?" Seven answered emphatically, "No," one said "Yes," and two teachers had reservations. Teachers C and I expressed reservations: "I guess you could say they might have gotten most of us to use graphing calculators by now," and, "The only thing we might have changed is a few things about our current textbook." Teacher D tries to put sharing into perspective when he adds,

> I see it all as really quiet positive. If you have the right situation, you can really make some major improvements. I figure it changes the style. And once again, I wouldn't say it's all the standards. I mean, I think I'm much more involved with the students rather than the material. By working as a team, you start really considering a little bit more about the individual and the materials get taught all the same. After you've done this, you realize, well, that didn't hinder how much we accomplished. It didn't. I see it has changed my style from when I was teaching in high school.

Summary

In most instances, sharing was an activity built around chance meetings in the hallway. Some teachers saw merit in swapping ideas and materials in order to make teaching more efficient and effective, but, rarely was it seen as a tool for professional

growth. Teacher G illustrated the typical outlook of the teachers involved: "Well, we share a lot. I don't know if it's standards-based or if its just plain curriculum-based. I guess the answer is 'yes' but I don't know if I can answer to the specific instances."

Even in its most elemental state, teachers who were involved in sharing wished to continue as well as to aspire to higher levels as illustrated by Teacher A. "Future plans are that we continue it. That we even do more closely-knit planning and possible interaction with other classes, where we combine some classes and those kind of things for projects or special groups." Teacher F had a dream:

> So I think we give each other hope that yes, occasionally, someone does have something to add and to contribute to students. And I think this idea of giving each other hope that we are doing something right is important.

Modification of Instruction to Reflect Standards-Based Reform

The modification category is comprised of comments from interviewees that define teacher-generated adaptations to mandated standards-based instruction. The responders fell into three degrees of change: no modifications needed or desired, those who are experimenting with various changes, and others who "never do the same thing twice."

No Changes Made

To the question, "Have you made any changes recently in how you use the standards," three of the 11 teachers responded with comments such as, "Not since I've been in DoDDS and that's been five years," and, "Can't say that I have." One person

responded, "No," but added, "I'm almost at the point where I'm getting the kinks worked out! It seems to be working pretty well."

Never Stay the Same

At the opposite end of the modification spectrum were three teachers who indicated that, in their classrooms, nothing stays the same. Teacher F commented,

> I make changes all the time. I sometimes envy those teachers who have a folder for every chapter they taught last year and use the same tests and worksheets the next year. Because, the only way I ever use last year's stuff is for make-up tests and for little extra activities. . . . For me, every year is different. Never do I ever come up with the same lessons and spend the same amount of time on the same chapters as I did the previous year.

Teacher H echoed these sentiments:

> I know some teachers that have file cabinets full of worksheets, tests, and projects from the last twenty years. But at the end of the year, I write about a one-page narrative and then I throw everything out and start over. You got to do it - different kids, different personality of class. Your approach is different. You chase off on different tangents. You can't go down the same garden path the next time. It's always a different garden!

The response of students is what reminded Teacher D that her classes never remained the same:

> Some of the eighth graders came back and got rather surprised and said, "But, are you using a new book this year or what?" And I said, "No, but every year isn't the same, you know. We're not into a rut here where we do the same thing. So, there will be a number of things they do this year that we didn't do last year and there are things we did in your class last year that we're not doing this year." It makes sense to me.

These three teachers based their change on the fact that the students' needs were different. As Teacher D stated,

> I mean, it kind of goes with the flow about how the group is working and what kind of skills they have. And then, with the team approach, something will come up. Like our science teacher was new last year and had some influx of new ideas. And I'd say, "Why don't I try that?" or "Here's what I can do in math that'll tie into what you're doing in English." I don't have them planned as yet, but there's always a certain amount of variety even though we stick to the same units. I haven't gone off anywhere. It's the same basic units that come out of Interactive Math.

Degree of Change in Teaching

Nearly all interviewees discussed the degree to which implementing the mathematics standards had changed their methods of teaching. A few, like Teacher C, stated emphatically that they were philosophically opposed to some of the fundamentals of standards-based instruction and therefore were not willing to adopt their teaching to reflect the thinking behind standards.

> I don't use the manipulatives at all. Very, very rarely with the seventh and eighth grades. My personal opinion is that by the time they are in the sixth grade, if they don't have an idea, they aren't ever going to get it.

Teacher F added,

> I think it's deplorable when kids get to seventh grade and really don't know how to even divide whole numbers. Over the last few years, we should have looked at a student and said, "You have to divide 7 into 42. You don't need a calculator for that. And if you do, we need to work on it." I think, in general, my guess is that all across America, technology has become the place where every teacher in elementary and junior high school and high school has said, "Well everybody says it's there, everybody says let's use it, it is a good tool, let's use it." But I think we're over-using. And that's where I'm starting to be a little bit more careful and judicious in its use. . . . All of my, well, I won't say all of it; much of the homework that we do aside from our regular seventh grade text is arithmetic oriented and, granted, they use their calculators sometimes to do some of that work, but I try to encourage them to do it mentally or in a written form.

Some teachers reduced standards to a supplementary position within their preferred way of teaching. Teacher E was an example.

> One of the standards I use, I usually do at the beginning because it doesn't go as far in depth as it needs to for this age group. So, we started there and then I use other materials to continue.

Five teachers, or nearly half of the interviewees, noted changes in format and order rather than changes in philosophy. Teacher I gives an example:

> I decided to change the order of the units. They are independent units anyway. The first year I did them in order. Last year I did them in a different order and this year I'm doing them in even another order. I think it is working out better this year.

Teacher A agrees:

> This year I got a brainstorm that, gee, why should we teach the area and perimeter unit separate from the geometry unit? And, in the textbook, the area and perimeter unit comes before the geometry unit. I don't know why it took me this many years to figure that out, but I taught the geometry unit and then the area and perimeter unit. And, it sure made a whole lot more sense to kids. And we as teachers said, "Wow, that really worked a lot better!"

More than half of the teachers reported that their modifications were in the form of supplementing to enhance the learning opportunities for their students. Reports Teacher K,

> I use the activities, most of the activities, that are in the book but supplement with my own follow-up questions or my own follow-up activities, adding worksheets that are different from the skill sheets that come with the book. So, I've found ways to change and expand some of the projects or take the basic idea of an activity in the book and alter it a little bit to fit the materials that I have and the students that I have.

Teacher K represented the thoughts of seven educators when she shared,

> I have a lot of workbooks that I've gotten over the last three years from teachers' stores, from Scholastic Book orders, from our book fairs, borrowing from other teachers. Seeing a workbook and saying, "Can I use that," making copies of things.
>
> . . . I've actually gone back a couple of times to the old, old textbooks that we used and taken some things out of there to give them as mini activities or as homework.

A specific example is offered by Teacher I:

> The only thing that might change is the things in our current textbook that we've needed to change to fit our population better. One thing that we did just recently in the textbook, there was a investigation using baseball cards where they get statistics on certain players and then compare them and try to decide which ones we should hire for a team. What they are supposed to do is use a spreadsheet and write a report on it. And what I did, instead of using the cards first of all, I expanded it to other sports so kids would have a choice: football, women's and men's basketball, and ice hockey. I did some research to set this up and the kids went onto the Internet and clicked on a hyperlink to get to an Internet site to where they could get the data, print it out, and use it to put it into a spreadsheet and then write the report. So, I modified it to make those changes so they had some choices and also to use Internet.

Teacher C reflected the feelings of many that used supplementary materials:

> I guess I fall into a comfortable pattern of using the text and supplementing it on my own. If I had to use a percentage, probably, I spend 40% of my time on the supplements. I try to wait to use the supplements until a question has come up from the problems because I think it means more to the kids at that point.

Several teachers found a need to supplement the standards with drill and "the basics." Teacher G is passionate: "I'll have to tell about basic skills. I try to tie in the basic skills with some of the theory questions a little bit, even though I think it's probably on a lower level than what the standards are addressing." Teacher C agrees: "The text doesn't allow for any practice of any sort. I use mini boards for the kids to practice just to give them five or ten minute drills once or twice a week."

Three teachers expressed comments that indicated openness to change and concomitant action. Teacher D elatedly shared an example of how it has altered learning in the classroom:

> I'm a real experimenter. I love to try different things. We tried how to do a real math study. Our topic was, 'Why do students in the seventh grade find reading difficult?' So we set ourselves a statement of purpose, strategy, procedures, and analysis of the data. We included scatter diagrams as well as all the statistics that they had learned earlier in mean value. We did a lot of graphing and things. And then, came to a conclusion, which I think is the key issue in terms of where I'm working now with math standards. . . . After you've done it, you discover you should have spent way more time on the rough draft and not so much time on the finished product. So, I'm going to do it again. I think it was highly successful. It integrated the mathematics into another area with some very interesting results.

Commented Teacher A,

> When I teach a lesson, I go back and say, "How, did this go? They really didn't understand that." And, I look for information from different publications and at what the standards say. What didn't I do right here or what can I do differently? It's a self-evaluation.

Teacher J added, "Any type of changes I can make to benefit the students and to help them in learning, then I will do it."

Summary

The interviews indicated that all teachers were implementing the standards to some degree. Three expressed strong reservations while three others expressed the challenge of teaching to new standards in elated terms. The majority of teachers, from the most reluctant to the most enthusiastic, believed they were modifying and supplementing based on needs of students. "I apply it depending on what kind of students I have," relates Teacher A, "I have to look at the student population I'm dealing with each year, take the

standards and design projects and things from the standards that I feel are most beneficial to the students."

Effects on Students

Data collected from teacher interviews regarding the effects of the standards on students and their achievement are represented in this category. To organize the data further, teacher commentary was divided into three areas: Making Learning Meaningful, Student Achievement, and Effects of Student Feedback on Classroom Instruction.

Making Learning Meaningful

Five of the 11 interviewees - nearly half - specifically mentioned making standards more meaningful for students. Four methods were employed by these five teachers to promote meaning. Teachers 1) clarified the content to make it more specific, 2) augmented with additional materials, 3) accessed students' prior knowledge, and 4) made it applicable to their world. As Teacher J relates,

> We start with the activities in the book, and like I said, they are very vague. So, I say, 'How can I break this down in simple terms so that the students will get it the first or second time, so I won't have to go over it and over it again?' Maybe it's just a little more than they can comprehend.

Teacher C adds, "I will try to combine it as well as I can with supplementary materials to make it mean something to the students."

Searching for ways to make the standards meaningful, two teachers discovered significant strategies to access students' prior knowledge and hook new learning to the students' base of reality. Teacher H described it this way:

> What I've tried to do is to go from where they are to where we need to be in a logical manner. What I've found myself doing more and more is starting each class with a series of three to seven questions which would tie into their experiences as much as I could and then have that as a spring board to what they actually were going to do. So, I sort of set the stage with a set of questions and we hope they go running off in the right direction. Every once in awhile I have to sort of herd them along and sometimes we just go off on a tangent and have a wonderful time.

Teacher K describes a similar route for making meaning:

> A lot of times though, especially the first year I worked with the book, we finished an activity and they'd say, 'Why did we do that,' or, 'What was the point?' I'm trying to alter it so that they're getting more out of it and seeing why are we doing this unit on graphs, why are we doing statistics, why do we need probability? I'm tying to make it more real life issues. And so, I've made the changes that way. What I'm seeing in the unit itself doesn't seem to fit what I think the kids want or what they need to have to understand it and I try to change it a little bit to fit the kids.

Student Achievement

Fourteen references were made by more than half of the teachers regarding student achievement. Fifty percent of the comments were from teachers suggesting a back-to-basics approach to instruction and the other fifty percent found positive solutions to students' difficulties in the way the standards presented mathematics.

The back-to-basics comments were represented in the thinking of Teacher B. "At the seventh, eighth and ninth grade, it's pretty important to get the basics. There's no hope at a higher grade level to accomplish Algebra II and Analysis without your basic algebra." Teacher F added,

> We've got to get back to teaching some arithmetic. I mean, we can't say, "There is a blue calculator on the wall that will divide ½ and ¾ for you, so why don't you use it?" Basically though, at the seventh grade level, it's almost too late to teach it, frankly. It's got to be done earlier. And I think we've encouraged teachers to believe that technology is the answer.

Later in the interview, he added,

> And sometimes it can get very discouraging trying to teach upper-level thinking skills, to try to raise the bar so to speak, to raise the standards for kids who are struggling at such a low level that they can't see where the bar is much less get over it!

Other teachers saw many of the same challenges in a different light. In many cases, the very issues that are unacceptable to the back-to-basics group (cooperative learning, use of manipulatives and calculators, students in the same classroom on different levels of understanding, and emphasis on problem solving instead of arithmetic) are the very issues that the second group of teachers viewed as the pluses in standards-driven mathematics. Teacher D talked about the evidence from standardized tests:

> Their scores, if you check the CTBS, the Terra Nova, their scores are quite good. So, this is helpful feedback. We actually expected their scores to drop, particularly in math. We thought that the calculation in the first part of the test, not the problem solving part, but computation, I guess it's called computation, we thought those would drop off quite a bit since we aren't doing any of that at all. But it didn't. The computation scores stayed rather good. Their problem solving scores seem to increase slightly.

Teacher K reiterated,

> The strength would be problem solving. Giving them different ways to approach problems and allowing the opportunity to bounce ideas off of one another without always being considered right or wrong. Knowing that there are different ways to get to the answer.

Several teachers shared their notions of why they believed standards-based instruction was a success. Teachers J, E, and D addressed the importance of standards-based instruction. Teacher J conjectured,

> The strength is that the students are allowed a lot of hands-on experiences. They are allowed a lot of cooperative learning and working together in groups. I would say that is a very valuable strength for the textbook and the Interactive Math Program.

Teacher E echoed,

> The strength is for kids who've been turned off math. All at once they can do it. And, seeing the kids react and realize they can do it. For gifted kids in math, sometimes they do know it, but I have found that when I have them explain it, then they need those materials, too. So it's good for both.

Teacher D added thoughts concerning the positive nature of calculators.

> It's all a matter of educating. The students are delighted. I mean, the students find out that working with those calculators all the time takes off a lot of that burden. Then those that weren't good at calculating find that they are relieved from that and more focused on the most important thing; you know, the procedures rather than getting lost in the small details.

Teachers K and E discussed solutions to varying ability levels in the classroom.

> I try to make sure their groups are different enough each time so that everybody has an opportunity to work with everyone else. And, I have a couple of kids who are on IEPs [Individualized Educational Prescriptions] who I have noticed work better with certain students, so, I try to make sure they are close enough to that person to feel free to ask questions. Or, for that person to see, "Oh, I think that that person needs help," to be able to go help on their own. I have a couple of kids that are ESL [English as a Second Language], who speak very little English, so I try to make sure that they are sitting with the other persons in class who speaks Japanese, so there can be a little translating back and forth. It seems to help.

Demonstrating a similar philosophy, Teacher E contented,

> Not everybody has to do the same activities. They can do something else with it. It's more advanced, or, if you're not quite ready for that stage, then maybe they need something at a beginning stage to get up to that stage.

The Effects of Student Feedback on Classroom Instruction

The interview question, "Have you ever received any feedback from students that would affect the way you are implementing the math standards in the classroom," was asked of each participant. Only three teachers claimed they solicited student feedback. More than half of those who received unsolicited feedback chose not to apply it toward

their teaching. Comments from Teachers A, B, D, E, and F confirm this outlook. "I file it in the back of my brain. I don't really formally write it down. If a parent writes a note, I have my 'rainy day' file of anything positive. The negative ones I chuck." Teacher D speaks for himself, "Feedback per say on math standards? I wouldn't think so," while math chairperson, Teacher B, speaks for his teachers, "I'd say our math teachers do not use student feedback. So, I don't know how teachers would be able to determine whether their program is working or not."

Teacher J and H solicited feedback from their students. Said J,

> I use that information before I go on to another activity, whether it is an activity that's new or an activity that's branching off from the first activity. I will use that information to go back and review if it tells me I need to review. Or, sometimes I will just explain a little more in detail the lesson based on that feedback.

Of the teachers who took note of student comments, there was great disparity. In an attempt to demonstrate the contrasts, I have partnered one reported extreme with another. An example is Teacher C and Teacher F. Reports Teacher C; "The feedback that I get from the students is that they really don't like the text. They love it when I give them a worksheet," while Teacher F reports,

> They love the problem-solving section. They would rather do those than the pages where there are 40 derivatives to find. And, that's good were they have to make a drawing, they have to build a basis, you have to write up your problem, and you have to solve it. I think that's good news. The key words in Algebra I and often times in Algebra II is, "Oh, I hate word problems!" They don't like word problems because they have to evaluate and they have to read and they have to build their own base and equation. I find that heartening. I hope next year's class will be just like it in Analysis and in Calculus.

Another interesting comparison was provided by Teachers E and F. Teacher E enthusiastically comments, "The feedback you get from kids is that they've always been

turned off by math and now they like it. That encourages you to go ahead and continue doing it." While Teacher F declared,

> It's [the textbook] quite difficult to deal with. With both the parents and the students, I have to use a lot of the addendum, whatever they call it, the skills, you know the skills. So we do an awful lot of those worksheets there. Like I said, the parents want something that's more traditional. They want to be able to say, "Well, where does it say what to do?" And it never tells them anything what to do.

While Teacher F's students were asking, "Where's the arithmetic, where's the stuff you're supposed to really learn," Teacher K reported,

> A lot of times, I see them helping one another. They don't come to me for questions, which is what I prefer. I prefer them to ask each other first. If they don't get it, then come to me. But, I see them being very helpful to one another within a group and also going group-to-group.

Looking at the same coin from a different side, Teachers A shared, "Some kids will come in and say, 'That was really good. I liked doing that.' I've got a lot of positive reaction from the geometry project. That'll be something I'll do again," and Teacher I admits, "If I see an activity on a particular standard and it just doesn't work, I just throw it out."

In addition to the previously shared comments, four other teachers related unsolicited negative feedback from students. Student commentary included not having enough homework, not having enough structure, and not enjoying journal writing.

Summary

Making the mathematics standards meaningful to students was a concern of nearly half of the responders. The teacher comments under this category spanned the continuum from those that solicited and used student feedback to inform instruction to those that

neither solicited nor gave credence to student indicators. Most teachers fell in the latter column, however.

Two very distinct groups appeared in the data. The first group talked about deficits while the second group talked about solutions. Teacher A put it into perspective, "I think the big thing is student achievement. We're seeing that the kids are achieving because we are coordinated ourselves. We're coordinating through the standards. Student success; that's the biggest thing I see out of it."

Although Teacher B was the only one to express the following feelings, one wonders whether others might be both concerned and intimidated by the same thoughts:

> Our kids do very well at this school. We're always concerned with the lower students that are not doing well. In this school there is a gap; there is an achievement gap in math and science. That's one of our school's issues. Our math department, it's difficult for them to look at that because they think, "Jeez, it's not my fault. I mean, what can we do?" It is a very difficult problem. All the kids at this school do pretty well and our scores are pretty good. But, there definitely is a gap in the lower classes, in the lower achieving students and the average.

Impact of Institutional Support

This category is composed of interview data that reflected teacher readiness for implementation of new standards and the concomitant teacher expressions of certainty, adequacy and confidence that emerged from the support. Comments are organized under the two headings of 1) Teacher Readiness and, 2) Administrative Support and Supervision.

Teacher Readiness

According to the teacher interview data, preparation for the task of implementing mathematics standards was achieved through a variety of opportunities with varying degrees of success. At one end of the continuum was first-year Teacher J.

> Right now, I feel that I am above water. I feel that hopefully, by the end of this year, I will feel more confident and comfortable teaching Interactive Math. But, this is new to me right now. I feel that if I revise as I go along and make modifications as I go along, then everything will be okay at the end of the year. And, I'll have something to look back on and reflect on. And, if I teach it next year, then I have something to work on from there.

Teacher F observed the implementation process over the years and gave his analysis of the situation:

> I can say, that those people who are new to the, in particular, junior high materials, really are overwhelmed with the kind of education, kind of curriculum we're presenting at this time. Many of those I've worked with in the last few years, have tried to find another way to teach their classroom because of the differences in what they are use to and what they've done in the past.

There were conflicting comments regarding the training. Teacher B claimed teachers were not trained:

> You know Interactive Math in the seventh and eighth grade, Middle School? That also was a program much like MathLand because we weren't trained. The teachers that taught it weren't sufficiently trained in the beginning and they had a problem the first year or so. And parents had problems with it. But our teachers were pretty good. They adapted much better than a lot of other teachers did in other schools.

Teacher I chose to be involved in other opportunities: "I haven't been on any math standards committees or anything. I was asked to be on one but there is another committee I prefer to serve on so I turned that one down." Teacher D also expressed some needs for training. However, his response indicated that he believed his training in

the standards was sufficient with the exception of one area: "Actually, I am looking for one thing only, I'd say. And that's how we might utilize the computer more because I'm not particularly computer adapted."

Others shared various training experiences but did not comment about whether the professional development was sufficient for them to carry out their classroom responsibilities. For Teacher D, training brought about change: "I think the big change from what I had done before taking the training on the math standards is the communication level. That is the biggest difference." Teacher B reflected on the number of opportunities available, "There's a lot of different options that come up at some of the workshops. Even this year, we went over with half of our teachers during a three-day workshop with some visiting teachers from California." Another teacher recalled a training experience,

> [The presenter] was working for a textbook company in California that DoDDS had contracted and she was just trying to give us new ideas with ways to get some new things started like using a lot more team work. That is, getting kids in sets of four or five students. She didn't really stress cooperative learning but she stressed learning in teams and a lot of different projects that you can do with that, such as putting in the middle of the floor the tape on which you put an x-y coordinates system and have the kids find their seats. A lot of new ideas, a good refresher course. But, I don't think it was anything radically different.

Teacher A "spent three days at a re-write of the DoDDS curriculum using the NCTM Standards 2000, and using a new standard, the NCEE Standards, that DoDDS purchased and meshing them into a new curriculum for the upcoming school year."

Three teachers spoke about their summer training experiences at the University of Northern Iowa. Teacher H believes, "that's what summers in Northern Iowa are for; to sit

back, reflect, and find out about things." Teacher B, a confessed veteran of UNI, shares a more detailed version:

> Well, the UNI courses, it's pretty good. I've gone to it for four or five years. It's mainly repetitious. They do try to add some new things every year and they have come up with a sort of beginning level and gone up to an advanced level. But, probably teachers should go to that only one or two years. It's in the summer for a week. In DoDDS, the government pays for it. It's pretty nice. It's a nice break during the summer. You have to get there by your own means but then they give you $1250 back. One year, DoDDS actually put us on salary. Anyway, it's good and every DoDDS teacher should probably go to it for one or two years. I've probably gone to it too much. . . . There aren't many workshops that we can go to that are subject related. Now the University of Iowa are subject related. It's primarily for the entry courses and now it's progressed to the higher math courses. But other than that, workshops that I've been to in the summer mainly address, you know, those standards and policies of mathematics as a whole. I think DoDDS really should provide two or three different kinds of workshops for math teachers in the summer at least, at DoDDS' expense. We have 50 or 60 teachers that go to the University of Northern Iowa every summer.

When educators perceived that training was necessary and not forthcoming, some took on the responsibility themselves. Teacher B talked about inservicing his own teachers:

> I think we've probably gotten all of the teachers here at the school to use calculators, especially the graphing calculators. Of course, that's almost a necessary tool now. The graphing calculator is taking the place of the computer. And if any teacher comes into our department without being familiar with that, we try to address that, trying to get him to use the calculator with his classes.

Teacher D talked about wanting a computer lab in his classroom to the extent that he commandeered antiquated machines that were headed for disposal.

> I have, as you can see here in the classroom, they're only Apple computers and I have limited myself at this point to spreadsheets using these old Apple computers because its all I know. I've not seen anything coming up about how a computer would really enhance their education according to the standards. I mean, there is a lot of core software, in my opinion, that

> does nothing other than repeat what's in the book. And it's a lot of drill work and I find I have absolutely no use for that whatsoever, unless you have a classroom in which you have a one-on-one situation with the student and the computer. We do not have access to a computer lab here in the seventh grade. I would have liked that. So, as you can see, I have just the eight old Apples and I really understand spreadsheets on there. I've had some students try to teach me how to do it on Excel but it is so complicated they couldn't figure it out. I don't even pretend. An old guy like me just says, "No, I'll just keep teaching you how to do the old Apple Works spreadsheet which is very useful." I find it has some really interesting ways to use it in the seventh grade curriculum.

Teachers also took the initiative by joining their professional organizations and reading professional journals.

Administrative Support and Supervision

Four teachers elected to speak about administrative supervision. Many claimed they looked to the administration for guidance on standards and did not receive it. Commented Teacher A, a math chairperson, "I'm looking for what their ideas are, what our long-term plan is. Are we meeting the standards? Are we teaching the curriculum?" Teacher H laments the lack of supervision. "I suspect I am [using the DoDEA Math Standards]. I think I am but I don't think I've ever had anybody who could be considered an expert in it in my class long enough that could verify that," he mused. "But, like I said before, I think I know what I'm doing. I haven't had anybody in there to tell me 'yes' or 'no.' Until that happens, ignorance is bliss."

Teacher B seemed to echo the sentiments of many of the teachers who believed teachers needed to monitored in order to make certain that they were actually implementing the standards:

> Unless you have somebody in the school that really looks at that and really keeps everybody on task, it's not [going to happen]. I mean, administration hasn't done anything like that for several years. I think we tried it five or six years ago. Unless it's part of the syllabus, it also probably won't get done.

Summary

Teacher comments regarding readiness for implementation of the mathematics standards were conflicting and confusing. Reading between the lines, the problem may not have been lack of training, but rather, that teachers were not trained to a level of proficiency that allowed them to feel comfortable or competent with the new standards. Those who chose to comment on administrative support felt it was lacking, that it was the role of the administrator to enforce the implementation of the innovation.

Teacher H, so often the exception to generalities, expounded on his own theory:

> The weakness is, and if this sounds like bragging that's too bad, if you don't have somebody that's knowledgeable and confident, they're going to feel like they have no support and they are going to retreat to the book and the book is going to become the whole course. And whether it should be done or not done, its going to get done and if they don't get through the book, they'll get whatever they get and important things may just be omitted, skipped over. The strength is, right or wrong, if you have a clear idea of what you want done, when you want it done and how you want it done, you just sort of take a deep breath and do it. And if the kids don't see that you're nervous and have sweaty palms, they're like puppies, they get interested and off they go. And it's sort of like you're chasing to make sure they don't get themselves in trouble.

Logistics Issues

The logistical issues category consists of comments regarding time allocation, resources, supplies, and supplementary materials.

Time

The most passionate issue was time. Seven of the 11 respondents specifically mentioned time as one of their greatest frustrations. Concerns included two teachers who sited block scheduling as the culprit that dictated an inappropriate use of their time and one who believed that the high school schedule adversely affected the time allocations in his middle school. Several lamented that scheduling meetings with a colleague was "almost an impossibility."

The amount of time required to implement was a theme woven through many of the interviews. Desperately seeking the preparation time necessary to implement the new standards, Teacher H pleaded,

> If only they would leave me alone. I come in at quarter of seven in the morning and I'm at school till 6:00 - pretty much a 12-hour day. I would say that about 50% of my classes are well planned and they're good. And, the rest should be, but they aren't because I simply don't have enough time to think through what I want to do.

"I haven't taught every unit," regretted Teacher K, "because I haven't had time to get to every unit."

Overwhelmed by the demands on their time, perhaps Teacher H summed it up by asking, "Who's got the time? My thinking is that if you have time and energy left over and you want to spend it on something related to school, it should be preparing for class and delivering." He goes on to say, "I'm trying to fully integrate Sketchpad into my geometry class and I'm trying to teach myself MathCad. I have four different classes, and I'm couching soccer. Sure, I would love to have time to read more [about standards]!"

Materials

More than half of the teachers commented on the lack of materials needed to implement the standards to their satisfaction. A teacher who represented the thinking of nearly half of the teachers expressed frustration with the initial implementation.

> It was hard to work with in the beginning - not having. When we first got the book, that is all we had was the book. We didn't have the study skills or the worksheets that went with it. We didn't have the manipulatives kit. And when you're trying to do a probability game where each group needs four dice, and you have no dice, it is kind of hard to do an activity. So the first year I was out scrounging trying to get a lot of those things on my own. And having only one set of teacher's editions and two people who teach the class, the books are running back and forth and that creates a problem.

For three-fourths of those who encountered the initial lack of materials, the problem lingered. Lack of teacher's editions was a continuing problem for at least three respondents. Echoed one teacher,

> Jamie [fellow teacher] and I are on the same unit now. I didn't know it was going to happen that way. And when I went over to pick up the unit eight book from her, she said, "Oh, I'm in the middle of unit eight." I said, "I'm getting ready to start unit eight. Okay, you keep the book. I've done it before. I can fudge my way." I want her to have access to the notes and things that are in the teacher's manual. I'm just going to have to go borrow and make copies and do that if I need something. So, that is kind of frustrating to deal with, but we've been trying for three years to get another set and it hasn't happened yet!

"Another problem that I've found," added teacher K, "is with the end of the unit big projects, group projects, and individual investigations. A lot of times we don't have the resources and materials to do those."

The issue of lack of supplementary materials was significant for five of the 11 teachers. Instead of waiting for the system to provide materials, however, most talked

about acquiring their own. "Our teachers here at this school have been pretty good. I mean, they're experienced. They have provided supplementary materials to the kids themselves on their own for the last two or three years." Added another teacher,

> I have some supplemental materials that I brought over with me. Some math books, different types of work sheets and things. Some drill and practice stuff. I have borrowed some things from Mrs. Jones who is the seventh grade math teacher also. I've borrowed some things from her and I've been going back to some of the old textbooks and just pulling out some information to supplement the program, actually.

Even those who received the supplementary materials commented, "The workbooks that they sent were much worse than I feared. So, I went out and purchased some with my own money. Supplementary, but it's better than nothing."

Summary

The need to create or locate their own materials coupled with the amount of time necessary to make it happen was overwhelming for many. Teacher C regrets,

> There is only so much time you can give to the kids and I'm forever supplementing and I'm having to make sure it correlates with what's coming up in the textbook. Then, I don't have time to let the assessment of the students really tell me where they are and it's just a matter of, you only have so much time and you have to take it from somewhere.

Teacher C summarized the logistics frustrations quite succinctly when she stated, "I have to supplement it and I have to scurry around and find it, which takes my time away from the children and away from the planning."

Empirical Information Summary

The purpose of the data collection was to examine the degree of implementation of the DoDEA mathematics standards and the perceptions of secondary teachers regarding the use of the standards. This was accomplished by documenting, through LoU interviews, the classroom teachers' beliefs and activities regarding the implementation of the DoDEA mathematics standards.

The interview information gathered from 11 secondary DoDDS mathematics teachers was grouped into seven categories: 1) Reaction to Mandated Change, 2) Commentary on Mathematics Standards, 3) Sharing of Ideas and Materials, 4) Modifications of Standards Implementation, 5) Effects on Students, 6) Impact of Institutional Support, and 7) Logistical Issues. Comments from teachers revealed that the continuum of perceptions was broad and varied. Despite data that was often conflicting, patterns from the seven categories did emerge.

Although the question of mandated standards implementation was never posed during any teacher interview, many responders found an opportunity to share frustrations. More than half believed that they had been forced into mandated change. Comments on standards highlighted teacher misconceptions and confusions. The most widespread misconception centered on the belief that "the textbook was the standards."

Many teachers saw sharing as a necessity, although it was generally reduced to fleeting moments in the hallway. The need for sharing was heightened by the need to make the standards meaningful to students and to supplement their instruction. Although teachers received training regarding the innovation, very few felt prepared to meet the

task. Many did not feel supported with proper supplies and materials, nor did they feel their efforts were supported by the administration. Lack of time was the single most significant factor for the greatest number of teachers.

The most unique teachers studied were J, H and A. Teacher J was a first-year teacher who served as the reality base, the litmus test, for comments from veterans. The insights and gut-honest comments from someone new to the profession and new to the innovation put much of what others were experiencing into perspective. Teacher A was a well-informed, highly-trained mathematics chairperson functioning as a Level V implementer. Extensive experience and knowledge tempered her insights. Teacher H was also a Level V implementer; a maverick who accomplished feats with students and peers that no other participant in the study reported.

> I think that I understand the spirit of the standards and I think that not only am complying with them, but I'm sort of enjoying the fact that I get to do it this way . . . I always sort of did it this way. It was always close the door because everybody around me was doing something else and I didn't want to get found out. And the first time I had somebody explain to me what the standards were, it was like, WOW, neat, it's okay!"

CHAPTER IV

ANALYSIS OF THE DATA

The purpose of this study was to explore the implementation of mandated change by classroom teachers using the conceptual framework of Hall's *Concerns Based Adoption Model* (CBAM). Specifically, this study explored the degree of implementation of the DoDEA mathematics standards and perceptions of secondary teachers regarding the use of the standards. This purpose was accomplished by the following:

- Documentation of classroom teachers' perceptions and activities in support of the implementation of DoDEA mathematics standards;
- Analysis of these perceptions and activities through the CBAM lens;
- Reporting of other realities revealed; and
- Assessing the usefulness of the CBAM lens for explaining this phenomenon.

To determine the degree of implementation and teachers' perceptions of mandated standards, data was collected from classroom teachers tasked with the responsibility for implementing standards. This information was provided through qualitative methods of research employing the focused interview process (Merton, Fiske & Kendall, 1956). Prescribed questions from the *Levels of Use* (LoU) interview, required to preserve the

integrity of the research-based model (Hall & Hord, 1987), provided the basis of inquiry for respondents.

The research was conducted through a random systematic selection (Creswell, 1994) of seventh and ninth grade mathematics teachers from DoDDS schools in the European and Pacific regions. After the initial selection, all participants were assigned an LoU rating commensurate with their degree of math standards implementation by certified CBAM raters. From this list, a purposive sample (Erlandson et al., 1993) of 11 teachers was chosen to ensure representation of varying degrees of standards implementation.

Transcriptions of recorded interviews furnished data for analysis. Through the process of constant comparison (Glaser & Strauss, 1967), seven categories emerged and were sorted from the data according to their salient properties to provide descriptive, inferential information that could be compared to formulate propositions (Lincoln & Guba, 1985).

This chapter analyzed the seven categories and their accompanying empirical data and superimposed these profiles on the CBAM. This model is an empirically-based conceptual framework, which provides a comprehensive method of assessing the implementation of the change process (Hord, 1986). The CBAM dimensions represent a conceptualization of the way the concerns and behaviors of individual teachers change as they become familiar with and involved with the innovations (Hord, 1986). It describes the developmental process that individuals experience as they implement new innovations. The *Levels of Use of the Innovation* (LoU) and *Stages of Concern About the Innovation* (SoC) were employed as a means of explaining the empirical data in this study.

This chapter was designed to examine the type of comments teachers made and the type of activities teachers engaged in at each level of the DoDEA mathematics standards implementation. To reflect this purpose, the content of Chapter IV includes five phases of analysis: 1) analysis of the categorical data against the LoU framework, 2) summary of LoU profiles based on categories generated from interview data, 3) analysis of categorical data against the SoC framework, 4) exploration of the anomalies encountered in the interview data, and 5) a summary of the findings.

Analysis of Categorical Data Against the Levels of Use (LoU) Framework

Each section included in the Analysis of Categorical Data Against the LoU Framework highlights a specific LoU. Only Levels III, IV A, IV B and V are discussed as they were the only levels represented by the participants in this study. This phenomenon was actually quite predictable since Levels 0, I, and II are levels designed for teachers who have not heard of the innovation or are just preparing for implementation. Since the math standards implementation occurred three years before the interviews took place, it stands to reason that teachers would represent degrees of implementation reflected in Level III and above. The fact that the mathematics standards were implemented three years before teachers were interviewed also explained why there were no Level VI participants. This very sophisticated level requires teachers to be knowledgeable and skilled in the innovation and aware of students' needs to the extent that they are in the process of superceding the innovation based on those perceptions. Few teachers ever reach this level; even fewer reach it within the first three years of implementation.

In this chapter, each LoU section is divided into three parts. The first part introduces the specific LoU by defining its attributes. The second part analyzes the data of each LoU based on the seven categories that emerged from the interviews as discussed in Chapter III. The seven categories and their definitions are as follows:

- Reaction to Mandated Change: teacher perceptions regarding top-down mandated standards implementation, local-level input, and teacher involvement in decision-making.
- Commentary on Mathematics Standards: teacher remarks regarding the standards, standards implementation, and standards-based instruction.
- Sharing of Ideas and Materials: teachers meeting, sharing and working together.
- Modifications of Standards Implementation: teacher-generated adaptations to mandated standards-based instruction.
- Effects on Students: teachers' perceptions of the impact of the standards implementation on students and student achievement.
- Impact of Institutional Support: teacher readiness for implementation of new standards and the concomitant teacher expressions of certainty, adequacy and confidence regarding the support.
- Logistical Issues: time, resources, supplies, and supplementary materials.

In order to examine the possible impact of the CBAM conceptual framework on the data collected, each category contains the summary of the teachers' comments that were identified as having the same LoU rating. For example, in the section entitled Level III, the seven categories that emerged from the original classification of the data are listed.

Under each category is a summary of the beliefs, perceptions and activities of all teachers in the study who were given an LoU rating of III for their degree of implementation of the innovation.

The third part of each LoU section summarizes the seven categories by creating a profile extracted from the data. Superimposing the data profile onto the matching LoU allowed an assessment of the CBAM framework for its usefulness in explaining the phenomenon of the implementation of the DoDEA mathematics standards.

Level III: Mechanical

Definition for LoU III

> Level III is the state in which the user focuses most effort on the short-term, day-to-day use of the innovation with little time for reflection. Changes in use are made more to meet user needs than to meet client needs. The user is primarily engaged in a stepwise attempt to master the tasks required to use the innovation, often resulting in disjointed and superficial use. (Loucks, Newlove & Hall, 1998, p. 179)

Categories Generated from Participant Interview

Data for Analysis

The seven categories that emerged from organizing the interview data in Chapter III were used to display the data from participants with the implementation rating of Level III.

Reaction to Mandated Change. Most of the concerns in this category dealt with the frustrations of the book: "It is very difficult to teach out of the book," "The book

needs to be better organized," and, "This would be great combined with a more traditional type of mathematics." The concern was that, "we went too far;" implying that the standards were much too radical. One teacher commented that life needed to be "compartmentalized and all straightened out. The book is not like that. It is very difficult to teach." Another teacher shared her solution: "I try not to use it for about three weeks and use something else instead."

Comments on Mathematics Standards. The most blatant misconception was that the textbook was the standards. "The standards don't need to be ditched totally. . . . Honestly, I just think it is a bad book." When responding to the question, "How do you teach to the standards in your classroom," one teacher replied, "I probably don't know how I teach to the standards. I just teach," indicating that time had not been taken for reflection or self-evaluation. When asked, "How do you see yourself in relation to implementing the standards," one teacher remarked, "Sometimes struggling with it and sometimes pleased with it." Despite the frustrations expressed, however, when asked if they were looking for more information, all teachers respond, "No."

Sharing of Ideas and Materials. Of the six types of sharing generated by the participants, this group experienced the lowest form of sharing - swapping materials and ideas with a peer. "We share worksheets that work particularly well. . . . It's an informal thing." When asked, "Do you work with others," even those who had previously given an example of sharing, relied, "No, not really," and "I don't share." In answer to, "Do you talk with others," they responded, "No, not much." One teacher lamented not sharing but commented that it was because of the book; "Sharing makes people feel like they aren't

alone and it makes them feel like they have some help because of the weakness of the book. I think it's the worst book I've ever taught out of."

Modifications of Standards Implementation. It was difficult to detect a pattern in this category. Comments were negative and teachers felt imposed upon. Many continued to center their complaints on the text: "The text doesn't allow for any practice of any sort," and, "I have to supplement it and I have to scurry around to find it."

One teacher admitted, "I fall into the comfortable pattern – using the text and supplementing it on my own 40 per cent of the time." Another teacher voiced her resistance to standards implementation when she reported, "I don't use manipulatives at all."

Effects on Students. There was an extreme disparity in this category. One teacher reported that, "The feedback that I get from the students is that they really don't like the text," while another believed,

> The feedback you get from kids is that they've always been turned off by math and now they like it. That encourages you to go ahead and continue doing it. The strength is for kids who've been turned off math. All at once they can do it!

Despite the extreme views, when asked, "What do you do with information you get from students," all agreed they "haven't done anything with it."

Impact of Institutional Support. No comments.

Logistical Issues. Some of the logistical issues mentioned had no relation to the implementation of standards-based instruction. For example, one teacher commented on

having 27 students in her class and felt that having "only 14 kids, is easier to get around." Another "Can't work with others in a block schedule." Aside from these concerns, the need for more supplementary materials was paramount. "Finding supplementary materials takes time." "It takes my time away from the children and away form the planning. Mainly, it takes time away from evaluation."

Summary Profile and Comparison with the LoU Definition. The profile that emerged from identified LoU III participants generally demonstrated resistance and frustration. Compared to participants on other levels, they had relatively little to say. Their answers were short and contained words and phrases that indicated negativism, resentment, and a lack of confidence and enthusiasm. In at least one case, it was apparent that being interviewed was an imposition.

In general, they blamed the textbook and resisted change by not using elements required in the standards. The teachers felt isolated. Sharing with peers was rarely practiced, nor was addressing student feedback to inform instruction. Lack of time was a significant and frustrating factor.

Casting this profile against the definition of a Level III teacher yielded results that were similar but more extreme. As predicted in the LoU III definition, teachers focused their efforts on the day-to-day use of the innovation. The lack of time for reflection and the limited degree of sharing were evident. The teachers' decision to implement only selected portions of the innovation while they continued their more traditional means of teaching was also indicative of their LoU III rating.

Level IV A: Routine

Definition for LoU IV A

> In Level IV A, the use of the innovation is stabilized and going along satisfactorily with few if any problems. Little preparation or thought is being given to improving innovation use or its consequences. Few, if any, changes are being made in ongoing use. The implementer knows both long and short-term requirements and how to use the innovation with minimum effort or stress. There is no special effort to seek information, little or no reference to ways of changing use. Evaluation is solicited when mandated, but not used for instructional change. (Loucks, Newlove & Hall, 1998, p. 183)

Categories Generated from Participant Interview

Data for Analysis

The seven categories that emerged from organizing the interview data in Chapter III were used to display the data from participants with the implementation rating of Level IV A.

Reaction to Mandated Change. This group of DoDDS mathematics teachers was generally not thrilled with the mathematics standards, but found ways to acquiesce. They complained about having "to do technology," having "no choice," being forced into cooperative learning even though it is "not a math thing," and having to use a text which should have been selected as "a nice supplement to a traditional textbook."

But, in reality, "we basically conform." "I address [the standards] without actually doing exactly what it says," or, "I'm probably close to 50 per cent of them being covered - well enough to say they're covered," or, "We teach it our way as long as we get the objectives

done." Some commented that the standards fostered positive happenings for students: "The standards force us to teach kids to communicate. It takes time to write, but it's good for the kids to do that, to understand what they are thinking."

Comments on Mathematics Standards. Their comments on the math standards reiterated their views expressed above. It's "essentially good direction," even though "they are too vague." "They don't address the basic skills," but they are "relatively easy to use." The bottom line was, "I like it more now than I used to." When asked if they were looking for new information regarding the standards, their reply was "No."

Sharing of Ideas and Materials. Sharing expanded considerably with the Level IV A group. Four of them shared materials and ideas, two shared curriculum and standards implementation, two discussed intra-grade articulation, one (the math chair) discussed articulation among the grades, and one practiced peer support. Despite the variety of types of sharing, the frequency was quite low. One person met monthly, the rest "happened when it happened." We visit each other's classrooms, mainly just to drop in socially." One person spoke for the Level IV A group. When asked, "Do you work with others," the teacher responded, "Very little."

Modifications of Standards Implementation. With the exception of one teacher who reported that, "I make changes all the time," modifications for persons at this level were modest. When asked, "Are you making any changes," they replied, "I follow it [the standards] but not to the letter," "Can't say that I have," and "No." When asked about changes, one teacher summarized for the group, "No, I'm almost at the point where I'm

getting the kinks worked out. It seems to be working pretty well." Modifications were as mild as, "I try to tie in the basic skills with some of the theory," "Just using the same kinds of workbooks and trying to find new worksheets instead of using the same ones over and over again," "I've changed the order of the units in the textbook," and "We have to be careful how we use calculators."

Effects on Students. Unlike the LoU III group, the LoU IV A teachers were much more aware of their students and what they wanted. "They love the problem solving," "didn't like the journals," and "they are great at helping one another." They also felt strongly about knowing what their students needed; "I've got to make it meaningful," "They'll ask what that was all about or why we did that," or, "It's important to get the basics," and, "They don't know how to divide . . . it's a little scary to me." At times, their cynicism showed; "It can get really discouraging trying to teach upper level thinking skills to kids who are struggling . . . It's almost too late, quite frankly."

When asked if they made instructional changes based on student feedback, all but one answered that student feedback did not alter their teaching.

Impact of Institutional Support. Whereas Lou III teachers had no comments regarding the impact of support, this group had things to say. All had been trained in the standards implementation. They mentioned that there were "lots of options" at their training sessions and that they learned "a lot of new ideas but nothing radically different." One was a member of NCTM and received their updates. Another mentioned that administrative monitoring and parent review of the syllabus were the only reasons teachers would apply the standards as intended. Perhaps the most telling comment was made by a

teacher who seemed to speak for others in this group when he shared, "We talked about the fact that we didn't like this program at first because a lot of us didn't understand how we were supposed to implement it."

Logistical Issues. Logistical concerns were still important issues for Level IV A participants. Time remained an important factor; "Scheduling with a colleague is impossible," "There is no time to teach every unit," and, "We lose time with block scheduling."

More than lack of time, however, was the unavailability of supplies and materials. Three years after the implementation, "we still don't have the resources and materials to do the projects," and there was "only one set of teacher's manuals" for both of us," and we are still having to "provide our own supplementary materials."

Summary Profile and Comparison with the LoU Definition. The profile that emerged from this group was one of increased confidence. They have more to say and were more self-assured in their answers than the previous level. Many of these teachers were back-to-basics persons. They were certainly not pleased with everything the standards movement represented, but they found ways to acquiesce without compromising some fairly strong beliefs. They were in a holding pattern that seemed satisfactory to them. Their greatest annoyance was not having the supplies and materials they needed to do their jobs nor the time to make it happen.

They experienced a wider variety of sharing experiences than their counterparts in Level III but the experiences were infrequent and informal. Sharing was limited to their math colleagues in the building. The LoU IV A participants appeared to be well trained

and not concerned about acquiring further knowledge. They seemed to have what they believe they needed. They were much more aware of what their students think and what their students needed. Even with this knowledge, however, they admitted that they did not intend to use student feedback in order to alter classroom instruction.

Casting this profile against the LoU definition of a Level IV A teacher yielded results that were quite similar. In the LoU Level IV A, use of the innovation is stabilized. This was definitely true with the participants of this study. They were content to function at their current state and demonstrated no aspirations to move to another level of implementation. The major difference was that the behavior described by teachers in the study was compliance. These Level IV A teachers were very aware that they had chosen not to implement the innovation in its entirety because it did not mesh with their preferred way of teaching. In both the LoU IV A definition and the data derived from interviews, teachers made no special effort to seek further information. There were few references to change. In fact, changes when alluded to, were merely rearrangements of chapters or replacements of worksheets. With the exception of plaguing problems with supplies and materials, there were no management problems.

Level IV B: Refinement

Definition for LoU IV B

> The LoU IV B is a state in which the user varies the use of the innovation to increase the impact on clients within their immediate sphere of influence. Variations are based on knowledge of both short- and long-term consequences for clients. The teacher is aware of the cognitive and affective effects of the innovation on students and ways to increase impact on them. The teacher solicits information and materials that focus

> specifically on changing the use of the innovation to affect student outcomes. The teacher discusses her own methods of modifying use of the innovation with others and assess the use of the innovation for the purpose of changing current practices to improve student outcome. (Loucks, Newlove & Hall, 1998, p. 187)

Categories Generated from Participant Interview

Data for Analysis

The seven categories that emerged from organizing the interview data in Chapter III were used to display the data from participants with the implementation rating of Level IV B.

Reaction to Mandated Change. Teachers in Level IV B acknowledged the changes – many of them dramatic – in the way they formerly taught and the way in which the standards dictated classroom instruction. Comments were free of negative emotion and were very matter-of-fact. They expressed the belief that there were many positive changes that came about because of the standards implementation and they were not reluctant to admit these positive outcomes.

> The standards make you have to learn to work well in groups, and sometimes those groups are the entire class or a large part of the class so you will have to come up and present your "record of thinking." That's a big thing in the seventh grade standards.

Close examination of several of the comments indicated that these teachers had leanings in this direction all along, and that the standards gave them the impetus to continue moving in that direction: "A lot more English has come in using actual paragraphs, sentences, and the mode of communication. I always did a lot of that, but I think even more now."

Instead of seeing parent resistance as a reason to abandon standards implementation, these teachers sought ways to turn parent attitude around. "Parents have to be educated. We have orientation meetings to explain these things to them. I send a newsletter home and rubrics so they understand how I evaluate their child."

Comments On Mathematics Standards. The comments made by teachers in Level IV B regarding the standards were positive, supportive and constructive: "The students know exactly what they are studying and why. There is a clear objective and a purpose so they have an overall view," and, "There is a lot more emphasis on how you go about getting answers - it's how you go about trying to get the learning."

Sharing of Ideas and Materials. The frequency of sharing traversed the extremes from, "I feel I am very isolated from everybody," to, "We don't officially meet every day, but essentially we do. We use our common prep period frequently where we share." Regardless of the frequency of sharing, however, the reason for sharing moved to a more sophisticated level. As demonstrated by this teacher's conversation with a colleague, LoU IV B teachers shared with colleagues to improve student comprehension. "They give me an answer and I understand how to work it out, but could you help me to deliver this message to the students so they can understand it in a simple way?" Level IV B teachers also communicated with teachers other than mathematics colleagues and participated in discourse that centered on developing an integrated approach to learning. "We work on a unit for the whole time – use an integrated approach. I say, "I can try that! Here's what I can do in math that'll tie into what you are doing in English." I haven't gone off anywhere,

it's the same basic units that come out of the Interactive Math." It is significant to note that the integration was still being done within the prescribed units of study.

The following comment demonstrated the radical shift from teacher-centered to student centered thinking and from a negative to a positive attitude.

> I see it all as really quiet positive. If you have the right situation, you can really make some major improvements. I figure it changes the style. And once again, I wouldn't say it's all the standards. I mean, I think I'm much more involved with the student rather than the material. By working as a team, you start really considering a little bit more the individual, and the materials get taught all the same. After you've done this, you realize, well, that didn't hinder how much we accomplished. It didn't. I see it has changed my style from when I was teaching in high school.

Modifications of Standards Implementation. Level IV B teachers were no longer tied to the text. They contemplated modifications based on the integration of subject matter and the feedback they solicited from students. The following quotations made their stance quite clear.

> I pick and choose different activities to go over throughout the textbook instead of trying to be faithfully going from one activity to the next. I will develop more of a modification where I pick and choose different activities to work on that I feel are beneficial to the kids instead of the same thing over and over.

Another teacher commented, "If the students have mastered whatever we are going over, then I feel I should move on to something else." One teacher reported with no regrets,

> Every year isn't the same, you know. We're not in a rut here where we do the same thing. There will be a number of things they do this year we didn't do last year and there are things we did in your class last year that we're not into doing this year. We kind of go with the flow about how the group is working and what kind of skills they have.

And finally, a teacher commented,

> I've collected quite an enormous amount of peripheral material. I use the standards as the core, the unit, but I still have 30 years of collected information and there's quite a bit of things that I bring in that are not in the textbook that helps make math more meaningful to these kids.

Their enthusiasm for keeping what they do fresh and inspiring to students was evident in what they shared. "I'm a real experimenter. I love to try different things. We just finished a unit that investigated a real problem: why do students in the seventh grade find reading difficult?"

Instead of dwelling on problems, they moved to solutions. When one teacher discovered that seventh grade students would not have access to the computer lab, instead of using it as a reason not to study the spread sheet section of the standards, he commandeered Apple computers on their way to the dumpster and created his own mini lab. "I find some really interesting ways for the kids to use it in the seventh grade curriculum."

Student feedback is both solicited and acted on:

> I do a pre-assessment activity and then I cover the basic things about the unit – things that I feel they learned last year or years before that I feel I just need to review. So, I review them. I find myself going back and reviewing things so that we can get a good start once we begin the unit. And then, I don't have to stop as we go along and review things as often. . . . I use student feedback before I go on to another activity to know whether to go back and review or improve my explanation. When the explanation in the book seems very vague to students, I think about how I can break this down in simple terms so that the students will get it the first or second time.

Reflection was an important part of instruction with Level IV B teachers. It kept them in tune to the needs of their students and informed their decision-making.

> When we finish the lesson, I go back and write in my teacher's evaluation as to whether I felt the activity went over well, if the students mastered

> whatever I was trying to deliver, or whether I need to go back and change something and maybe next time do it a little differently.

One teacher summed up the attitude of the Level IV B teachers by stating her credo: "Any type of changes I can make to benefit the students and to help them in learning, then I will do it."

Effects on Students. Level IV B teachers believed in the standards approach and were open to the indicators that demonstrated that it was beneficial to students. Their positive attitude was reflected in the attitude of their students. "They like the situations in the book. Many of them are interesting and we do them and we extend it so it's more difficult." "The strength of it [the standards] is that the students are allowed a lot of hands-on experiences. They are allowed a lot of cooperative learning and working together in groups. That's a very valuable strength of the standards." "Students who return tell me that they are grateful for the organization and structure I gave to their math thinking."

They celebrated their students' progress: "Their scores on national tests reflect progress in computation as well as problem solving. Doesn't that tell us something?" "It's all a matter of educating. The students are delighted. I mean, the students find out that working with those calculators all the time takes off a lot of that burden. Then those that weren't good at calculating find that they at least are relieved from that and are more focused on the most important thing, you know, the procedures rather than getting lost in the small details."

Impact of Institutional Support. Teachers on this level had no complaints about training. They seemed to be looking beyond the basic understanding and implementation to other areas that would enhance their presentation of the standards. For example, one teacher wanted further training on computers so that he could import this understanding to the students via the standards.

Instead of focusing on their lack of training, teachers on this level responded by talking about what the training had done to alter their approach to teaching. "I think the big change from what I had done before taking the training on the math standards is the communication level. It made the biggest difference."

Logistical Issues. Few issues surfaced under this category. "I think we have everything we need except a schedule. Our real problem now is we're interlaced with the high school and we're having some difficulty getting some flexible time that we really need." Even when they talked about the need for supplemental materials – a request that surfaced at lower implementation levels – it was discussed under the guise of acquiring student feedback to modify their teaching. "I need supplementary materials for assessment to find out whether the students really mastered the concept," and, "I want something to go back and be able to asses students in some type of way that they understood the activity they did."

Summary Profile and Comparison with the LoU Definition. The focus of this group was positive and upbeat. They enjoyed talking about their students and the variety of new and different ways they discovered to help them achieve. Emphasis was on modifications designed to promote student achievement built on student observation and

feedback. License was taken with what was generally perceived as the prescribed course of study. Lessons were integrated, problem-based, and revolved around student needs. Despite modifications, lessons still reflected the guidelines of the standards.

Level IV B teachers had almost nothing to say regarding mandated change. For these teachers it seemed never to have been an issue or a stumbling block. Their attitude was constructive and positive; they were problem solvers. They were innovative in their approach to the standards and reflective in their teaching.

LoU IV B teachers engaged in sharing for the purpose of discovering improved methods for accommodating students' needs. One teacher lamented that teaching was an isolated profession and regretted that very little sharing took place.

These teachers were excellent models of the LoU IV B description. Their comments correlated identically. As the LoU would have it, teachers related comments and stories about how they modified instruction based on the needs of their students. The importance of teacher reflection and the need to solicit and act on student feedback was woven throughout the interviews.

The composition of the group of teachers rated as Level VI B implementers was fascinating. Interview transcripts revealed that one teacher was a thirty-year veteran in the teaching profession. It seemed reasonable that the knowledge and skills acquired over a lengthy career were an asset when implementing a new innovation. What was totally unexpected, and very difficult to explain, was that the other person in the study with a Level IV B rating was a first-year teacher. This anomaly will be discussed in more detail later in the chapter.

Level V: Integration

Definition for LoU V

> Level of Use V is a state in which the user is combining his or her own efforts to use the innovation with related activities of colleagues to achieve a collective impact on the clients within their common sphere of influence. (Loucks, Newlove & Hall, 1998, p. 191)

Categories Generated from Participant Interview Data for Analysis

The seven categories that emerged from organizing the interview data in Chapter III were used to display the data from participants with the implementation rating of Level V.

Reaction to Mandated Change. No comments.

Comments On Mathematics Standards. Commentary concerning the standards and the standards implementation was positive and enthusiastic. Teachers in Level V did not succumb to the types of frustrations that seemed to overwhelm many of their colleagues. To them, the solution was self evident: "If you have a clear idea of what you want done, when you want it done and how you want it done, you just sort of take a deep breath and do it." Their comments demonstrated accurate and extensive knowledge of the standards and noted the importance of remaining updated. They enjoyed relating ways they used the standards to inform instruction. "As I prepare to do a unit, I look at what standards fit

with whatever unit I'm getting ready to teach in my curriculum and I mess all those things together to make sure I'm touching on all the areas possible."

Sharing of Ideas and Materials. Sharing distinguished Level V teachers from their colleagues more than any other category. They communicated not only with their immediate mathematics peers but also with teachers in other grade levels and teachers in other subject areas. They spoke about inventing a school-wide problem for students to solve, about "sharing test problems and projects," making "dramatic video presentations of historical math with several departments," and being part of an "integrated lunchtime group" that met informally to swap ideas and talk about how they could work together to help their students. Sharing did not stop there, however. "I'm on cc:Mail with about half a dozen teachers from Korea to Turkey. I listen carefully, I read carefully." These Level V teachers modeled all six types of sharing mentioned by the participants in the study. They were the only teachers for whom this distinction could be made.

The frequency with which they shared also set them apart from their peers. "We are almost in daily communication. The physics teacher and I share problems all the time." The frequent communication included informal sharing as well as regularly scheduled formal department meetings. Level V teachers not only worked on improving their communication and sharing, they planned ahead. "Future plans are that we continue sharing and that we even do more closely-knit planning and possible interaction with the classes where we combine some classes and those kinds of things, for projects or special groups." To be involved to any lesser degree was not a possibility for these teachers,

> I can't imagine a math department where four or five people walk in the classroom, close the door and don't talk. That is so incredible to believe,

> and I'm told that it happens. But, if you can't meet for a few minutes in the morning and sort of swap tales about what happened yesterday and what you're planning today, if it can't happen, then it's wrong, or there are reasons that I don't want to know about.

Modifications of Standards Implementation. A self-confident group, they gave themselves permission to do what they knew was right for students. "If it doesn't work for you when you try it, you need to fix or replace it!" They never said "ignore it", they consistently said, "find a better way." When asked what they will be doing next in regard to implementing the standards, one Level V teacher remarked, "Continue using them. I can't see any changes at this point that I'm going to make in what I'm doing but again, continue to use and mesh with the DoDDS curriculum and so forth." They are not into replacing the innovation with something else. Instead, they are working with colleagues and students to polish the stone.

> They cannot imagine teaching the same way year after year. I know some teachers that have file cabinets full of worksheets, tests, and projects from the last twenty years. But, at the end of the year, I write about a one-page narrative and then I throw everything out and start over. You've got to do it. Different kids, different personality of class. Your approach is different; you chase off on different tangents. You can't go down the garden path the next time. It's always a different garden.

Using available resources in the school encouraged modification. "We're in the computer room all the time and we're in the information center pretty regularly doing research."

Self-reflection is another strategy they used to modify what they did. Level V teachers constantly asked themselves,

> How, did this go? They really didn't understand that. And, I look back and I look for information from different publications and at what the standards

> say. What didn't I do right here or what can I do differently? It's a self-evaluation. They not only reflected, they acted on their reflections.

Effects on Students. Student achievement was paramount with Level V teachers. "I think the big thing is the student achievement. We're seeing that the kids are achieving because we are coordinated ourselves. We're coordinating that through the standards. Student success; that's the biggest thing I see out of it."

How did they achieve that goal?

> What I've tried to do, is, I've tried to go from where they are to where we need to be in a logical manner. And, what I've found myself doing more and more is starting each class with a series of three to seven questions which would tie into their experiences as much as I could and then have that as a spring board to what they actually were going to do. So, I sort of set the stage with a set of questions and we hope they go running off in the right direction.

Feedback from students kept them on track. "Some kids will come in and say, 'That was really good. I liked doing that.' I've got a lot of positive reaction from the geometry project. That'll be something I'll keep doing."

Impact of Institutional Support. Level V teachers seem to have little concern for lack of external support. They took responsibility for themselves. Observing the comments and attitudes of their colleagues moved one to comment, "If you're not knowledgeable and confident, you're going to feel like you have no support and you are going to retreat to the book. And, the book is going to become the whole course. . ."

These teachers were knowledgeable and involved in their profession. They attended the summer training offered for DoDDS teachers at the University of Northern Iowa. In addition, one teacher "spent three days at a re-write of the DoDDS curriculum

using the NCTM Standards 2000, using a new standard (the NCEE Standards that DoDDS purchased) and meshing them into a new curriculum for the upcoming school year."

Logistical Issues. Their most burning logistics-related request was to simply be left alone. Time was the greatest factor.

> If they would [just] leave me alone. I come in at a quarter of seven in the morning. I'm at school till 6:00 - pretty much a 12-hour day. I would say that about 50 per cent of my classes are well planned and they're good and the rest should be but they aren't because I simply don't have enough time to think through what I want to do.

Time was a precious commodity to these Level V teachers. "I'm so busy. . . . I'm trying to fully integrate Sketchpad into my geometry class, I'm trying to teach myself MathCad, I have four different classes, and I'm coaching soccer. I would love to have time to read more [about standards]!"

Summary Profile and Comparison with the LoU Definition. Level V teachers who participated in the study were knowledgeable and self-confident. "I think we're doing it right," and, "I know what I'm doing." It did not occur to them to comment on the ills of mandated change. There was nothing exploitative or unreasonable to them about being expected to teach to DoDEA mathematics standards.

These teachers were positive and enjoyed using the interview as a forum for sharing the exciting things they were doing with students and their peers.

Although their interviews demonstrated perceptions and actions that were unique, sharing was the one category where they were most exceptional. The types of sharing and the degree to which they shared, both formally and informally, set them apart. Not only

did they communicate with their mathematics peers, but they also relied on colleagues in other subject areas, on other grade levels, and even in other countries to help them make instructional decisions.

This DoDDS profile of the Level V teacher is in direct concert with the definition of the Level V user from CBAM. The words of these teachers accurately mirror the LoU definition for this implementation level. The greatest asset for LoU V users is the type of collegiality that is used to inform instruction. It is the only major attribute assigned to this level and is considered the highest form of collaboration.

It stands to reason, that if any teacher should rise to the Level V stage of proficiency within the first few years of implementation of an innovation, that a mathematics department chairperson should be among them. It is not a surprise to discover that one of the Level V participants disclosed that she was a mathematics chairperson. What is extremely unusual, however, is that the other participant in this study that received the LoU V rating was a teacher who claimed, "I don't have a teaching degree. I don't have any education classes." This teacher, referred to in Chapter III as Teacher H, represented an anomaly in this study and will be discussed later in the chapter.

Summary of Profiles by LoU

A profile of each of the seven categories, generated from an analysis of the interview data, was created below. These profiles were designed to illustrate the progression of perceptions and activities of DoDDS teachers during each level of the implementation of the DoDEA mathematics standards.

Reaction to Mandated Change

The evolution in thought and attitude regarding mandated implementation of the DoDEA mathematics standards was amazing to observe as it unfolded through the Levels of Use. Level III fixated on the textbook, blaming it for their frustrations. They reflected an almost victim-like status. "It is *very* difficult to teach." Level IV A adopted a form of passive-aggressive compliance toward the implementation. They believed the standards were being forced on them and resisted by adopting what they considered to be a reasonable balance between the requirements of the standards and their traditional mode of teaching. "We teach it our way as long as we get the objectives done."

Level IV B teachers exhibited a complete break in attitude from their Level III and IV A peers. They acknowledged, with no remorse, the major shift that their teaching underwent in order to implement standards-based instruction. In fact, they seemed to enjoy talking about their metamorphosis. Level V participants never mentioned it.

Comments Concerning Mathematics Standards

Comments from both Level III and Level IV A participants highlighted the misperception that the textbook was the standards. Whereas Level III teachers expressed anger regarding the imposition of the standards, Level IV A persons blamed the standards for not addressing the "basic skills" and then admitted "I like it more now than I used to."

Consistent with their positive and enthusiastic attitudes, Level IV B teachers believed that standards allowed the students to know "exactly what they are studying and why." Their thinking shifted from the drill and memorization of their Level III and IV A

counterparts to the belief that students should develop a math sense, a need to understand the problem. Level V teachers addressed the standards on a totally different level. Their conversation dealt with the innovative ways they incorporated the standards into problem-based learning and group investigations.

Sharing of Ideas and Materials

Analysis of the interviews of the 11 participants generated a list of six types of sharing in which teachers engage. They include 1) sharing materials and ideas, 2) sharing curriculum and standards implementation, 3) intra-grade articulation, 4) integration of other subject areas, 5) inter-grade articulation, and 6) promoting peer support. Analysis of the teachers by LoU indicated that there was a progression in teachers sharing based on their degree of implementation. Level III teachers participated only in sharing of materials and ideas. The intent of this sharing was to save time by using a test or worksheet created by a colleague.

Level IV A teachers focused on sharing materials and ideas, sharing curriculum and standards implementation, and intra-grade articulation for the same time-saver purpose. Level IV B teachers concentrated on acquiring knowledge from their in-house peers in order to accommodate the needs of their students. Level V participants discussed tapping sources outside the school in order to accommodate students. This progression followed the LoU framework, which indicated that teachers move from sharing materials for the benefit of the user to the benefit of the client.

Not only did the type of sharing increase as teachers implemented the innovation more fully, but the intensity and frequency of the sharing also increased.

Modifications of Standards Implementation

With Level III participants, it was difficult to detect a pattern to explain the modifications that teachers were implementing. Although teachers claimed that they were returning to the basics because their "students needed it," it was evident that they were clinging to traditional means of delivery to avoid altering their instruction or their established methods of teaching. Level IV A teachers were consistent in their passive attitude toward change. When asked if they intended to make modifications, they replied, "Not really." They had established their niche and were content to remain there.

Modifications were of a different ilk for the Level IV B teachers. In previous levels, surface changes were made concerning the order of chapters and substitution of worksheets. Level IV B teachers, on the other hand, were caught up in modifying their teaching to match the standards. No longer tied to the text for security, they branched out, selectively choosing experiences for students based on student feedback.

Level V participants were the problem solvers. Sophisticated in their use of the innovation, they were skilled in being able to examine an activity and judge its merit with the help of student feedback. These teachers did not teach skills or concepts the same way because they understood that the needs of the students altered the instructional design. That thought was exhilarating not depressing to them.

Effects on Students

Level III teachers were unaware of the effects that standards-based instruction was having on their students. There seemed to be a correlation, however, between their degree

of negative feelings about the innovation and the degree of negative feelings they reported from their students. Participants rated as Level IV A teachers were more aware of the likes and dislikes of their students but were, for the most part, unable to describe the effects of the implementation on their achievement.

Level IV B teachers shared a more expanded view of what their students liked about the program (problem solving, hands-on learning, working together), but were also able to articulate their students' progress. They talked about increased scores on national standardized tests and spoke about their students' increased ability to solve problems instead of merely calculating them. Teachers at Level V expanded these insights. For them, student achievement was "the biggest thing to come out of it [the standards]." They welcomed discussing their plans to increase student success.

In addition, each group was asked whether they used the feedback provided by students to inform instruction. Level III and IV A teachers neither solicited nor used the feedback to change instructional practices. Level IV B and V solicited student feedback and used the responses to make instruction more beneficial for students.

Teacher reflection became a significant activity for those at the IV B and V levels. They took the time to self-evaluate, to examine their expectations and redirect their course of action. Level III and IV A teachers did not mentioned reflection.

Impact of Institutional Support

There were no comments from teachers assigned to the LoU III rating regarding institutional support. Level IV A teachers shared information regarding ongoing training experiences that contained "nothing radically different." A comment by one of the

because they were looking for assessment tools that would provide feedback necessary to inform instruction. Level V participants were not concerned with supplemental materials.

Resentment caused by the mandate of standards prompted Level III persons to use the interview as a forum to air discontents that had no relation to the implementation of standards. The interview became an opportunity to air frustrations with the system including class size and block scheduling. Level IV A used the interview for the same purpose and aired their frustrations concerning the power of parents to overturn teachers' recommendations for student placement in mathematics courses. Level IV B had "everything we need except a schedule;" - another concern out of the purview of standards implementation. Level V had no issues.

Summary

The LoU process sifted the data of 11 teachers into two groups. Although the following generalizations run the risk of unfairly assigning attributes to all members of the group, there was evidence to support the effort. The LoU III and IV A teachers tended to be anti-standards, back-to-basic, traditional teachers. They felt resentful, unhappy, negative, victimized, and forced to implement an innovation they did not believe in and that demanded more of them than they were able or willing to give. After three and four years, they were still uncommitted to the standards. Their conversation was often blaming and I-centered. Their needs, wants, and comfort level often superceded the obligation to their students.

LoU Levels IV B and V were, in many respects, the antithesis of their colleagues. Their words were positive, they blamed no one, they supported the process and, they were

convinced of its worth. These teachers believed that the standards movement had given them permission to teach in a way they always wanted to teach or, at least, to teach in a way that was comfortable for them. Their interviews were lengthier because they chose to tell stories of ideas they were trying that were exciting to them, of student successes, and of solutions they had found to improve student learning. They spoke about students in terms that demonstrated their focus on students. These teachers were self-confident and believed they were "doing the right thing for kids."

Analysis of Categorical Data Against the Stages of Concern (SoC) Framework

The *Stages of Concern About An Innovation* (SoC) was consulted to determine whether the CBAM framework could explain the feelings expressed in the interview data of the 11 participants. Hall and Hord (1987) hypothesized that there is a set of developmental stages teachers move through as they became increasingly sophisticated and skilled in using new programs and procedures. The SoC dimension focuses on "the feelings, thoughts and information needs of the innovation user" (Loucks et al., 1998, p. 1). "The composite representation of the feelings, preoccupations, thoughts, and consideration given to a particular issue or task is called concern" (Hall, George & Rutherford, 1998). "As these concerns are resolved, more task-oriented concerns emerge" (Loucks et al., 1998, p. 1).

The following is a brief description of the seven *Stages of Concern About an Innovation* divided into three main categories as outlined by Hord et al. (1987):

Self Concerns

0. Awareness: Little concern about or involvement with the innovation is indicated.

1. Informational: A general awareness of the innovation and interest in learning more detail about it is indicated. The person seems to be unworried about herself in relation to the innovation. She is interested in substantive aspects of the innovation in a selfless manner such as general characteristics, effects, and requirements for use.

2. Personal: The teacher is uncertain about the demands of the innovation, her inadequacy to meet those demands, and her role with the innovation. This includes analysis of her role in relation to the reward structure of the organization, decision making, and consideration of potential conflicts with existing structures or personal commitment. Financial or status implications of the program for self and colleagues may also be reflected.

Task-Oriented Concerns

3. Management: Attention is focused on the processes and tasks of using the innovation and the best use of information and resources. Issues related to efficiency, organizing, managing, scheduling, and time demands are paramount.

Impact-Oriented Concerns

4. Consequence: Attention focuses on impact of the innovation on students in the teacher's immediate sphere of influence. The focus is on relevance of

the innovation for students, evaluation of student outcomes, and changes needed to increase student outcomes.

5. Collaboration: The emphasis is on coordination and cooperation with others regarding use of the innovation.
6. Refocusing: The focus is on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative. The teacher has definite ideas about alternatives or the proposed or existing form of the innovation.

Influence of the SoC on Interview Data

In order to employ the SoC to explain the perceptions of the 11 DoDDS teachers, it was first necessary to compare its stages to the categories generated from the interview data. The following graphic representation (Table V) demonstrates the relationships that were discovered when the two were juxtaposed.

Several significant observations were derived from this comparison. Because the teachers had been implementing the mathematics standards for three to four years, there was no interview data to parallel the *Awareness* and *Informational* stages. Most of the categories that emerged from the interview data were incorporated in the stages of *Personal*, *Management*, *Consequence* and *Collaboration*. Of the seven categories that emerged from the interviews, six were found in the *Personal* and *Management* stages. The categories of Reaction to Mandated Change, Commentary on Mathematics Standards, Impact on Institutional Support, Logistics, Modifications, and Sharing of Ideas and Materials were all found under *Personal* and *Management* stages. This explained the low

TABLE V

COMPARISON OF STAGES OF CONCERN TO CATEGORIES GENERATED BY INTERVIEW DATA ANALYSIS

Stages of Concern	Categories Generated by Interview Data Analysis
Awareness: No concerns about the innovation.	No category generated from interview data.
Informational: Interest in learning more about the innovation.	No category generated from interview data.
Personal: Interest in knowing how the innovation will affect the individual. Uncertainty regarding role and ability to implement. Lack of confidence in oneself. Lack of confidence in support of administration and other uses.	Reaction to Mandated Change: Top-down mandated change concerns. Commentary on Mathematics Standards: Implementation concerns. Impact on Institutional Support: Teacher preparedness and administrative support.
Management: Focus on time, logistics, available resources, energy involved in implementation. Attention focused on the processes and tasks of using the innovation and the best use of information and resources. Includes efficiency, scheduling, organizing, and managing.	Logistics: Time, resources, and supply concerns. Modifications: Teacher-generated adaptations for the benefit of the teacher. Sharing of Ideas and Materials: Material and idea swapping to benefit teachers.
Consequence: Focus on impact of the innovation on students within teacher's immediate sphere of influence.	Effects on Students: Impact on achievement of their students. Modifications: Teacher-generated adaptations for the benefit of the student.
Collaboration: Emphasis on coordination and cooperation with others regarding use of the innovation.	Sharing of Ideas and Materials: Teachers meeting, sharing, working together for the benefit of students.
Refocusing: Focus on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative.	No category generated from interview data.

degree of implementation of the mathematics standards and offered an explanation for why so many teachers resisted its implementation.

Effects on Students was the only category derived from the interview data that found its way outside of the Self- and Task-Related SoC. It was also a category that few teachers mentioned as having significance to them. Two interview categories, Modifications and Sharing of Ideas and Materials, had their roots in *Personal* and *Management* stages. They were related to these two stages because the intent for most teachers in modifying and sharing was to lessen the burden of teaching the innovation. It allowed teachers to swap tests and worksheets so that they did not have to generate them on their own. However, a few teachers talked about sharing ideas and materials and modifying their instruction for the express purpose of accommodating the needs of their students. These teachers provided the impetus for repeating the category of Modifications in the *Consequence* stage and the category of Sharing of Ideas and Materials with the *Collaboration* stage. None of the 11 teachers mentioned superceding the innovation with a more powerful one. For this reason, there is no category generated by interview data under the *Refocusing* stage.

Influence of the LoU in Concert with the SoC

Although the comparative analysis of the categories derived from the interview data and the SoC were significant, the addition of the LoU analysis added yet another dimension. The following illustration (Table VI) depicts the SoC, the categories of the interview data, and their relationship to the LoU.

TABLE VI

STAGES OF CONCERN, CATEGORIES OF INTERVIEW DATA, AND THEIR RELATIONSHIP TO LEVELS OF USE

Stages of Concern	Categories Generated by Interview Data Analysis	LoU III	LoU IVA	LoU IVB	LoU V
Self Concerns					
Awareness: No concerns about the innovation.	No category generated from interview data.				
Informational: Interest in learning more about the innovation.	No category generated from interview data.				
Personal: Interest in knowing how the innovation will affect the individual. Uncertainty regarding role and ability to implement. Lack of confidence in oneself. Lack of confidence in support of administration and other uses.	Reaction to Mandated Change: Top-down mandated change concerns.	X	X		
	Commentary on Mathematics Standards: Implementation concerns.	X	X		
	Impact on Institutional Support: Teacher preparedness and administrative support.	X	X		
Task-Oriented Concerns					
Management: Focus on time, logistics, available resources, energy involved in implementation. Attention focused on the processes and tasks of using the innovation and the best use of information and resources. Includes efficiency, scheduling, organizing, and managing.	Logistics: Time, resources, and supply concerns.	X	X		
	Modifications: Teacher-generated adaptations for the benefit of the teacher.	X	X		
	Sharing of Ideas and Materials: Material and idea swapping to benefit teachers.	X	X		
Impact-Oriented Concerns					
Consequence: Focus on impact of the innovation on students within teacher's immediate sphere of influence.	Effects on Students: Impact on achievement of their students.			X	X
	Modifications: Teacher-generated adaptations for the benefit of the student.			X	X
Collaboration: Emphasis on coordination and cooperation with others regarding use of the innovation.	Sharing of Ideas and Materials: Teachers meeting, sharing, working together for the benefit of students.			X	X
Refocusing: Focus on exploration of more universal benefits from the innovation, including the possibility of major changes or replacement with a more powerful alternative.	No category generated from interview data.				

In the LoU analysis discussed earlier in the chapter, it was discovered that the 11 teachers fell primarily into two divisions. Those who were LoU III and IV A had many of the same perceptions and actions while the LoU IV B and V teachers had much in common. The integrated data on the table above explains why the profiles of LoU III and IV A teachers were similar and why, collectively, they differed greatly from the profile that emerged from the composite data of Levels IV B and V. Levels III and IV A were in the self concerns and task-oriented stages. Issues for these teachers were strongly I-centered, with little room left for meeting the concerns of students (Hall & Hord, 1987). Levels IV B and V, however, were not encumbered with burdens of personal demands and management concerns. As a result, they were able to progress to impact-oriented concerns and implementing the standards to a higher degree (1987).

By analyzing the integration of the LoU, SoC, and interview data it was possible to examine the perceptions of the teachers at each concern stage and at each level of implementation. Using quotations from the teacher interviews, Table VII was designed to demonstrate the developmental progression at each stage via LoU-generated commentary. For example, the reader will notice when reviewing the row representing the stage of *Personal* concerns, that the quotations are developmental. The concerns progress from the Level III comment indicating I-centered resentment, "I am required to use it;" to Level IV A's partial compliance, "I probably try to address the standards without actually doing exactly what it says;" to Level IV B's willingness to "use the standards faithfully;" and finally, to Level V's belief that "the standards give me permission to do what I've always believed I should do."

TABLE VII

PERCEPTIONS OF TEACHERS AT STAGES OF CONCERN AND LEVEL OF USE

Stages of Concern	Level of Use III	Level of Use IVA	Level of Use IVB	Level of Use V
Self Concern				
Awareness: I have no concerns about the innovation.				
Informational: I would like to know more about it.	Looking for more information on standards? No	Looking for more information on standards? No	Looking for more information on standards? No	Want more information on standards? "All the time."
Personal: How will using it affect me?	We went too far. This is very difficult to teach. I am required to use it.	I probably try to address the standards without actually doing exactly what it says.	I use the standards faithfully.	The standards give me permission to do what I've always believed I should do.
Task-Oriented Concerns				
Management: I spends all my time getting materials together.	I need supplementary material to teach.	I need supplementary material to teach.	I need materials that will help me assess what my students have learned so I know where to go next.	[no reference to need for supplementary materials]
Impact-Oriented Concerns				
Consequence: How is my use affecting students?	The students don't like the text either.	They don't even know how to divide.	Their scores are quite good – problem solving and computation.	Student success; that's the biggest plus to this.
Collaboration: I wish to coordinate and cooperate with others for the benefit of students.	Do you work with others? Share? No, not really.	From time to time we get together and swap stuff.	Help me deliver this message to students so they can understand it in a simpler way.	We do school-wide problems & dramatic video productions together. I'm on cc: Mail with half a dozen math teachers.
Refocusing: I have some ideas that would work even better for students.				

By using this matrix, it is possible to select a concern expressed in the interview and trace its development through the levels of implementation. Hall claims that "earlier

concerns must first be resolved (lowered in intensity) before later concerns emerge (increase in intensity)" (Hall, George & Rutherford, 1998, p. 6). It is interesting to note in the examples below, that the concerns do not decrease in intensity until Level IV B which is where participants began to break away from the Task-Oriented Concerns level.

Summary of SoC as it Relates to Interview Data

The SoC aided in the interpretation of the perceptions and activities of the DoDDS teachers in relation to the implementation of the mathematics standards. Sorting teachers' perceptions into the three general categories of *Self Concerns*, *Task-Oriented Concerns*, and *Impact Oriented Concerns* afforded a deeper look into the analysis of the interview data. The most profound insight offered by the SoC was that nearly all of the categories of concern that emerged from the interviews (six out of seven) were located in the *Self Concerns* and *Task-Oriented* arenas. Effects on Students, the category generated by teacher interviews that most closely aligns with student success, was outside the realm of these two bands and included only a few participants.

Most powerful, was the integration of the LoU and the SoC when acting on the interview data. This combination highlighted the progression of teachers' perceptions at various *Levels of Use* and *Stages of Concern*. The addition of the LoU ratings indicated that the category from the interview data, Effects on Students, was comprised of teachers engaged in Levels IV B and V implementation.

Anomalies

In this study, there were two teachers whose interviews reflected beliefs and actions that set them apart from their peers. Their genuine desire to do the best for students and their enthusiasm in working with the innovation made them interesting personalities to study. However, what moved them from the realm of interesting to the realm of unbelievable, were the traits they revealed concerning their careers.

Teacher J

The interview with Teacher J revealed a conscientious teacher who pre-tested her students, selected their learning activities based on the student feedback, observed and listened carefully as students solved group problems, assessed their learning regularly, and modified instruction accordingly; the profile of a model teacher.

This teacher "uses the standards faithfully," but is "selective in the use of the text and the lessons," based on constant assessment. "If I don't want the kids to do the activity exactly the way it is in the textbook, then I will use some type of an alternative that will mean more to them. I try to broaden it a little bit."

Feedback was gathered from students on a continual basis:

> I need to find out whether or not they really mastered learning about the concept. Usually, for the students' evaluation, I will informally and formally assess them. I will informally assess them while they are in the classroom working together in their groups. I walk around and listen to the interaction between the students . . . Formally, I like to give them something; a quiz, a problem, something that's an assessment tool. I use the information to decide about going on to another activity. I use the information to go back and review if I feel like I need to redo my explanation of the lesson. Sometimes they need more detail.

On the other hand, "if I know the students have mastered whatever we are going over, then I feel I should move on to something else."

Self-reflection was a significant part of her teaching.

> When I write out my lesson plan, I write out everything. When I finish the activity or the lesson, I go back and write in my teacher's evaluation as to whether I felt the activity went over well, if the students mastered whatever I was trying to deliver to them, or whether I need to go back and change something and maybe next time do it a little different.

For example,

> I'm finding that as I go along through the year, I'm going back and reviewing before I even go on to the next unit. Things that I feel they learned last year or the year before that I feel I just need to review. So, I review them. I find myself going back and reviewing things so that we can get a good start once we begin the unit . . . It took me two months to pick up on that.

When asked if she were considering making any other changes, Teacher J replied,

> I am sure I will. I'm sure as time goes on and I go thorough the textbook and go on with the standards, I'm sure I will be making other changes. Any type of changes I can make to benefit the students and to help them in learning, then I will do it.

An advocate of the standards, this teacher believed the strengths included learning through hands-on activities and working together in groups. Actively pursuing the best approach for students, she solicited the help of colleagues with such questions as, "Okay, they give me an answer and I understand how to work it out, but could you help me deliver this message to the students so they can understand it in a simple way?"

Although her comments reflected solid teaching strategies expected of experienced teachers, no other teacher in the study mentioned these ingredients when defining their teaching. Basing her teaching on the needs of students was an additional dimension not

discussed by most participants in the study. In fact, when asked what action they took based on student feedback, the majority replied, "None."

However, what made Teacher J an anomaly was not just her method of teaching, but the fact that "this is my first year teaching, ever..." Questions beg to be asked. Where did she get the insights and knowledge? The veterans had three and four years to work with this innovation and had not arrived at the place where she was functioning. What allowed her to be so comfortable with strategies that frustrated many of the veteran teachers – manipulatives, cooperative learning, experiential learning? How did she figure out the importance of student feedback and personal reflection when it was not in the repertoire of many senior members of the teaching profession? "Everything is new to me but I figure, if I revise as I go along and make modifications as I go, then everything will be okay at the end of the year. And, I'll have something to look back on and reflect on."

Teacher H

Referred to in Chapter III as the Level V maverick, Teacher H was unique to the study in numerous ways. He offered examples of sharing and teaching modifications that were far beyond what his peers in this study recounted.

> The first thing I had to do was figure out where they were and what was left to do. . . . I've tried to go from where they are to where we need to be in a logical manner and what I've found myself doing more and more is starting each class with a series of three to seven questions which would tie into their experiences as much as I could and then have that as a springboard to what they actually were going to do. So, I sort of set the stage with a set of questions. . .

Ever experimenting, his motto is: "Only be prepared to make a different mistake next time."

Self-reflection was a part of his repertoire as was student feedback.

> Either you sit down and talk to a kid one-on-one, which you don't have time for, or you try to have them tell you in writing. . . . I've had kids write me how they did the word problems and I realized it was purely coincidence that some of them came to the right answer.

Teacher H was the epitome of sharing.

> The three of us in the math department are almost in daily communication. We share problems. We share projects when we can. The chemistry teacher is beginning to get in on the act. When I do projects we roped in the social studies people, we roped in the English department and we did a lot of dramatic video presentations of historical math.

In addition, this teacher was involved in school-wide problems to solve, and informal lunchtime forums for teachers and students. "I'm on cc:Mail with about half a dozen teachers from Korea to Turkey." What did he share with colleagues? "One is just the general climate of the students; the second is how to reach kids; and the third type is specific techniques, specific questions and things like that."

Teacher H believed in what he was doing and believed it was for the benefit of his students.

> If you have a clear idea of what you want done, when you want it done and how you want it done, just sort of take a deep breath and do it. And if the kids don't see that you're nervous and have sweaty palms, they're like puppies, they get interested and off they go!

He adds, "Every class is different and one trick won't work with the same class day after day either. You just hope your bag of tricks is big enough to go with it."

He was a supporter of the standards. "I think that I understand the spirit of the standards and I think that I not only comply with them but I'm sort of enjoying the fact that I get to do it that way."

Modifications were made with the students in mind.

> I know some teachers that have file cabinets full of worksheets, test, and projects from the last twenty years, But at the end of the year, I write about a one-page narrative and then I throw everything out and start over. You got to do it; different kids, different personalities of classes, your approach is different, you chase off on different tangents. You can't go down the garden path the next time. It's always a different garden.

And, "if it doesn't work, you've got to fix it or replace it."

When compared to the 11 teachers in the study, Teacher H appeared accomplished, competent, positive, and student-centered. However, these alone were not the attributes that earned him the distinction of the second anomaly. These attributes came in concert with the revelation that, "I don't have a teaching degree. I don't have any education classes." This anomaly provokes a myriad of questions. How did he know what to do for students? Where did he acquire the extensive repertoire of teaching strategies? What background was he drawing from to have started the year as the physics teacher and later the calculus and general mathematics teacher? What made him open to sharing in ways that teachers with extensive education backgrounds could not or would not participate? What made him receptive to the concepts of standards-based teaching?

Summary of the Anomalies

There are two anomalies in this study. One anomaly is a first-year teacher with an LoU rating of IV B. Although her words and actions verify her rating, it is highly unlikely that this phenomenon could occur. Many seasoned veterans in this study were unable to approach this level of implementation after three and four years. It is even more difficult to explain how a person new to the profession could achieve a IV B level of implementation in such a short time.

The second anomaly is a Level V teacher who stated that he has no teaching degree and no methods courses. Close scrutiny of this teacher's interview transcript validates the LoU rating. Implementation of an innovation at the integration level is a significant accomplishment. For this reason, investigating the implications of these anomalies would be significant.

Chapter Summary

This chapter analyzed the seven categories that emerged from empirical data derived from the 11 teacher interviews. Interview data was analyzed to develop a profile from each category. Data profiles were then superimposed against the CBAM's *Level of Use of the Innovation* and *Stages of Concern About the Innovation* to determine whether these two CBAM dimensions could provide further insight into the implementation of the DoDEA mathematics standards.

The LoU construct sorted the interview profiles into two very distinct groups. The first group of LoU III teachers and LoU IV A teachers had a great deal in common. For the most part, they were not supportive of the standards implementation and were rarely involved in collegial sharing. Their interviews were generally negative and I-centered. They implemented the standards on a mechanical or routine level in their classrooms.

The second group was composed of LoU IV B teachers and LoU V teachers who were implementing the standards on the refinement and integration levels. Their interviews were confident, positive and student-centered. They supported the standards implementation and were anxious to describe how the standards looked in their classrooms.

Superimposing the interview data profiles onto the SoC yielded results that further explained the feelings of the participants. The SoC divided the data profiles into three main categories. Six of the seven categories generated by the interview data fell into the *Personal* and *Task-oriented* stages. For this reason, most of the teachers were functioning in the I-centered and management stages and were therefore unable to be in touch with or respond to the needs of their students.

Further illumination was provided by the integration of the SoC and the LoU lenses. A matrix, derived from this integration, illustrated the developmental progression of teachers' concerns by degree of implementation of the innovation. The matrix further demonstrated that only a few of the Level IV B and Level V teachers involved in the study were able to rise above the *Personal* stage and become receptive to students' needs.

Two anomalies were revealed during the analysis of the interview data. One was a first-year teacher with an LoU rating of IV B. The other was a Level V teacher who claimed not to have a teaching degree or methods courses. These teachers were among the few in this study to attain the upper levels of implementation as well as the higher concern stages.

Analysis of the interview data through CBAM's LoU and SoC underscored the value of these dimensions in studying the implementation of the innovation. These dimensions were able to determine the degree of implementation of the mathematics standards and explain the perceptions and activities of the teachers involved in the study.

CHAPTER V

SUMMARY, CONCLUSIONS, RECOMMENDATIONS, IMPLICATIONS, AND COMMENTARY

"Educational change depends on what teachers do and think – it's as simple and as complex as that" (Fullan & Stiegelbauer, 1991). This explanatory case study (Yin, 1994) examined what teachers did and what they thought about a change initiative. Their perceptions and actions were the basis of the investigation. This chapter includes the summary, conclusions, recommendations, implications, and commentary derived from the empirical information compiled in the study.

Summary of the Study

Secondary teachers of mathematics, responsible for the implementation of an innovation, were the focus of the study. The data collection, presentation, and analysis focused on explaining the connection between teacher perceptions and actions and their degree of implementation of the initiative.

Purpose

Through the lens of Hall's *Concerns Based Adoption Model* (CBAM), the purpose of the study was to explore the implementation of mandated change by classroom

teachers. The degree of implementation of the DoDEA mathematics standards and the perceptions and actions of secondary teachers regarding the implementation of the standards was the focus. Specifically, the following were accomplished:

- Classroom teachers' degree of implementation of the innovation was determined and their perceptions and activities in support of the implementation of DoDEA mathematics standards were gathered;
- Analysis of their perceptions and activities was achieved by examining the interview data through the lens of two dimensions of the CBAM: *Levels of Use of an Innovation* (LoU) and *Stages of Concern about an Innovation* (SoC);
- Other realities were identified and reported; and
- The usefulness of the CBAM lens for explaining this phenomenon was determined.

To accomplish these purposes, empirical information was needed.

Data Needs and Sources

Data needs were identified in two areas: 1) the degree of implementation of the mathematics standards by each of the participants in the study and 2) information that reflected the teachers' perceptions and activities regarding the implementation.

Eleven secondary teachers of mathematics participated in the study. Teachers were employed by the Department of Defense Dependents Schools located in Europe and the Pacific.

Data Collection

The research was conducted through a random systematic selection (Creswell, 1994). Employing a focused interview (Merton, Fiske & Kendall, 1956), all participants were assigned an LoU rating commensurate with their degree of mathematics standards implementation by certified CBAM raters. From this list, a purposive sample (Erlandson et al., 1993) of 11 teachers was chosen to ensure representation of varying degrees of standards implementation. The research was based on data gathered from the 11 focused interviews following the *Levels of Use* format.

Data Interpretation

An extensive review of the literature on the standards movement, the implementation of mandated change, and the CBAM was conducted. Data obtained from the LoU interviews was continuously cast against the literature.

Through the process of constant comparison (Glaser & Strauss, 1967), categories emerged from the interview data and were sorted according to their salient properties to provide descriptive, inferential information that could be compared to formulate propositions (Lincoln & Guba, 1985). Relational statements from the respondents emerged from the data to provide seven meaningful and relevant categories to explain the data. Tables and a matrix were formulated to represent the infusion of the interview data with the LoU and SoC dimensions.

Knowing that my biases could affect the collection and interpretation of the data, I often reflected critically on the progress of the study, making corrections when necessary. My final bias, as mentioned in Chapter I, has, however, become the mission of this study:

> I believe that there are ways (some known and others yet to be discovered) that permit human beings to move through the stages of change in a less painful manner; and I believe that it is our duty as educators to find out what those methods might be and employ them for the betterment of all.

Data Analyses

This study entailed several layers of analysis. Initially, the interview data was analyzed individually by certified CBAM raters in order to determine each teacher's degree of implementation of the mathematics standards. The interview data was then analyzed collectively to determine categories (Glaser & Strauss, 1967) that reflected the perceptions and activities of the 11 teachers. Seven categories emerged that allowed the data to be organized by profiles. Each profile was a compilation of the perceptions and actions of the participants in relation to the category.

The next step in the analysis process involved making sense of the data profiles through the use of two dimensions of the CBAM. The profiles were first examined through the lens of the LoU. After thorough investigation under that lens, the profiles were superimposed onto the SoC. Insights gained by this comparison were heightened in the last stage of analysis when the LoU and SoC levels were integrated with the profile data. This final analysis yielded further insight into the perceptions and actions of the mathematics teachers in relation to their degree of implementation of the standards.

Summary of Findings

An intended outcome of the study included a more thorough understanding of each level of the implementation in regard to teachers' perceptions and activities. An additional expectation included insights into future planning of innovations in the DoDEA system; ways to "do it better next time." Unintended outcomes appeared in the form of the anomalies, which surfaced during the data analysis.

Summary of Interview Data

Through the process of constant comparison (Glaser & Strauss, 1967), seven categories emerged from the interview data. The categories were highly significant, as they represented the major concerns and issues of teachers during implementation:

- Reaction to Mandated Change,
- Commentary on Mathematics Standards,
- Sharing of Ideas and Materials,
- Modifications of Standards Implementation,
- Effects on Students,
- Impact of Institutional Support, and
- Logistical Issues.

A profile of each of the seven categories, generated from the interview data was created. Each profile was rich in issues, attitudes, and behaviors that required *attention* and support in order to promote successful implementation.

Summary of LoU Findings

When the categories generated by interview data were cast against the LoU construct, each category profile was stratified according to the degree of implementation of the mathematics standards. These profiles illustrated the perceptions and activities of DoDDS teachers at each level of implementation.

The LoU ratings divided the teachers into two groups: 1) LoU III and IV A and 2) LoU Levels IV B and V. In this study, the line of demarcation between the LoU IV A and the LoU IV B teachers was a most significant division. It clearly illustrated a marked difference in attitudes, needs, issues, activities, use of time, and philosophies of education.

Each category, when broken down by LoU, illustrated the developmental progression of teacher perceptions and activities based on degree of implementation. Significant progressions included teachers moving from:

- Concern for the textbook to concern for the student,
- Using the interview as a forum for complaints to using the interview as a showcase for what was happening for students,
- Traditional or back-to-basics teaching to constructivist teaching,
- I-centered concerns to student-centered concerns,
- Blaming the system to bragging about what was happening with students,
- Problem finding to solution finding, and
- Mandated and logistical issues to student issues.

In addition, the progression from low implementation to high implementation indicated that the

- Degree of hostility lessened,
- Positivism increased,
- Attention to student feedback increased,
- Self-confidence increased,
- Sharing increased, and
- Self-reflection increased.

Summary of SoC Findings

To extract further meaning from data generated by participant interviews, the categories were assigned to specific stages of the SoC. Analysis revealed significant patterns:

- Comments from the majority of teachers in the study placed them exclusively in the *Personal* and *Management* concerns stages. These teachers functioned under the influence of self concerns and task-oriented concerns and were unable to invest their energies in the needs of students.
- Teachers who shared with colleagues for the purpose of student growth, demonstrated a significant shift in thinking that moved them from self concerns to impact-oriented concerns. As a result, these teachers were able to concentrate on the needs of students over personal needs. It was a category that involved very few participants in the study.
- Teachers who modified their instruction and materials for the benefit of the student also demonstrated a significant shift from self concerns to impact-

oriented concerns. The shift in emphasis allowed these teachers to concentrate on student success. Few participants described this practice.

- No teacher in the study was found in the highest level of concern, *Refocusing*.

Summary of the LoU in Concert with the SoC

By integrating the LoU and SoC concepts with the interview-generated data, a more detailed form of analysis emerged. It became possible to examine the perceptions of the teachers at each level of implementation through various concern stages. A matrix was designed using specific words and phrases from teacher interviews to study the developmental progression in detail. When using the interview data from DoDDS teachers, the following analyses were made regarding the merger of SoC and LoU constructs:

- Teachers at different levels of implementation described similar issues from very different perspectives.
- Those who viewed the issue from lower implementation levels tended to view the issue negatively. Those who viewed it from a higher level of implementation viewed it more positively.
- As a concern progressed through the levels of implementation, it tended to move from an issue to a non-issue.
- There is a direct correlation between teachers who modify instruction and share with colleagues for the purpose of meeting student needs and a higher degree of implementation of the innovation.

Areas of Further Study

The appearance of two anomalies provided cause for further study. As interview transcripts were analyzed, Teachers J and H surfaced as possessing perceptions and instructional strategies that placed them above many of their peers in this study. Of these two exemplary teachers, one was a first-year teacher and the other had never taken an education course. These phenomena bring into question the effects of pre-service education, content knowledge, and experience on teacher effectiveness – all areas for further study.

The findings of this study would be enhanced by a similar study of administrators responsible for implementing the DoDEA mathematics standards. Where are they in their understanding of the standards initiative? What are their needs? How do they see their role in the implementation process? What are their perceptions and activities relative to the implementation of the innovation? Since their role is critical to the success of the standards movement, the findings would help to complete the picture.

Implications and Recommendations

This study has implications for adding to the base of knowledge on change implementation particularly in the area of teacher sharing and collegiality. It reinforces the CBAM as a conceptual framework for the analysis of implementation of an innovation. In addition, it serves to inform practice in regard to implementing mathematics standards in DoDDS schools.

Theory

This study was designed, in part, to assess the usefulness of the CBAM in 1) determining the degree of implementation of the innovation and 2) exploring the perceptions and activities of the teachers involved in implementing the innovation. The LoU dimension proved to be invaluable as the source for rating each participant according to degree of implementation of the mathematics standards. The ratings organized the interview data for further analysis. Although the LoU interview was never created to elicit comments necessary to study teachers' feelings and perceptions, there was no doubt that the emotionalism attached to this particular innovation solicited useful data.

The SoC provided the structure for sorting the interview data. The three divisions of the SoC - *Self Concerns*, *Task-Oriented Concerns*, and *Impact-Oriented Concerns* - sorted the interview data in ways that were both simplistic and insightful. Issues raised by the teachers in the study fell perfectly within the framework. The stages were narrow enough to make the data meaningful and broad enough to incorporate all of the categories generated by the data. Two data categories fell into more than one concern stage. Upon closer examination, however, it was determined that the intent of each comment determined the appropriate concern stage. As an illustration, comments in the modifications category fell into both the *Management* and *Consequence* concerns stages. This division became clear as the data sorted itself into 1) modifications for the sake of the teacher, which matches the *Management* concern stage; and 2) modifications for the sake of the students, which matches the *Consequence* stage.

Analysis of the data through the unique integration of the LoU and the SoC provided further illumination and verification regarding the perceptions and actions of the teachers in the study. The addition of the LoU in concert with the analysis of the SoC permitted a more detailed view of the intensity of feelings, issues, and concerns as seen through the eyes of teachers at various levels of implementation. The integration permits change agents to pinpoint not only the degree of the concern but its relationship to other teachers on the implementation continuum.

In this study, a definite pattern emerged in the analysis of the LoU. Level III and IVA teachers reflected similar profiles, attitude traits, perceptions, and teacher-centered philosophy. The profiles of the Level IVB and Level V teachers demonstrated many striking commonalties including a more student-centered philosophy. According to the data analysis of this study, the transformation begins when one crosses from a IVA to a IVB. For the purposes of efficiency in analyzing the data and the planning and monitoring of an implementation in its third or fourth year, the outcome of this study suggests that Levels III and IVA be combined into one category, and that Levels IVB and V be combined into a second category.

The analysis of the data presented may possibly have extended the CBAM construct in three areas.

- Types and levels of sharing. Analysis of the interviews of the 11 participants generated a list of six types of sharing in which teachers engage. They included (1) sharing materials and ideas, (2) sharing curriculum and standards implementation information, (3) intra-grade articulation, (4) integration of other subject areas, (5) inter-grade

articulation, and (6) promoting peer support. Analysis of the teachers by LoU indicated that there was a progression in teachers sharing based on their degree of implementation. Level III teachers participated only in sharing of materials and ideas to save time. Level IV A teachers focused on sharing materials and ideas as well as sharing curriculum and standards implementation information through intra-grade articulation for the same time-saver purpose. Level IV B teachers concentrated on acquiring knowledge from their in-house peers in order to accommodate the needs of their students, while Level V participants discussed tapping sources outside the school in order to accommodate students. Not only did the type of sharing increase as teachers implemented the innovation more fully, but the intensity and frequency of the sharing also increased.

- Degree of resistance. In the study, a continuum emerged during the analysis of the category entitled "Reaction to Mandated Change." The continuum began with resentment in the form of blaming and resistance to implementation in Level III participants. It proceeded into a passive-aggressive type of compliance with many Level IV A teachers and evolved into acknowledgement of change in instruction caused by the innovation for LoU IV B teachers. Level V participants never mentioned the issue.
- Progression of issues. When the LoU was integrated with the SoC, it demonstrated a progression of the issues raised in the interview data by level of implementation. Issues tended to have their roots in the lower

levels of implementation. As they moved through the various levels of implementation, they became non-issues.

Research

The history and research on mandated change is replete with examples of unsuccessful attempts at educational reform. The CBAM research suggests that failure ascribed to an innovation may actually be a failure caused by implementation and not the innovation (Hall & Hord, 1987). To promote successful reform, it is significant for educators at all levels to be cognizant of the impact of the implementation process. This explanatory case study (Yin, 1994) explored the implementation of the DoDEA mathematics standards by examining the perceptions and actions of 11 secondary teachers who were responsible for implementing them. This study added to the existing knowledge base of mathematics standards implementation for the Department of Defense Schools. In addition, many of the specific lessons learned through the study can be applied to the implementation of other educational interventions in the system.

Practice

"Transferability of ideas is a complex problem of the highest order," Fullan reminds us. "You should never worry about your good ideas being stolen in educational reform, because even when people are sincerely motivated to learn from you, they have a devil of a time doing so" (1999, p. 63). With that in mind, there are several lessons learned from this study that may impact the implementation of future educational innovations.

Because teachers are at the grass-roots level for "making it happen," support for successful implementation of innovations becomes the responsibility of many persons within the educational organization. District-level curriculum coordinators and staff developers, as well as school-level administrators and school improvement teams can benefit from the following insights gained from this study:

- To successfully implement change, local-level administration and district-level personnel must value both the individual and the group. In this study, participants from all levels of implementation expressed or implied the need to be valued or validated. Teachers with the lowest degree of implementation tended to be the most negative. Although their behavior in the study was often labeled as resistant, naysayers provided valuable information regarding the progress of the implementation. "Breakthroughs occur when we begin to think of conflict, diversity and resistance as positive, absolutely essential forces for success" (Fullan, 1999, p. ix).
- There are specific comments, as recorded in Chapter III, that teachers make at various levels of implementation that aid an administrator or curriculum coordinator in identifying their level of implementation through informal conversation. Becoming aware of these types of comments will enable those in support roles to note progress and to offer services necessary to promote success.
- The number one impediment to implementation, according to the participants in the study, was time. Whatever can be accomplished on the district and local levels to preserve, protect, and even create time for

teachers, is essential. Streamlining or eliminating other tasks and demands on teachers' time while they are implementing an innovation buys time for teachers to become involved in opportunities that promote personal and professional growth. According to the study these activities allow them to progress to higher levels of concern and become more involved in promoting student achievement.

- One of the most important by-products of time – especially for teachers at higher concern stages and higher levels of implementation – is self-reflection. Exposing teachers to the benefits of this practice and then providing them with time to implement the process is significant in the promotion of the implementation.
- The SoC construct demonstrates that sharing is an activity that enables teachers to move to higher levels of concern. Analysis of the interview data created a list of 6 types of sharing in which teachers were engaged. Administrators, staff developers and school improvement teams must find significant and meaningful ways to encourage sharing for teachers. Since the types of participant sharing were progressive, offering a variety of opportunities that teachers can move in and out of depending on their needs and stages of concerns will be necessary. Basic swapping of materials and supplies must be encouraged to accommodate those in the lower SoC ranges. However, forums for problem solving based on supporting student achievement must be encouraged, especially for teachers in the upper stages of concern. By observing the teachers most

successful at implementation, this study offers suggestions. Teacher H, for example, was in contact with teachers in various parts of the world to solve his classroom problems. Opportunities must be engineered to allow and encourage teachers to communicate not only with their local peers, but also with those in other localities. Offering opportunities for interaction with mathematicians other than teachers would also be significant.

- Basic information about the innovation must be communicated to teachers in as many modes as possible. A one-shot inservice will not accomplish this goal. Teachers need the opportunity to revisit the concepts of the intervention as many times as needed in order to completely understand and become more supportive of the process. In the study, for example, the confusion that "the textbook is the standards" may have been corrected with periodic monitoring and staff development.
- This study supports the notion that "one size fits all" in professional development will not promote change. Formal staff development that introduces largely standardized content to individuals whose teaching experience, expertise, and settings vary widely does not address the needs of teachers. As the study indicates, each teacher is on a different level of use with different needs ascribed to the implementation level. Professional development that offers meaningful intellectual, social, and emotional engagement with ideas, with materials, and with colleagues both in and out of teaching will help to accommodate the needs of individuals. This study demonstrates that teachers do not assume an active professional role simply

by participating in a "hands-on" activity as part of a "scripted" workshop. Professional development must include subject matter collaboratives to engage teachers in the study and "doing" of mathematics, enlarging teachers' access to mathematicians or industry settings, and establishing mechanisms of consultation and support among teachers. "The most promising forms of professional development engage teachers in the pursuit of genuine questions, problems, and curiosities" (Fullan, 1997, p. 145).

- Availability of supplies and materials needed to implement the innovation was essential. Lack of materials gave the teachers in this study cause to believe that the demands of the standards were unreasonable. Although it might be assumed that supplementary materials would be more helpful after the teachers become oriented to the basic innovation, the study revealed a need for teachers – especially at the lower levels of implementation – to have access to supplemental materials from the onset. Being provided with supplemental materials was equated with demonstrating reverence for teachers' time.

In addition, this research suggests the necessity of significant modifications in terms of pre-service and inservice education. Data organized under the structure of the SoC indicated that educators who are teacher-centered are preoccupied with issues that place teacher needs above the needs of students. In most cases, over the three to four year implementation, teachers in this study remained teacher-centered. This would appear to indicate that the philosophy of the teacher was driving the concerns rather than, or in conjunction with, the newness of the innovation and the complications inherent in change.

Analysis of the data indicates that teachers in the lower levels of implementation – even after three to four years – reflected a philosophy of teacher-centeredness.

There was a definite correlation between lower levels of implementation and more traditional, teacher-centered philosophies. On the other hand, those who were student-centered in their ideology were also more advanced in their degree of implementation of the innovation. For this reason, both pre-service and in-service training should focus on the knowledge, skills and abilities that allow educators to create student-centered classrooms. For many educators, neophyte and veteran alike, this is a major paradigm shift. Teachers cannot be expected to take the leap unless they understand what such an educational setting looks like and sounds like. The concepts must be clearly embedded in the minds of educators before they officially become teachers. They must be observed, analyzed, and coached while they are teaching to transform the vision into daily reality.

The findings of this study appear significant to educational practice since they provide guidelines that will aid in promoting and monitoring successful implementation of innovations. The literature review for this study underscores the findings particularly in the areas of resistance to change, barriers and support for the implementation, and collegiality and self-reflection as it relates to student success.

Commentary

The quest for educational reform is illusive. In an attempt to improve the quality of education for students, countless interventions have been undertaken. This study examined the implementation of one such innovation and provided insights into the implementation process. Gene Hall was right; "Change is a process, not an event" (Hord

et al., 1987, p. 5). More specifically, implementation is not an event and its consequences are far reaching.

Levels of implementation are predictable and definable. Comments teachers make, perceptions they hold, and activities in which they involve themselves indicate where they are in the implementation process and how they can be supported.

Implementation of an innovation is individual. Variables that govern how much and how quickly teachers will soak in the concepts of the innovation and apply them to their classrooms are infinite. However, there are certain profiles, as revealed through the analysis of the data, which are particularly significant to successful implementation. The profile of the teacher who, after many years, is still in the lower levels of implementation, tenaciously resisting standards-based instruction, is an example. When I described this profile in greater detail to Gene Hall during a recent discussion, he shook his head and said, "Mushrooms. They are mushrooms." He spoke about this phenomenon and shared the newest addition of his change theory: the Mushroom Effect. A fascinating conjecture, it seeks to explain how the DoDDS mathematics standards implementation became such an emotional issue. In a yet unpublished manuscript, he proposed,

> Persons with high Stage 2 [*Personal*] concerns can easily interpret whatever occurs as undercutting them or as a personal attack. If this occurs only once, then there is no mushroom. However, if over a few days or weeks there are several events that are seen by the person as suspicious and questioning of them, then a poisonous mushroom will start to grow. . . . When two or more personal concern individuals who are growing "Insecurity Mushrooms" talk to each other, the social construction process works overtime. . . . At this point the individual Insecurity Mushrooms have combined into one that is shared and is ready for rapid growth through continued group construction. (Hall, 2000, p. 9/21).

A study of the phenomena of the mushroom and its effect on the implementation of the DoDEA mathematics standards would yield significant information.

Another significant question arises from contemplating the findings of the study. If the process for implementing an innovation is highly significant, then surely the innovation itself must be highly significant. How do we know what is worth fighting for? Is it the mathematics standards? Are they the panacea that advocates profess? Are there teachers who, without the guidance of standards, produce mathematics students whose knowledge and understanding of mathematical concepts, problem solving abilities, and calculation skills rival those from the best standards-based classrooms? If so, what do they know? What are they doing that generates success?

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APPENDIXES

APPENDIX A

UNION AGREEMENT

DEPARTMENT OF DEFENSE
EDUCATION ACTIVITY
PERSONNEL CENTER
4040 NORTH FAIRFAX DRIVE
ARLINGTON, VIRGINIA 22203-1634

JUL 24 1998

Dr. Marie Sainz-Funaro
President
Overseas Federation of Teachers
Cmr 426, Box 541
APO AE 09613

Dear Dr. Sainz-Funaro:

As part of our continuing efforts to foster cooperative relationships, I wanted to give you a heads up on an evaluation project being scheduled for this coming school year. As part of The Systematic Linking of Instruction, Curriculum and Evaluation (SLICE), the DoDEA Research and Evaluation Branch plans to conduct a Math Implementation Evaluation during SY 98-99 in districts containing your bargaining unit members. A one page outline of SLICE and the evaluation is attached to provide you some information on the mission, design and data collection methods. We will be asking 288 randomly selected math educators to participate in the evaluation study. District liaisons will be trained to conduct teacher observations and interviews. I want to assure you that the results of the observations and the study will NOT be used in the performance evaluation of any participating teacher.

We will be completing the selection process by August 15 and will provide you with a list of educators selected in your bargaining unit. We anticipate notifying teachers of their selection to participate in this study by September 1.

I am sure that you will have many questions about this research study. I recommend we place this on the agenda for the JLMC to be conducted on September 29 in Incirlik. We could request the Turkey District liaison attend the meeting to answer any concerns you may have about the study.

Please feel free to contact me if you have any immediate questions about the Math Implementation Evaluation/SLICE.

Sincerely,

Louise Schuster

Louise Schuster
Chief of Labor Relations

Attachments:
As stated

APPENDIX B

INFORMATION LETTER TO INTERVIEWEES

DEPARTMENT OF DEFENSE
EDUCATION ACTIVITY
4040 NORTH FAIRFAX DRIVE
ARLINGTON, VIRGINIA 22203-1635

SEP 15 1998

MEMORANDUM FOR AREA SUPERINTENDENTS, DODEA
DISTRICT SUPERINTENDENTS, DODDS

SUBJECT: Systematic Linking of Instruction, Curriculum and Evaluation (SLICE)

During school year (SY) 1997-98, the Office of the Associate Director, Accountability, Assessment, Research and Evaluation (AARE) initiated a program to systematically link instruction, curriculum and evaluation (SLICE). Staff members from education, research, evaluation and professional development collaborated with Dr. Gene Hall of the University of Northern Colorado to focus on the systemwide linking of the implementation of curriculum programs to student outcomes, which is a vital concept in education. Dr. Hall's Concerns-Based Adoption Model (CBAM) serves as the theoretical basis and practical procedures for the program. CBAM addresses the degree to which a curriculum program has been implemented (Levels of Use), which components of the program have been implemented (Innovation Configuration Map) and the concerns that teachers and other staff have about implementing the program (Stages of Concern). Years of research have validated this model of evaluating implementation of educational programs.

This SY 1998-99, the SLICE program addresses two major systemwide efforts within The Department of Defense Dependent Schools (DoDDS): Mathematics and Social Studies. Both efforts represent important collaboration in action research between headquarters and district offices.

The Mathematics Implementation Evaluation Study builds upon the study conducted in the Hessen district over the past 4 years, linking implementation of math standards to student outcomes. Each DoDDS district this year is planned to participate in this research that aims to identify specific practices that make a difference in student success. We will be selecting randomly a systemwide sample of 288 DoDDS teachers of math to study how different teaching practices link to differences in student achievement by gender and ethnicity.

The Social Studies Standards Evaluation Study focuses this year on gathering baseline data in all DoDDS districts on implementation of social studies standards. The results of the study will be used by social studies liaisons to plan appropriate professional development.

Specific details of the social studies and mathematics studies will be sent to all DoDDS superintendents and principals in September 1998. The reports of results will be shared with all schools in fall 1999. Results will assist all educators by identifying which specific teaching practices have the most impact on student achievement.

Attached is an information paper on the math study that can be used to inform other educators in your district about the study.

We look forward to this collaborative work to improve education for our students. Representatives from all DoDDS districts participated in the August CBAM Workshop in Breckenridge, Colorado. They were excellent participants and left the workshop with a commitment to the studies. We believe this capacity building in the districts will benefit our teachers and students.

Your support of this project is appreciated.

Lillian Gonzalez
Director

Attachment:
As stated

APPENDIX C

LEVEL OF USE INTERVIEW QUESTIONS

LEVELS OF USE INTERVIEW QUESTIONS

• O-II/III-VI Are you currently using _____?

If NO, continue. *If YES, turn page.* →

• Have you ever used _____ in the past?

YES *NO*

PAST USERS

1. If so, when?
2. Why did you stop?
3. Can you describe for me
   - how you organized your use of _____,
   - what problems you found,
   - what its effects appeared to be on students?
4. When you assess _____ at this point in time, what do you see as the strengths and weaknesses?

↓

Complete interview or continue with questions O/I-II

• O/I-II	Have you made a decision to use _____ in the future?
• I/II	If so, when will you begin use?
• Knowledge	Can you describe _____ for me as you see it?
• Acquiring Information	Are you currently looking for any information about _____? What kinds? For what purposes?
• Knowledge	What do you see as the strengths and weaknesses of _____ in your situation?
• Assessing	At this point in time, what kinds of questions are you asking about _____?*(Give examples to illustrate, if necessary.)*
• Sharing	Do you ever talk with others and share information about _____? What do you share?
• Planning	What are you planning with respect to _____? Can you tell me about any preparation or plans you have been making for the use of _____?
• Status Reporting	Can you summarize for me where you see yourself right now in relation to the use of _____?

YES

• Open-ended	Please describe for me how you use _____. *(Ask sufficient questions to cover minimal criteria for use.)*
• Assessing Knowledge	What do you see as the strengths and weaknesses of _____ in your situation? Have you made any attempt to do anything about weaknesses? *(Probe those they mention specifically.)*
• Acquiring Information	Are you currently looking for any information about _____? What kind? For what purposes?
• LoU V	Do you work with others in your use of _____? Do you meet on a regular basis? Have you made any changes in your use of _____ based on this coordination?

YES | *NO*

LoU V PROBES

1. Please describe for me how you work together. (What things do you share with each other?)
2. What do you see as the effects of this collaboration?
3. Are you looking for any particular kind of information in relation to this collaboration?
4. • Do you talk with others about your collaboration?
   • If so, what do you share with them?
5. Have you done any formal or informal evaluation of how your collaboration is working?
6. What plans do you have for this effort in the future?

If you do not have enough evidence to place at LoU V, go to the question, "Sharing," to complete the interview.

OR

If you have enough evidence to place the person at an LoU V, go to question, "III-V/VI," to complete the interview.

• Sharing	Do you ever talk with others about _____? What do you tell them ?
• Assessing	• Have you ever considered alternatives or different ways of doing things with _____? • Are you doing any evaluating, either formally or informally, that would affect your use of _____? • Have you ever received any feedback from students that would affect the way you're using _____? • What have you done with the information you got?
• III/IVA/IVB	Have you made any changes recently in how you use _____? What? Why? How recently? Are you considering making any changes?
• Planning	As you look ahead to later this year, what plans do you have in relation to your use of _____?
• III-V/VI	Are you considering or planning to make major modifications or replace _____ at this time?
• Status Report *Final Question*	Can you summarize for me where you see yourself right now in relation to the use of _____?

APPENDIX D

DEPARTMENT OF DEFENSE EDUCATION ACTIVITY

PERMISSION TO RESEARCH

DEPARTMENT OF DEFENSE
EDUCATION ACTIVITY
4040 NORTH FAIRFAX DRIVE
ARLINGTON, VIRGINIA 22203-1635

October 25, 1999

Ms. Jean Silvernail &
Mr. Bill Ramos
4040 N. Fairfax Drive,
Arlington, VA 22203

Dear Ms. Silvernail & Mr. Ramos:

Your research "Comparative Analysis of: LOU Math Interviews, Mathematics Configuration Map, DoDEA Standardized Testing", has been approved by the DoDEA Research Committee.

Approval of your research allows you to proceed with the research as described. It is not an endorsement and does not compel any personnel of the DoDEA system to participate. Parent, student and staff participation is strictly voluntary, and informed consent is required before any data can be collected on students.

Please contact me at (703) 696-4385 if you have any questions.

Sincerely,

Kristin Medhurst
Specialist, Research and Evaluation

APPENDIX E

INSTRUCTIONAL REVIEW BOARD

EXEMPTION LETTER

OKLAHOMA STATE UNIVERSITY

OSU

Thomas C. Collins
Vice President for Research
203 Whitehurst
Stillwater, Oklahoma 74078-1020
405-744-6501, FAX 405-744-6244
collins@okstate.edu

Memorandum

To: Jean Silvernail and Bill Ramos
From: Carol Olson, Director of Planning, Strategic Research Development, and University Research Compliance
Date: March 3, 2000
Subject: Institutional Review Board Exception

Given that the research you propose for your dissertations uses data sets generated by the Department of Defense Dependent Schools and you will not be interacting with human subjects, no Institutional Review is necessary.

VITA

Jean L. Silvernail

Candidate for the Degree of

Doctor of Education

Thesis: THE RELATIONSHIPS BETWEEN DEGREE OF IMPLEMENTATION AND PERCEPTIONS OF SECONDARY TEACHERS REGARDING MATHEMATICS STANDARDS

Major Field: Educational Administration

Biographical:

Personal Data: Born in Palmerton, Pennsylvania, on June 28, 1949, the daughter of Richard and Joyce Ridings.

Education: Graduated from Neshaminy High School, Langhorne, Pennsylvania, in June, 1967; received a Bachelor of Science degree in Education from the College of New Jersey in Trenton, New Jersey, on June 4, 1972; received a Master of Arts in the Social Sciences in Gifted Education from the State University of New York at Binghamton on May 12, 1981; received a Master of Science in Elementary Administration and Curriculum Development from the University of Scranton, Scranton, Pennsylvania, on May 25, 1985; and a Master of Science in Secondary Administration and Supervision from the University of Scranton, Scranton, Pennsylvania, on May 25, 1985. Completed the Requirements for the Doctor of Education degree at Oklahoma State University in July 2000.

Experience: Raised in Levittown, Pennsylvania; employed by the Council Rock School District as an elementary school teacher in 1972; employed by Neshaminy School District as elementary teacher from 1972 to 1974; employed by the Tehran American School, Tehran, Iran as elementary teacher and building coordinator from 1974 to 1977; employed by Harpursville School District as Director of Gifted Education from 1977 to 1980; employed by New York State Department of Education at Albany, New York, as Gifted Education Specialist from 1978 to 1985; employed by

State University of New York at Binghamton, New York, as adjunct professor of Gifted Education from 1981 to 1985; free lance consultant in Gifted Education from 1978 to 1986; employed by the Windsor Central School District as Director of Gifted Education from 1979 to 1984; employed by Vestal Central School District as Director of Gifted Education from 1984-1885; employed by U.S. Department of Defense Education Activity from 1986 until present as Teacher of the Gifted, Assistant Principal, Principal, Staff Development Specialist for Europe Region, Staff Development Specialist for United Kingdom District, Professional Development and Education Equity Specialist for Washington Headquarters.

Professional Memberships: Phi Delta Kappa; Association for Supervision and Curriculum Development; National Staff Development Council; Smithsonian Institution; the Kennedy Center for the Arts.