Measuring Implementation in Schools:
INNOVATION CONFIGURATIONS

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Acknowledgments

We would like to acknowledge the efforts and invaluable contributions of Susan Heck and the late Susan Loucks-Horsley, coauthors of the original Innovation Configurations manual—*Measuring Innovation Configurations: Procedures and Applications* (1981).

The authors of this manual also wish to express their strong appreciation and thanks to Leslie Blair, developmental editor. Leslie worked long and hard in listening, developing an understanding of the CBAM constructs, and adding to the quality of the final product. She has become an invaluable resource and colleague.

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Foreword

SEDL is pleased to publish a reprint of the manuals describing the use of the three dimensions of the Concerns-Based Adoption Model (CBAM). All three manuals have been updated and given a new title. Each manual will be available individually, but also as a set under the title *Measuring Implementation in Schools: Using the Tools of the Concerns-Based Adoption Model.*

The title of this series may appear at first to be a misnomer. How does one "measure implementation"? Implementation is a complex process or set of processes. Researchers have proposed many models and explanations of the implementation process based on variables such as the nature of the understanding and autonomy of the implementing individuals—their capacity or their will to make changes. Other explanations focus on the clarity with which the reform policy describes outcomes, processes, and consequences. All of these models attempt to portray what accounts for successes and failures during the process of policy implementation such as standards-based education reforms.

Measuring the process of implementation is tantamount to measuring a journey. Indeed, the developers of the Concerns-Based Adoption Model have compared implementation to a journey across a chasm. In change implementation, there is a chasm between adoption of new practices and their implementation which will result in improved student outcomes. It is impossible for teachers to make a leap across the chasm; instead there is an implementation bridge, which is crossed as practice is changed and reforms are implemented. An implementation researcher certainly can't measure the journey across the bridge. But one can measure many things related to that journey: the distance from one bank to the other, the length of the bridge, and the number of steps and time it takes to reach the peak of the bridge or to cross the bridge. An evaluator can estimate how many people are needed to take the journey; she can describe how they organize to pack, navigate and choose the route, correct their course, and complete the journey. And in the end, the measurements will help us see what happened during the course of the journey; we can understand how we came to begin and complete the journey and arrive where we planned.

If "implementation as a journey" is a metaphor, the notion of taking measure of aspects of that journey is an extension of that conceptual metaphor. It reminds us of some important qualities of the process of implementing educational change: it is dynamic, it is difficult, its success or failure is affected by many interdependent factors and variables, many of which we still know little about. And it provides the framework in which to consider some of the tools we might take to make that journey more memorable and productive. The various dimensions of the Concerns-Based Adoption Model (CBAM) provide some of those tools.

Scope of the Revision of the CBAM Manuals

Purpose and Intended Audiences

The CBAM conceptual framework, data collection tools, and model for considering implementation are among the most important contributions to research on the process of change in education in the past 30 years. During those years, observers of school improvement have documented movements from "effective schools," to "school restructuring," to "systemic reform," to "standards-based reform and accountability." How we think about implementation has also evolved from thinking about the success of an implementation process as a function of one teacher and one curriculum, to thinking about it as a function of an instructional group—a team or a faculty. Though CBAM was developed during an era when introducing single innovations was a prevalent way to improve teaching and learning, the model continues to inform education reform today. The refined CBAM manuals accomplish the following: (a) present the constructs of the model; (b) update the knowledge base; and (c) support appropriate applications of the CBAM through appropriate use of the CBAM tools to assess the implementation of innovations in school settings.

The new generation of CBAM materials is aimed primarily at researchers charged with measuring the implementation of a new practice or innovation in a school setting. By "researchers" we mean university researchers, program evaluators, and change facilitators who are gathering data to assess, describe, evaluate, or monitor the implementation of change. Evaluators, administrators, and other staff members can use the CBAM tools formatively to track how they are implementing particular reform initiatives.

Implementation researchers may also use the CBAM tools to build knowledge about how teachers make sense of reform policies and resulting innovations. Reviewing data gathered using all three tools helps them add to the implementation literature to refine what is known about how teachers' cognition, affect, and sense of their situation helps them make sense of and interpret policy reforms. Their ability to do that sense making is critical to their implementation of an instructional innovation. The CBAM tools used in an integrative way can help researchers add to the implementation knowledge base.

A third audience includes administrators, teachers, and change leaders who are charged with implementing and sustaining change in a school or across a district. Faculty and other staff members can use the CBAM tools to clarify the components of complex reforms. Administrators can use them to collect data that will help them determine what modifications to make or what types of support they need to provide—more resources, professional development for teachers, or tutoring for students—to improve and sustain implementation of a standards-based reform.

Parameters of the Updates

The principal authors, who were among the original CBAM developers, identified the following parameters for refining the selected materials in each volume: (a) incorporate most recent advances in methodologies; (b) use approachable, accessible language that represents the depth and rigor of the knowledge base about CBAM for an evaluation audience yet is instructional for the practitioner user; (c) explicitly discuss the strengths and limitations of the updates of this version, especially in discussion of most recent statistical analyses; (d) update literature review for each construct and include explicit descriptions of research design, methodologies, and source and year of publication; and (e) include recent examples of application of the model or one of the CBAM tools, focusing especially on assessing the progress of implementation processes.

Structure of Volumes

Each of the three CBAM dimensions is described in a separate volume, *Measuring Implementation in Schools: The Stages of Concern Questionnaire; Measuring Implementation in Schools: Levels of Use;* and *Measuring Implementation in Schools: Innovation Configurations.* The three volumes contain similar or redundant information so that each volume can stand alone as a CBAM reference. All three volumes are structured as follows:

Foreword
Preface
Introduction
- Describe CBAM constructs
- Describe relationship of the tools to each other

Example applications and scoring measures
Literature review
- Narrative
- Summary chart: author/reference/findings

Resources
References

Each CBAM dimension has a unique tool, with specific traits and strengths as a tool. The Stages of Concern (SoC) Questionnaire is a quantitative instrument that measures what a teacher or user is feeling about an innovation. The Levels of Use (LoU) Interview is a focused interview protocol that measures teachers' actions in eight behavioral profiles along a continuum of use. The Innovation Configurations (IC) Map is a verbal description of the components of an innovation; it describes what individuals will be doing as they are implementing each component, with variations of practice from poor to ideal. Likewise, each volume has its own particular characteristics, modifications to the structure, and specific resources.

Finally, a supplemental resource in video format is available on the SEDL website at www.sedl.org/cbam/videos/cgi? The video includes an overview of the CBAM constructs as they may be applied to assessment of implementation of standards-based reform and accountability initiatives. The video features interviews with Dr. Gene Hall, Dr. Shirley Hord, and Dr. Archie George, three of the original CBAM developers and principal authors of this revised series.

SEDL appreciates the support of the Institute of Education Sciences for this revision of CBAM tools. We are also grateful for the assistance and support of our colleagues who reviewed drafts of these manuals: David Marsh, University of Southern California; Kay Persichitte, University of Wyoming; Sharon Boutwell, Spring Branch ISD; and D'Ette Cowan, Ann Neeley, and Ed Tobia, SEDL. Our expectation is that evaluators, researchers, and practitioners will use the new generation of CBAM manuals to assess the implementation of reform initiatives with the goal of improving education for all learners.

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October 2005

Preface

The school reform movement in this country began in the late 1950s after the Soviet Union launched *Sputnik*. The United States responded to the Soviets' successful launch of a satellite into outer space with a large measure of criticism focused on its own schools. Obviously, the U.S. education system was not up to par if other nations were reaching space ahead of the United States. These criticisms stimulated a great deal of curriculum development, especially in mathematics and science, and resulted in a plethora of new programs.

Teachers were introduced to these new programs and expected to implement them in their classrooms. Although school leaders gave limited attention or support to the implementation process, they expected the programs to improve student performance. Not surprisingly, this scenario resulted in poor or no student gains. Thus ensued repetitive cycles of

- introducing a new program;
- providing little or no support for the classroom implementers; and
- assessing student gains after 1 year of use.

This usually led administrators to conclude that the current program was not effective. They then rejected the program and replaced it with another one, with the same results. Finally, some wise person wondered, "Maybe it wasn't the programs; perhaps it was the process."

Fast forward to the mid-1960s when the U.S. Congress created two entities to support education in the United States: one was a set of educational research centers based at major universities that would help answer the questions that persons at all levels of the education system, from the classroom to the statehouse, had about educational practice. The second was a series of regional educational laboratories that would disseminate the research centers' findings to the state agencies and school districts in their respective regions.

One of these research centers was the Research and Development Center for Teacher Education (R&DCTE) at the University of Texas at Austin. Not long after its creation, the center was invited to explore the issues involved in implementation of new programs and practices in the nation's teacher education institutions and in schools and classrooms. Long-term studies resulted in the development of the Concerns-Based Adoption Model (CBAM). This model included the identification and confirmation of three diagnostic concepts and their measures: Stages of Concern, Levels of Use, and Innovation Configurations. It also articulated prescriptions—that is, an intervention taxonomy or actions that were deemed necessary for facilitating implementation and utilization of new practice.

During the past 25 to 30 years, CBAM and its dimensions have been the basis for numerous research projects and have continued to play a role in change processes in schools, districts, and institutions of higher education around the world. Researchers and change facilitators continue to request the original manuals for using CBAM's three diagnostic tools. Because of the manuals' enduring utility and value, the SEDL decided it was time to update them, especially in light of the number of journal articles, dissertations, and research reports that have been published on the model and its dimensions. It is a great honor for those of us who worked at the R&DCTE in the 1970s—Gene Hall, Archie George, Suzanne Stiegelbauer, and me—to work together again to update the three manuals.

In this manual we will explain the concept of IC more fully, provide information on how it was developed and is being used currently, and detail the steps in creating an IC Map. The manual has been designed to help researchers and program evaluators as well as change facilitators gather data to evaluate, assess, or monitor the implementation of change. Because education practitioners often find themselves in the role of researcher, evaluator, or facilitator, we have tried to make the manual usable to those who do not consider themselves experienced researchers as well as to those who are more experienced.

Shirley M. Hord, PhD
SEDL
Austin, Texas
July 2005

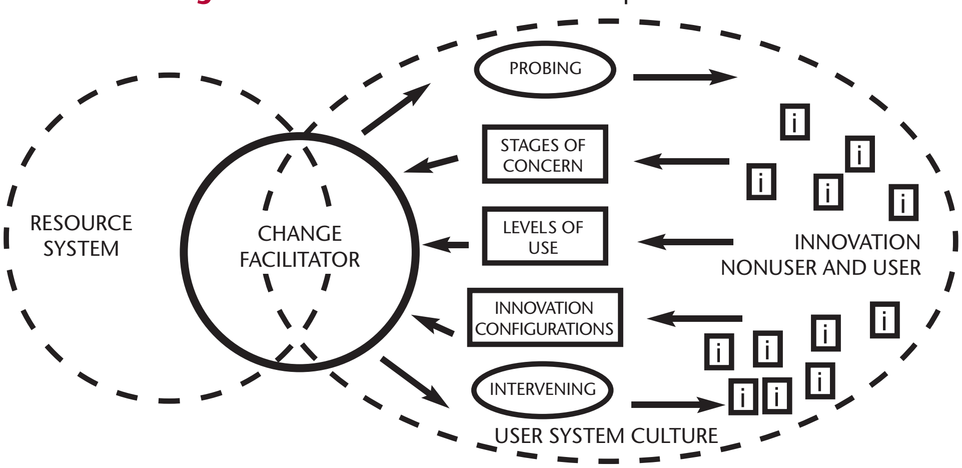
Chapter One
Introduction to Innovation Configurations: The "What" in Change

Schools, districts, institutions of higher education, states, and other organizations usually embark on the change process with the goal of improvement. Far too often, schools and districts are not successful in implementing change. This is as true today as it was more than 30 years ago when the Concerns-Based Adoption Model (CBAM) was developed in the era of science and mathematics reform. At that time delivering "teacher-proof" curriculum materials was thought to be the way to produce immediate change. Staff at the Research and Development Center for Teacher Education (R&DCTE) who originally developed the model (Hall, Wallace, & Dossett, 1973) realized there was more to change than just giving teachers a box of curriculum materials; there was a process involved. The CBAM researchers hypothesized that teachers and others who were implementing new innovations or change would progress through a set of developmental stages and levels as they became more sophisticated and skilled in using an innovation, whether the innovation was in the form of a program or set of strategies or procedures. Several premises underlie the model:

- Change is a process, not an event.
- Understanding the change process in organizations requires an understanding of what happens to individuals as they are involved in change.
- For the individual, change is a highly personal experience.
- For the individual, change entails developmental growth in terms of feelings about and skill in using the innovation.
- Information about the change process collected on an ongoing basis can be used to facilitate the management and implementation of the change process.

CBAM is a framework designed to provide measurement concepts and tools for evaluators and researchers to evaluate the effects or progress

Figure 1.1. The Concerns-Based Adoption Model



of implementation of an innovation or multiple innovations that may constitute a reform program. CBAM was also designed to help school or district leaders, coaches, staff developers, or others who take on the role of change facilitator identify the special needs of individuals involved in the change process and address those needs appropriately based on the information gathered through the model's diagnostic dimensions.

As shown in Figure 1.1, all of the dimensions and various interactions proposed in the framework are meant to acknowledge that change is a process and that change facilitation entails continuous and systemic interactions.

This manual is one of three in a series that describe the use of the CBAM diagnostic dimensions—the Stages of Concern (SoC), the Levels of Use (LoU), and Innovation Configurations (IC). Briefly, the Stages of Concern addresses the individual's perceptions, feelings, and attitudes relative to the innovation. The LoU focuses on the individual's behavior. It distinguishes among three levels of nonuse and five user levels. It describes how individuals are actually preparing to use the innovation or implementing the innovation. IC describes the innovation in action. IC clarifies what the innovation or change actually looks like along a continuum from high-quality implementation to least desirable practices. IC refers to the "what" of change.

With these dimensions it is possible to obtain systematic data about each person's use of and concerns about an innovation. When data from each dimension are compared for individuals or groups of staff, it is possible to rank order subjects on a scale ranging from those who have moved the least to those who have advanced the most in terms of implementation. The rankings for each of the three dimensions can be combined to give a composite ranking of implementation success. They can also be used as criteria for exploring the relationship of implementation success to various change process variables (Huling, Hall, Hord, & Rutherford, 1983).

The CBAM and the Current Era of Reform and Accountability

Current uses of the CBAM model are as diverse as the innovations to which its parts might be applied. The foundational development period for CBAM materials, based on research and testing applications, occurred from the mid-1970s to the mid-1980s, ending when the Research and Development Center for Teacher Education was no longer federally funded and the core research team moved on to other research and academic organizations. During this early phase of active development of CBAM materials, an international cadre of CBAM practitioners and researchers emerged. These practitioners became trained in the model and disseminated it to a wide range of school, organizational, and university settings. As a result, CBAM tools have been commonly used in federally sponsored research projects, dissertation research, evaluations, and change programs.

Since the initial development of CBAM, our conception of school reform has evolved from the diffusion and adoption era to one of systemic reform. The earlier era presented best practice in terms of discrete innovations or programs developed by an external source and presented to teachers as a packaged product. The movement toward systemic reform was strengthened in 2001 when the national agenda—as reauthorized in the Elementary and Secondary Education Act, or the No Child Left Behind Act—mandated a range of policy strategies. These included a focus on high academic standards and standards-based assessments, school choice, strong charter school laws, improvement of teacher content knowledge and certification, higher pay for teachers, more funding for instruction, and increased level of parent involvement in schools.

Although the policy intent was to give autonomy to the states, districts, and schools, the federal government prescribed accountability measures—including standardized testing and consequences for failing to make Adequate Yearly Progress, for example.

Because of this evolution of systemic reform, improvement is no longer viewed as the introduction of a single innovation as it was when CBAM was developed. Innovations are more complex, with multiple components, and include reform programs that span schools and districts and even entire states.

Instituting more complex reforms at multiple levels means that local implementation of education reform often is more difficult than it was in the past. However, the teacher's role in implementing reform is still key. Although researchers have deepened the knowledge base of reform implementation over the past 30 years, much is still unknown about how an implementing teacher understands or interprets a policy (Spillane, Reiser, & Reimer, 2002). The individual's own cognition, beliefs, and context or social situation all contribute to an ability to make sense of a policy. Teachers and administrators must be able to understand what is expected of them and they must be able to envision what standards look like in their classrooms. They must consistently make best and highest use of the instructional strategies and assessments to sustain these reforms for improved student and system performance. Even whole-school reform efforts will fail to produce results if the individual teachers do not implement the expected practices. Evaluators, researchers, facilitators, or school administrators who are charged with monitoring the implementation of standards-based reforms also need tools that will help them define the components of complex initiatives. For these reasons, the Concerns-Based Adoption Model, with its focus on the individual and on the innovations being implemented, continues to be a useful tool in measuring implementation.

The CBAM dimensions—SoC, LoU, and IC—give evaluators, researchers, and administrators flexible tools they can use to begin to assess, monitor, and better understand aspects of the implementation process. The CBAM dimensions are interrelated in that they describe affective and behavioral domains. District or school staff members charged with monitoring implementation can use the CBAM tools, such as Innovation Configurations, to begin to construct scales by which they can determine what is measurable within a single reform that has many variations, such as a statewide reading program. They can use Levels of Use (LoU) and IC to develop logic maps to clarify their goals, the outcomes, and the impacts of an approach, program, or strategy. Change leaders can use the tools to monitor and facilitate change, and administrators and their staff members can use the CBAM tools formatively to generate data and information they can analyze to make modifications that support the implementation and sustainability of an instructional reform.

Defining Innovation Configurations

When the researchers at the Research and Development Center for Teacher Education initially developed CBAM, their work was focused on individuals in the process of change and what was done to support the successful implementation of an innovation. The Stages of Concern and the Levels of Use both focus on the individual. However, the research team found it necessary to create a dimension that helps everyone evaluating or involved in the change process to understand what constitutes the ideal in terms of the new innovation, strategy, or program and to anticipate the variety and diversity of how individuals may implement it.

The idea for IC emerged when the CBAM research team was conducting two studies to develop reliable and valid procedures for assessing Levels of Use and determining whether teachers and faculty were using an innovation (Hall & Loucks, 1978). In one study, 400 teachers from three states were interviewed about their Levels of Use of team teaching. The other study focused on 350 university faculty members and their use of instructional modules. In the team teaching study, the teachers all said they were involved in team teaching, but when teachers were asked to describe team teaching, the answers varied greatly from school to school. The name of the innovation—*team teaching*—was the same, but the operational forms had different components and used different strategies. Similarly, in the second study, the university faculty reported using instructional modules. However, what constituted an instructional module varied among faculty members and from campus to campus. In both studies, the researchers had to ask, "Just what is this innovation?" It was impossible to answer the question in only one way because of the variations of implementation that they found among the teachers and university faculty. Some of the variations were in line with the goals of the innovations, and some were not (Hall & Loucks, 1978; Loucks, 1978).

The differences in how innovations were being implemented led the CBAM research team to develop the concept of Innovation Configurations—the operational forms of the innovation that result from implementation by different individuals in different contexts. As the examples of team teaching and instructional models show, most teachers and college instructors believed they were using the innovation. The CBAM researchers noted, however, that individuals used parts of an innovation in different ways, each characterizing a different use of the innovation. These uses are called *Innovation Configurations*. To describe these different configurations, the CBAM researchers developed a methodology and measure that is called an *IC Map*. It is called a map because it is like a road map that illustrates different ways of getting from point A to point B. An IC Map describes different possible operational forms for an innovation. The IC Map identifies the different components of an innovation and the variations in the ways each can be implemented.

In an instructional environment, for example, innovation components might include materials used, teacher behaviors, and student activities. The IC Map is the means of representing the parts of the innovation and variations in use of these parts. In other words, it provides a set of "word pictures" of how the innovation is being put into action from the individual and from the organizational perspective (Hall, 1979).

IC Maps emphasize the concrete and more tangible operational forms of the innovation, thereby increasing the possibility of having reliable and valid information about use of the innovation. See Figure 1.2 for an example of an IC Map that presents the components and variation of components for an innovation—in this case the innovation is a primary science program. In Chapter 3, we will begin more in-depth discussion of how to create an IC Map.

Definition of Terms

Before we discuss how IC Maps are used and how to create an IC Map, it would be useful to define the terms used in much of the Innovation Configurations work.

Throughout the manual, the term *innovation* is used. This term was selected to represent whatever change or reform is being implemented. An innovation may be new to the user, or it may be something that has been used for some time. In discussing Innovation Configurations, we often refer to the *developer* of an innovation or program. The developer is the organization, team, or person who created or developed the innovation or program. Developer(s) may be a school or district administrator, a policymaker, a university researcher, a publishing company, or other corporate group.

We use the term *component* to mean the major operational features of an innovation. With instructional innovations, components are usually materials, teacher behaviors, or student activities. *Critical components* are those core components that must be used if the innovation is to be considered implemented. *Related components* are those that are not critical or essential to the innovation but are recommended by the developer. A developer, change facilitator, user, researcher, or evaluator may designate a component as critical or related. Interestingly,

Figure 1.2. Innovation Configuration Map: Components and Variations of a Primary Science Program

Teacher ______________________________			
1. Uses instructional materials			
a	b	c	d
Uses only program materials	Uses program materials plus others	Uses only the textbook	Uses only teacher-made materials
2. Groups students			
a	b	c	
Arranges students to work individually	Arranges students in small groups	Organizes all students into one large heterogeneous group	
3. Administers tests			
a	b	c	d
Directs students to test themselves as they complete an objective	Tests students weekly with test results shared with students	Tests students once every 6 weeks—does nothing with test results	Uses only standardized achievement tests as required by the district

the designation of what is critical may change during the implementation process, depending on the progress made in implementation. The designations would also change in implementation of a complex program or reform that has multiple phases of implementation. Note also that the components selected for mapping are those that are identified as part of the innovation, not necessarily those that represent best practices per se—although it is hoped that a school undertaking an innovation or reform has chosen to implement an innovation that does represent best practice.

Components are distinguishable from *implementation requirements*. The latter are the support services and materials needed by individual users to implement the innovation. They are distinct from the behaviors of users as they use the innovation. Implementation requirements may be the monies or time that a district allocates for a remedial reading program, the physical facilities in which the program is housed, the training and/or professional development required of users, or the equipment and materials assigned to individual or groups of users. They are services and materials that may be necessary for use; they are not behaviors that describe the innovation as it is used.

A component will be made up of one or more aspects, or *dimensions*. The dimensions are the starting points around which the components and variations are developed. For example, suppose a school is introducing a new reading program, which for the sake of discussion here has four components: vocabulary, phoneme awareness, phonics, and comprehension. Below is an example of the vocabulary component. Let's suppose the new reading program's vocabulary component has three dimensions: (a) the texts that are part of the new reading program; (b) word walls; and (c) the weekly word special. These dimensions could be implemented by teachers in a variety of combinations. Each combination is a *variation*. For example, below are four teacher variations.

Component: Develops Vocabulary (texts, word walls, weekly word special)

Variation 1: Teaches using the reading program text, word walls, and the weekly word special
Variation 2: Teaches using the reading program text and the weekly word special
Variation 3: Teaches using the reading program text
Variation 4: Teaches using own materials

Note that the last variation is one in which the teacher uses his or her own materials instead of the texts provided by the new reading program. Let's take a look at another component—comprehension. Under our hypothetical reading program, teaching comprehension involves these dimensions: (a) questioning, (b) context clues, and (c) predicting.

Component: Increases Comprehension (questioning, context clues, predicting)

Variation 1: Asks questions about setting, characters, and plot; tests for context clues; and stimulates students' abilities to predict what will happen next
Variation 2: Asks questions about setting, characters, and plot; tests for context clues
Variation 3: Asks questions about setting, character, and plot; stimulates students' abilities to predict what will happen next
Variation 4: Tests for context clues; stimulates students' ability to predict what will happen next

Variation 5: Asks questions about setting, character, and plot

An Innovation Configuration Map is the key tool we use to enumerate components and their variations. As seen in Figure 1.2, on a map the components of the innovations are listed vertically, with the variations (most likely to be present when each component is in place) listed horizontally. The number of variations for each component may vary. The potential number of Innovation Configurations increases depending on the number of components an innovation has and the number of variations within the components.

The examples of IC Maps that we have shown so far have been created for teachers. The IC Map can also be created to show what students, principals, or even parents should be doing during implementation of an innovation or reform program. Figure 1.3 on page 8 shows an IC Map that presents what the students should be doing as part of a new reading program.

Figure 1.3. Innovation Configuration Map: Grade 3—Student Behavior and Progress at End of Each Unit of the New Reading Program

Class ______________________________

I. Students are engaged in reading throughout the daily reading period.			
a	b	c	d
Most students engage in reading for the 60-minute reading period	Most students engage in reading for part of the 60-minute reading period	Some students engage in reading for part of the 60-minute reading period; many are off task most of the time	Few students engage in reading any of the time during the 60-minute reading period
II. Students comprehend most of the story they have read.			
a	b	c	d
Most students orally relate most of the key facts and events of what they have read; they include important details and use key language from the text; they refer to characters or topics by name; they give insightful responses to teacher prompts or questions	Most students orally relate many of the key facts or events from what they have read; they include some important details and use some of the key language from the text; they refer to many of the characters or topics by name; they provide adequate response to teacher prompts and questions	Most students orally relate some of the key facts and events from what they have read; they include a few of the important details; they refer to 1 or 2 of the characters by name or by a generic term such as "boy" or "girl"; they provide some response to teacher questions and prompts but require many questions or prompts	Most students tell 1 or 2 key facts or events from what they have read. They include 1 or 2 important details. Students refer to characters or topics by pronouns. Students provide little response to teacher questions and prompts, even after being asked or prompted numerous times
III. Students are able to understand and utilize vocabulary from the story they have read.			
a	b	c	d
Most students define and use most of the new vocabulary words from the story they have read	Most students define and use many vocabulary words from the story they have read	Most students define and use several new vocabulary words from the story they have read	Most students define and use 1 or 2 new vocabulary words from the story they have read

Chapter Two
Applications of Innovation Configurations

Innovation Configurations can be and have been used for a variety of purposes. In this section, we'll discuss the most common applications: research, evaluation, dissemination, and professional development. IC also can play an important role in the school change process, which is discussed fully in *Implementing Change: Patterns, Principles, and Potholes* (Hall & Hord, 2006). Chapter 5 of this manual expands on the discussion of applications with a review of recently published literature related to IC.

Research Applications of IC

In a research context, information about ICs can be used to assess the extent to which the treatment is truly absent from the control group. Sometimes there is an implicit assumption that no members of the control or comparison group could be performing in ways that closely resemble behaviors of those in the treatment group. Conversely, it is often assumed that individuals assigned to a treatment group will implement an innovation as intended by the researchers or developers. However, as has been well documented (Berman & McLaughlin, 1978; Gallagher, 1967; Hall & George, 2000; Hall & Loucks, 1977; Rice & Rogers, 1980) innovations are often modified or adapted in the implementation process. Therefore, specification of the treatment and its placement in the study context is a crucial first step in determining its relative influence.

Another research application is to test the extent to which the hypothesized best practices that are stated in state standards do in fact lead to increases in outcomes. For example, the 1991 National Council of Teachers of Mathematics (NCTM) standards were research-based hypotheses about best classroom practices. Subsequently, IC studies were done that documented that in fact those classrooms with higher fidelity to the NCTM standards did have higher student outcomes. In other words, the NCTM standards were research verified through an IC Map study of implementation (George, Hall, & Uchiyama, 2000).

Evaluation Applications of IC

In an evaluation context, information about ICs can be used to answer questions such as whether the innovation has been fully implemented, what the innovation looks like 1 or more years after adoption, and what relationship the innovation has to student outcomes. Such information may provide a baseline for assessing further needs, for determining bottlenecks for broader implementation, for responding to funding sources, and for developing professional development activities. In outcome evaluation studies, IC Map information can be used to determine the degree to which different configurations are linked to student outcomes.

Dissemination Applications of IC

In a dissemination context, knowledge about IC can provide concrete descriptions about the range of "configurations" that are possible with a new program or practice. These text images can be of great assistance to the people who will actually be using the innovation or who might be affected in some way by the innovation. When an innovation is not described or communicated fully to those who will be implementing it, they are more likely to implement an unusual configuration. Ideally, it should be made clear prior to implementation which components must be part of the implementation in order for implementation to be considered successful. For programs such as whole-school or systemic reform programs, there will be numerous and possibly complex components. The descriptions of each component, or the basic operational elements of the innovation, can complement understanding of the philosophy behind the program, thus allowing teachers, administrators, trainers, researchers, evaluators, and others to envision what will be expected of implementers of an innovation or reform program.

For example, in the 1990s some 60 individuals who represented different roles in preK–12 education came together for a week and developed first drafts of IC Maps for the nine innovation bundles of the Kentucky Education Reform Act (KERA). Copies of these drafts were shared with all 1,300 schools across the state. These IC Maps provided everyone with a common set of descriptions and expectations about what the different reforms, such as “Integrated Primary” and “Restructured High School,” would look like (Kacer & Craig, 1999).

Professional Development Applications of IC

In terms of staff development activities, ICs provide a record of what teachers actually do, thereby giving clues as to how professional development might be planned to modify, complement, or change their current practices. For example, if using a program’s recommended record-keeping system is related to desired outcomes and it was found that teachers are having difficulty using the system, then a workshop could be planned to provide practice with the system, to explain its purpose, and resolve obstacles restricting its use. The IC Map describes the behaviors that are required by the innovation; therefore, it defines what is to be learned by the implementers in order to use or carry out or perform the innovation. An excellent example of IC Maps used in this way can be found in a recent publication of the National Staff Development Council (NSDC). In *Moving NSDC’s Staff Development Standards Into Practice: Innovation Configurations* (Roy & Hord, 2003), IC Maps are used to clarify what teachers, principals, central office staff members, superintendents, and school board members must learn to do in order to meet the standards NSDC presents for high-quality professional development. Figure 2.1 is an example given for principals for the Data-Driven standard.

The IC Map is also useful as a tool for ongoing professional development activities such as self-reflection, peer observations, and observation by coaches and change facilitators. In the case of self-reflection, a teacher may be inspired by some of the component variations that reflect more advanced practice than what he or she is currently doing. For observations, the IC Map provides a tool for focused observation.

As Hall and George (2000, p. 7) noted, a problematic application of IC Maps is in personnel evaluation: “It is not that IC Maps would not work well in evaluation, it is just that we have yet to work with an organization (in education or business) that was willing to invest the time to develop an IC Map to sufficient quality and establish its validity so that its use in personnel evaluations would be defensible.”

Figure 2.1. IC Map for the Principal—NSDC Staff Development Standard: Data-Driven

DESIRED OUTCOME 4.1: Analyzes, with the faculty, disaggregated student data to determine school improvement/professional development goals

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
Works with the whole faculty to analyze a variety of disaggregated student learning results to determine school improvement goals, plus student and adult learning needs	Works with a representative group of faculty members to analyze disaggregated student achievement data to determine school improvement goals, plus student and adult learning needs	Analyzes disaggregated student data alone and informs the faculty of the results and needs	Uses personal experience and opinion to determine school improvement and staff development goals		

DESIRED OUTCOME 4.2: Analyzes a variety of disaggregated data to identify school improvement/professional development goals

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
Analyzes a variety of student achievement/ learning results, as well as other data including discipline referrals, grade retention, high school completion, and enrollment in advanced courses, to determine school improvement/ staff development goals. Ensures that data are disaggregated by race, gender, SES, and special needs	Analyzes a variety of student learning results such as norm-referenced tests, student work samples, student portfolios, and district-designed tests to determine school improvement/staff development goals. Ensures that data are disaggregated by race, gender, SES, and special needs	Analyzes student achievement results (norm-referenced and criterion-referenced) to determine school improvement/staff development goals	Refrains from analyzing any data to determine school improvement/ staff development goals		

DESIRED OUTCOME 4.3: Engages teachers, parents, and community members in data-driven decision making

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
Works with parents, community members, and the whole faculty to make decisions about the focus of schoolwide work	Works with the whole faculty to make decisions about the focus of schoolwide work	Works with a representative teacher group to make decisions about the focus of schoolwide work	Consults with selected teachers and/or community members before making decisions about the focus of schoolwide work	Works alone to make decisions about the focus of schoolwide improvement work	

Figure 2.1. continued

DESIRED OUTCOME 4.4: Analyzes relevant staff data to design teacher professional development

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
Collects and uses data from teacher concern surveys, classroom observations, walk-throughs, and informal conversations with the staff to influence the design of teacher professional development experiences	Collects and uses data from classroom observations, walk-throughs, and informal conversations with the staff to influence the design of teacher professional development experiences	Collects and uses data from informal conversations with staff to influence the design of teacher professional development experiences	Does not collect or use data to influence the design of teacher professional development experiences		

DESIRED OUTCOME 4.5: Collects, uses, and disseminates data that monitor the accomplishment of schoolwide goals

LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
Collects and analyzes student and teacher data at least four times a year to monitor the accomplishment of schoolwide goals. Uses baseline data to monitor improvements within the school year. Celebrates improvements and accomplishments based on data. Reports results to parents and the community throughout the year, as well as results required by the state or district	Collects and analyzes student and teacher data at the beginning and end of the school year to monitor the accomplishment of schoolwide goals. Reports results to parents and the community throughout the year, as well as results required by the state or district	Collects and analyzes student and teacher data at the end of the year to monitor the accomplishment of schoolwide goals. Reports results as required by the state or district	Does not collect or use student and teacher data to monitor the accomplishment of schoolwide goals		

Source: From *Moving NSDC's Staff Development Standards Into Practice: Innovation Configurations*, by P. Roy and S. M. Hord, 2003, pp. 74–75.

Chapter Three
Constructing the Innovation Configuration Map

This chapter explains how to successfully construct an IC Map. Each step described is important to the process. We recommend reading the entire chapter before beginning to construct a Map.

This manual offers educational innovations as examples; however, the concept applies to noneducational settings, as well. The examples used here were selected for ease of illustration, but IC Maps can be created for more complex innovations or reforms.

Steps in Constructing an IC Map

The following section outlines the four steps involved in constructing an IC Map. The steps are shown in Figure 3.1. The blank Map in Figure 3.2 can be used to create your own Map. The blank Map has placeholders for the components, dimensions, and variations (a, b, c, etc.). Depending on how complicated your map is, you may not need to include dimensions.

Developing an IC Map is an interactive and iterative process. It is wise to engage a team developing an IC Map, as there are issues that come to light that need to be resolved through consensus building.

Step 1: Identifying Innovation Components

The first step requires the identification of components, or the major operational features, of an innovation. Identifying components is usually a multistep process that might include reading as much descriptive material about the program as possible and interviewing the developer of the innovation or program and/or change facilitator(s).

Keep in mind that developers are likely to focus on innovation requirements such as, "Teachers must use these materials and spend 30 minutes per day . . ." That kind of information often is useful, but researchers, evaluators, or facilitators really need to know how the materials are being used and what happens in the classroom when they are being used.

When it is possible to interview the program developer(s), the following questions help delineate components. These questions are suggestions and can be altered depending on the situation.

(a) Would you describe for me [name of innovation]?

This question is intended to help the map creator get a "feel" for the innovation, including the developer's mindset, the language he or she uses to talk about the innovation, and what he or she sees as the important focus of the innovation. Developers often begin by describing philosophy and implementation requirements. It may be necessary to push to get descriptions of what the innovation actually looks like when it is in use.

The next challenge is to listen for how the developer organizes his or her description of the innovation. The developer will naturally, and implicitly, describe use in terms of components, although he or she may not name the components. The IC Map developer has to identify the components and then seek confirmation from the developer. A second challenge arises with most developers at this point. They may be very uncomfortable with analyzing or describing their

Figure 3.1. Ladder or Scaffolding of the Steps to Construct an IC Map

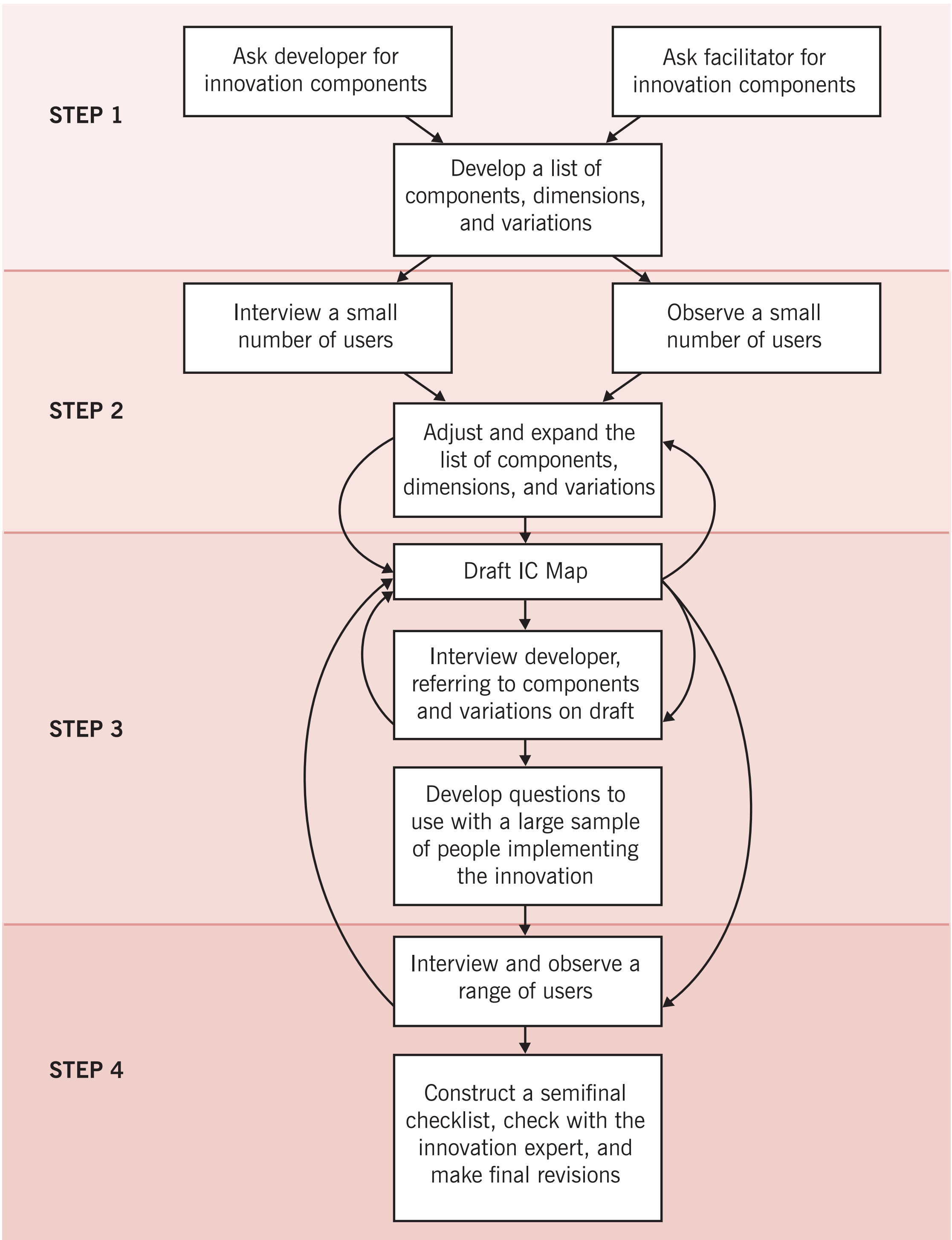


Figure 3.2. Blank Innovation Configuration Map

Component 1:		**(dimension 1, dimension 2, dimension 3)**	
a	b	c	d
Component 2:		**(dimension 1, dimension 2, dimension 3)**	
a	b	c	d
Component 3:		**(dimension 1, dimension 2, dimension 3)**	
a	b	c	d
Component 4:		**(dimension 1, dimension 2, dimension 3)**	
a	b	c	d
Component 5:		**(dimension 1, dimension 2, dimension 3)**	
a	b	c	d

Draft Version: ______________________ **Date:** ________________

innovation in terms of components. They will say, "But you can't just look at that part; it is all interconnected to make a whole." This systemic view is logical for developers who understand and have integrated the whole, but implementers have great difficulty in seeing the whole. It helps them to be able to identify parts—that is, components.

As the developer begins to describe each component, probe for more details using the following questions:

- What would [name of component] look like when it is in use?
- What do teachers do?
- What do students do?
- How do students and teachers interact?

(b) What would I see in a classroom where the innovation is in use?
Ask the developer to describe a typical sequence of activities over the course of a week or to pick a classroom and describe what goes on in implementing the ideal version of the innovation.

(c) What do you consider the most essential components of the innovation?
Be sure to distinguish implementation requirements from components. The developer may have already named some components in questions a and b. Further information can be probed by questions such as the following:

- Tell me some more about [name of components].
- You mentioned that [x, y, z] are important parts of your innovation. What are some other parts?

You might also ask about printed materials on the innovation that you have read before the interview.

(d) In order to identify the different ways each component might be exhibited in the classroom (that is, the variations), ask the following questions for each of the components named by the developer:

- What if [name of component] was not going exactly like [description above]?
- What are some other ways it might look? Can you give me a version of the component [x, y, z] that would be unacceptable to you?
- How would you like this component to be used in the classroom?
- How is it typically used?

The objective of this exercise is to establish the basic components, the dimensions of the components, and the range of component variations. Not all of the questions above may be necessary, depending on the responses obtained.

Often, someone other than the developer is responsible for facilitating use of the innovation—a central office curriculum coordinator, a staff developer, or a consultant. Most of the time there will be a group or team that is engaged formally and informally with facilitating implementation. You may wish to ask each of these people the same questions. Specific questions asked of a developer, a facilitator, or any other person connected with the innovation may vary according to your judgment of their involvement with the innovation. What is important is that you get a clear picture of what constitutes the innovation as key persons would like it to be used by teachers or others. The outcome from Step 1 is a *tentative* list of components, their dimensions, and a few variations for each component.

Figure 3.3 shows components, dimensions, and variations that might be described by a developer of a packaged elementary science curriculum called the Primary Science Program. The developer has identified the materials, time devoted to science, and ways to group students when they conduct experiments.

Step 2: Identifying Additional Components and Variations

Next, it is important to observe the innovation in use and to interview some of the individuals who are implementing the innovation. Whenever possible, the people interviewed should represent a wide range of implementers so that multiple variations will be noted. Don't limit your observations and interviews to those who are using the innovation as the developer intended, but meet also with those who have implemented it in a less than ideal manner.

When observing, you should take an ethnographic approach: every innovation-related action should be noted and every comment made by the implementer written down (Hall & Loucks, 1978). Also be sure to record a description of physical elements in the setting that are required by the innovation.

Observation has particular value when an innovation involves multiple user roles or has components that call for an interactive process such as teacher–student exchanges. Observation can also verify the presence and use of items and techniques required for the innovation: books, supplemental materials, classroom organization, learning centers, and so forth. When combining observation and interviews to create an IC Map or gather data using the already created

Figure 3.3. Innovation Configuration Map After Step 1—Primary Science Program

Teacher ______________________________			
Component 1: Uses PSP materials (PSP texts, PSP supplemental materials)			
a	b	c	d
Uses PSP texts and supplemental materials for in-class and laboratory activities	Uses PSP texts for in-class and laboratory activities; supplemental materials not used	Uses PSP texts in class only; does not use texts in laboratory	Does not use any of the PSP materials
Component 2: Spends time on science (daily, weekly)			
a	b	c	d
Teaches science daily	Teaches science 2–4 times a week	Teaches science once a week	Teaches science less than once a week
Component 3: Groups students for laboratory activities (individually, small groups, large groups)			
a	b	c	
Groups students to work individually in the laboratory	Groups students in groups of 3–4; students take turns conducting experiments	Groups students in larger groups of 6–8; students take turns conducting experiments	

Map, observation allows for a broader perspective of the innovation and a sense of the context, which can be helpful in interpreting users' responses. It also serves as a means to validate the information collected by interview method or pen-and-paper methods.

The following questions are useful when interviewing teachers who are implementing the innovation. These questions could also be used as a basis for observation.

- Would you describe the innovation for me?
- What would I see if I visited your classroom while you were using the innovation?
- What would you be doing in the classroom?
- What would your students be doing?

You will also want to ask about the use of each component identified in Step 1 to identify variations for each component. It may be helpful to ask the teachers if they have seen other teachers using the components differently.

The second step results in an expanded list of components and variations within each component. An IC Map is emerging.

Figure 3.4 shows the emerging draft of IC Map for the Primary Science Program might look like after the map creator has observed teachers using the program. Note that although the components remained the same, there are more dimensions of Component 1 (materials used), and more variations for each component, than the developer suggested there might be. Keep in mind there is no set number of variations for any component. The map creator should map the number of variations for each component that make sense.

Step 3: Refining the IC Map

If possible, return to the developer to discuss what you have heard and seen while interviewing and observing users in Step 2. A developer can help explain different activities and processes you might have seen in your observations but did not discuss in your first talk and can expand upon other points. Returning to the developer at this point helps identify the most important components, verify variations, clarify discrepancies between developer and user viewpoints, and decide what language to use when describing an activity or behavior.

In preparation for the second talk with the developer, create a draft of the IC Map for your own reference. As you talk to the developer, you can refer to the components and variations on the IC Map draft. You can expand the map once you have reviewed it with the developer. At this point care must be taken to

- standardize the IC Map's format, including repetition of the same dimensions within each variation in a single component and utilization of the same subject across the map;
- use language appropriate for the user;
- distinguish between critical and related components; and
- note any differences in variations due to student characteristics—that is, variations for a first grader may be different from variations for a second grader.

The last part of Step 3 involves sketching questions and observation guidelines to use with a larger sample of users.

Step 4: Testing and Finalizing the IC Map

This step involves testing the early draft by actually using the IC Map to observe and interview a wide range of implementers. This testing can be a reality check, as these observations and inter-

Figure 3.4. Innovation Configuration Map After Step 2—Primary Science Program

Teacher ________________________________					
Component 1: Uses PSP materials (PSP texts, PSP supplemental materials, teacher created materials, other materials)					
a	b	c	d	e	
Uses PSP texts and PSP supplemental materials in the classroom and laboratory	Uses PSP texts only in the classroom and the laboratory; does not use PSP supplemental materials at all	Uses PSP texts and materials he or she created in the laboratory and the classroom	Teacher uses old textbook and materials he or she created	Teacher uses only materials he or she created	
Component 2: Spends time on science (daily, weekly)					
a	b	c	d	e	f
Teaches science daily	Teaches science 2-4 times a week	Teaches science once a week but in a long block of time	Teaches science once a week	Teaches science less than once a week but teaches science on a regular basis; for example, every 2 weeks	Teaches science occasionally when there is time
Component 3: Groups students for laboratory activities (small groups, individually, large groups)					
a	b	c	d	e	
Groups students individually to conduct experiments	Groups students in small groups of 3–4; students take turns conducting experiments	Groups students in larger groups of 6–8; students take turns conducting experiments	Selects certain students to conduct experiments while others watch	Teacher conducts experiments while students watch as a large group	

views always bring out components, dimensions, and variations that were not identified earlier. The range of implementers should include individuals who are reputed to be doing a fantastic job with the innovation, others who are reputed to be doing "okay," and some who are not using it.

Problems with the Map usually become apparent the first few times it is used. Typical problems that tend to emerge from these first live trials include the following:

- The innovation implementers might use terminology different from the developer or facilitator to describe the innovation. If the map creator has relied solely on interviewing to gather information about innovation implementation, he or she may need to modify the interview questions, the observation guide, and the IC Map to avoid any miscommunications between the interviewer and the user.

- When observing or interviewing additional implementers, variations that are not on the draft IC Map may emerge. The Map creator should work with the innovation developer to determine whether it is appropriate to add additional variations to the IC Map.

Following the first tests, the Map will likely need to be revised. Additional consultation with the developer(s) will be needed, and subsequent rounds of observations will be necessary. It is helpful to clearly mark Maps as drafts and include a date or some other identification that will make it clear which version the Map represents.

Innovation Configuration Map Formats

IC Maps may vary in format depending on the data of interest, the resources available, and the innovation itself. The same components containing the same information can be expressed in different formats.

Simple Dimension Components

The major differences among IC Map formats concern the number of dimensions and variations of a component and the amount of descriptive detail within each variation. Some components have only one or two simple dimensions, whereas others are multifaceted. For example, the component "Teaches Objectives," which follows, consists of three variations such that the researcher or facilitator marks only the one variation that best describes the user's practice. Note that this component has little detail, few dimensions, simple variations, and mutually exclusive variations.

Component: Teaches Objectives

1. Teaches program objectives in sequence.
2. Teaches program objectives out of sequence.
3. Does not teach program objectives.

Within this format, the individual who is implementing the innovation either is *or* is not teaching program objectives and, if the user is teaching them, is *or* is not teaching them in sequence. In this case, one variation can be marked to the exclusion of the others. Little detail is offered about the teaching of program objectives other than their sequencing (or lack thereof).

Multiple-Dimension Component

A more detailed description of the use of objectives is obtained by isolating a set of dimensions of the component and describing different combinations to create word pictures. Note that in this example the component has more detail and more dimensions, and the variations may not be mutually exclusive.

Component: Teaches Objectives

1. Uses the program objectives as the primary curriculum guide for ongoing math instruction.
2. Devotes class time to teaching some or all program objectives for ongoing math instruction, not remediation.
3. Increases attention to teaching program objectives immediately prior to program testing (i.e., "preps" for program tests).
4. Teaches math objectives other than program objectives (whether or not program objectives are taught).

The example in the previous section asks whether objectives are being used in sequence. The second example, by contrast, asks how and in what context the objectives are being used.

In the latter example, the additional dimensions make the composite variations more detailed and rich. The formats illustrated in both examples are straightforward and can even be rated by the user without the presence of an interviewer or observer, thereby reducing some data collection costs. However, as more variations become possible due to combining specific dimensions, there is potential for some data analysis problems to occur.

More Complex Variations

Depending on the intended use of the Map and the innovation(s) being implemented, a more complex Map may be desired. For example, a Map may cluster components (see Figures 3.5 and 3.6), to emphasize the philosophy of the developers, or include indicators or examples of behaviors indicative of certain variations (Figure 3.7). Some Map developers, especially those who are creating Maps for purposes of implementation of a reform program, may find it useful to include a checklist of resources needed for implementation. An example of this is shown at the bottom of Figure 3.6.

Clusters are sets of components that describe a major theme or function of the innovation. They are useful for more complex innovations or reforms that include multiple innovations. The steps in creating a Map that features components grouped in clusters are basically the same as those described in the section above, except that after the initial document review and interviews (Step 1), a cluster Map is developed. This is a schematic Map of the array of possible components, their clustering, and perhaps some of the possible variations for certain components. The goal here is to develop a holistic organizing scheme of possible components and clusters of components that represent what the innovation is like when it is used. Figure 3.7 shows a more complex Map with examples of behaviors indicative of variations. If the clusters are organized around the roles of individuals, then individual IC Maps for each role may be created. For example, separate Maps may be created for the principal, teachers, and students.

Some IC Map users and creators have found it useful to add dimensions and variations that represent classroom practices that are being used instead of innovation components in operation as expected. These are usually “e” or “f” variations. An example of this format is shown on Figure 3.7. In that figure the “e” variation shows where there is nothing occurring related to the component—i.e., nonuse of the innovation. The “f” variation represents what a teacher could be doing that was the opposite of the philosophy of the *Essential Curriculum* that was being implemented.

Once an IC Map has been completed and there is consensus about components, dimensions, and variations, the Map should be labeled in a way that signifies that initial development has concluded. The authors suggest using “Form A” as the map’s initial label, noting that this “form” will be held constant for a time. This form of the map can then be distributed and used by the intended audience(s) and for the intended purpose(s). Later, when revisions are made, the label would be changed to “Form B.”

Deciding Which Variation to Use

As mentioned previously, the advantage of an IC Map with variations containing combinations of multiple dimensions is that it allows for greater subtlety in the description of the implementer’s adaptation and context. The disadvantage is that as more dimensions are combined, the number

Figure 3.5. Innovation Configuration Map Using Clusters

CLUSTER NAME					
Component 1:			**(dimension 1, dimension 2, dimension 3, dimension 4)**		
Variation a	Variation b	Variation c	Variation d	Variation e	Variation f
Component 2:			**(dimension 1, dimension 2, dimension 3, dimension 4)**		
Variation a	Variation b	Variation c	Variation d	Variation e	Variation f
CLUSTER NAME					
Component 1:			**(dimension 1, dimension 2, dimension 3, dimension 4)**		
Variation a	Variation b	Variation c	Variation d	Variation e	Variation f
Component 2:			**(dimension 1, dimension 2, dimension 3, dimension 4)**		
Variation a	Variation b	Variation c	Variation d	Variation e	Variation f

of possible combinations becomes too large to include them all. There may be matching problems between the variations that are presented and what a particular implementer is actually doing. More detail and more dimensions included within a variation increase the possibility that any particular implementer will be implementing a combination somewhat different from the way it is characterized on the Map. The possibility of specific variations existing that are not noted on the Map also increases. The researcher or facilitator must make a judgment of how many dimensions to include within each component, based on the intended use of the Map, his or her knowledge of the innovation itself, and the interview with and observation of the implementers.

Each type of variation design has advantages and disadvantages depending on the intent of the data collection effort and the nature of the innovation. A very complex innovation with multiple components might be better approached through a Map por-

Figure 3.6. Example of Innovation Configuration Map That Uses Clusters

A. TEACHER PRESENTATION AND FACILITATION			
1. Teacher uses Direct Instruction (communicating purposes and criteria, use of students, prior knowledge and errors)			
a	b	c	d
Teacher explicitly communicates the purpose of the lesson and criteria for the final product; teacher activates students' prior knowledge and uses it to guide his or her instruction; teacher capitalizes on "teachable moments" with the students; teacher uses student errors to enhance understanding	Teacher defines the purposes of the lesson and the criteria for the final product less well; teacher makes some use of the students' prior knowledge to guide instruction; teacher uses "teachable moments" and student errors to enhance understanding	Teacher communicates the purpose of the lesson incompletely or unclearly; teacher merely suggests criteria for the final product; teacher makes minimal use of students' prior knowledge to guide instruction; teacher makes little use of student errors to enhance understanding; teacher does not exploit many teachable moments	Teacher does not communicate the purpose of the lesson; there are no criteria for the final product; teacher makes no attempt to activate students' prior knowledge or errors to guide instruction or enhance understanding; there is no evidence of the teacher using "teachable moments"
2. Teacher facilitates student activity (asking questions, interacting)			
a	b	c	d
Teacher makes him or herself available to all students. He or she asks for student explanations and responds	Teacher spends his or her time with some of the students, while asking for student explanations	Teacher focuses on material management for the student activity; he or she asks few students for explanations	Teacher selects student to present answers to assignment; teacher directs general questions to the whole class
B. STUDENTS' ENGAGEMENT WITH TASK/INVESTIGATION			
1. Students engage in mathematical tasks throughout the lesson (engagement, time)			
a	b	c	d
Most students engage in mathematical tasks, most of the time	Most students engage in mathematical tasks, part of the time	Some students engage in mathematical tasks; many are off task most of the time	Few students engage any of the time

2. Students demonstrate understanding of problem-solving strategies (knowing your goal, knowing where you are now, knowing the steps to get to the goal, reflection)			
a	b	c	d
Students view the open-ended problem as a whole and analyze its parts; they create, select, and test a range of strategies	Students grasp the open-ended problem as a whole and analyze its parts; students pick an established/traditional strategy to try to solve the problem and apply it without considering alternatives; students reflect upon the reasonableness of the solution but not the strategy	Students approach the open-ended problem as a whole but do not have a clear understanding of the parts; the primary focus is on getting an answer; the students' reflection is on whether the answer is right rather than the reasonableness of the strategy	Students approach open-ended problems as unconnected/ unrelated parts and do not see the problem as a whole; students may manipulate materials and numbers but are not clear about the reason/purpose; if observable, reflection is about procedures

Checklists of Materials and Tools Needed for Implementation.
Check all that apply.

Manipulative Materials		Use of Technology		Other Resources	
____	Organized	____	Calculators	____	Games
____	Accessible to students during the lesson	____	Computers	____	Puzzles
		____	Overhead	____	Math dictionaries
____	Accessible to students during the day	____	Other	____	Other

Comments:

traying the interactions between dimensions, such as the complex variation illustration; this allows for a more in-depth description of the innovation. A quick index of use is more easily approached through the Map style in Figures 3.3 and 3.4.

Indicating Fidelity to Ideal Implementation

As noted earlier, a Map is formatted to allow comparison of actual implementation to the ideal or high-fidelity implementation specified by an expert or authority (who could be a school administrator, a change facilitator, a researcher, an evaluator, or the innovation developer). The Map can reflect variation in use that is "ideal," "acceptable," and "unacceptable."

This fidelity approach is also useful perhaps when creating Maps before implementation of an innovation begins or early in the implementation process. As one proceeds through the variations, beginning at the last variation and moving toward the "a" variation on the left, it becomes easy to see the behaviors and practices required to implement the innovation as expected.

Figure 3.7. Complex IC Map With Indicators, Reprinted From *The Essential Curriculum*, the Teel Institute, Kansas City, Missouri

II. ALL DAY IN THE CLASSROOM						
D. Teacher Component 6: Teacher applies principles and concepts throughout the day						
Consistent reliance on and integration of program (Complete integration)	Deliberate and conscious application of principles and concepts (Deliberate application)	Emphasizes selected principles and concepts (Selected emphasis)	Program delivery as designed (Motion)	Presentation of parts and pieces at random (Parts and pieces)	Nonuse (Nothing)	Opposition to principles and concepts (Antithesis)
a	b	c	d	e	f	g
Principles and concepts are integrated without conscious effort into activities of the day • Teacher and students acknowledge mistakes in words including “Oops, I goofed” • Teachers teach students through steps of correcting errors seamlessly • Students have “driver’s licenses” and “drive” to other parts of the building using self-control; the license can be suspended for lack of self-control	All principles and concepts are developed and consciously applied throughout the day • When opportunities arise, teacher and students draw connections to and apply specific principles and concepts • When faced with opportunities, teacher and students talk about the relevant principle or concept	Selected principles and concepts are emphasized and applied appropriately throughout the day • Teacher leads students in applying principles of self-control but does not refer to other concepts • Teacher recognizes opportunities around making mistakes but misses opportunities related to other principles and concepts	Lessons are taught, but no extrapolations to situations outside the Essential lesson context are made • When obvious opportunities to refer to principles and concepts arise, teacher does not make connection • Teacher handles fight on playground without reference to any Essential principle	Some activities are purposefully selected to teach the concept • Tap and Trade game is played without principles being taught • Social studies curriculum happens to lend itself to the selection of Essential lessons		Principles and concepts applied in classroom are antithetical to Essential Curriculum • Indiscriminate use of praise (unearned) • Self-esteem activities teach principles and concepts counter to Essential Curriculum’s principles and concepts • ”In this classroom we will not make mistakes” • ”I can give my students self-esteem”

In addition to constructing the Map so that the described practices range from ideal to less ideal reading from left to right, fidelity lines may be used to distinguish ideal and acceptable practices from unacceptable practices. This makes it easy to see at a glance how the practices have been ranked. A solid black line is used to separate unacceptable variations from acceptable variations, and a dotted or slashed line is used to separate "ideal" use from "acceptable" use (see Figure 3.8). *However, these "lines" should not be placed on a Map until either the developer or some other innovation authority has agreed with their placement or until there is empirical evidence to support their placement.*

Considerations for Final Draft

To complete the first full draft of an IC Map, it is important to consider some details having to do with Map clarity and format. Some of the points that follow have been mentioned earlier. They are important enough to reiterate for the development of a Map that is useful to researchers or change facilitators.

- The scope of the innovation and the degree to which specific activities have been prescribed by the developer will influence the number of components used to describe the innovation. Innovations that are broad in scope and/or prescriptive tend to have more components. Few innovations require more than ten components to sufficiently capture the nature of the program. Using more than ten components in an IC Map presents problems in data collection, especially if the collection is done during an interview. When the innovation involves more than one group or role of users and different behaviors have to be specified for each role, separate Maps should be created. Very complex innovations involving more than one subject area or grade level (sometimes called "innovation bundles") may necessitate a longer Map or more than one Map.
- The number of dimensions or factors included in component variations should be limited for the sake of comprehension and measurability. In its simplest form, a component could be a single variable that is either present or absent. More frequently, however, more than one dimension is included to capture the complexity and interrelatedness of dimensions within a component. In most cases, the more dimensions that are present, the more variations will be needed to reflect the possible combinations. This makes for some difficulty in identifying the variation with which the user is involved. As a general guideline, work with two or three dimensions that are present in the "a" variation and taper these off gradually as you write the "b" and "c" variations.
- Component labels should be as descriptive as possible, capturing the essence of the behaviors or activities included under the component. They should also be brief and constructed in action terms. The component label should allow the data collector or user to understand and visualize what the component refers to and therefore should not contain jargon, buzzwords, or research terminology except when absolutely necessary.
- The language used to describe components and variations should capture the essence of the developer's intent while remaining intelligible to the users. The language should reflect the user's context. Components should be worded in action terms that can be witnessed or observed either inside or outside the classroom.

Figure 3.8. Innovation Configuration Map That Shows Fidelity Lines

Cooperative Learning Map				
Teacher ______________________________				
Component 1: Structures groups				
a	b	c	d	
Assigns students to four-member groups	Assigns students to groups larger than four	Assigns students to work with only one partner	Does not assign students to groups	
Component 2: Develops group skills				
a	b	c	d	
Explicitly states, monitors, or rewards groups for social skills expected during the task	States and monitors group for social skills expected to be exhibited	States expected group for social skills but does not monitor or reward	Does not state, monitor, or reward group for social skills	
Component 3: Promotes positive interdependence				
a	b	c	d	
Consistently organizes tasks so that group members must depend on one another to complete the task	Frequently organizes tasks so that group members must depend on one another to complete the task	Occasionally organizes tasks so that group members must depend on one another to complete the task	Organizes tasks that permit group members to complete the task alone	
Component 4: Develops groups' skills in analysis and assessment				
a	b	c	d	
Provides students the time and procedures to analyze how well their groups are functioning and how well they are using the necessary social skills; uses activities that enhance these skills	Provides students with activities that enhance analysis and assessment skills	Monitors the students' development of group process analysis and assessment	Allows students to analyze and assess how their group functions	Does not give attention to analysis and assessment of group processing

IC Map Cover Page

The authors of this manual have found it often necessary to include a cover page with IC Maps, especially if the Map is to be distributed widely. Figure 3.9 is an example cover page.

Note that “Form A” with the date appears in the upper right-hand corner of the cover page. This is the designation the authors have used to indicate that the development of a Map is considered complete and ready for first use. This does not mean the map is final; rather, the current form will be left alone while it is being used and data collected. Notes about refinements and necessary updates will be collected, and then, when these are incorporated, “Form B” of the Map will be published. This notation provides a way to quickly check to see if the latest form is being used.

The ways that the IC Map will be used are included on the cover page, as well. Enumerating the ways the Map will be used is helpful to those who are not familiar with Innovation Configurations. The box indicating that the Map should not be used for personnel evaluation is important. As mentioned previously, using an IC Map for personnel evaluation should be discouraged. In reality, an IC Map could be used for such evaluation, but not until the necessary validation research has been completed.

Finally, the source information found under the “Acknowledgments” heading is important because unauthorized “borrowing” of material so often occurs. It is important for anyone who discovers the Map be able to find out about its development and for the developers to be able to make certain that interested parties learn about and have access to the most current form.

Figure 3.9. Sample Cover Page for an IC Map

Form A
2005

Innovation Configuration Map for *[Name of Innovation]*
School District or School Name
City and State

[Full Name of Innovation]

A very important part of teaching is choosing from the wide variety of strategies and techniques that could be used. Making choices is particularly important when a new teaching approach or curriculum is being implemented. Often there is need of a road map or a list of the alternative ways that teachers and students could use the new approach. Change researchers have developed a tool—an Innovation Configuration Map—that consists of "snapshots" of likely practices that can be seen in different situations. It describes the operational forms that an innovation or change can take.

The following pages contain descriptions of [give name of the innovation]. The descriptions are organized according to key components that are designed to be reflective of research-based practice. Each component includes a number of possible variations that describe different ways that [give name of innovation] may function or be carried out.

The Innovation Configuration Map for [give name of innovation] may be used in a number of ways:

1. **Team and individual self-analysis and reflection:** Frequently when new programs are implemented, too little information is provided to teachers about what they can do. The IC Map presents descriptions of different configurations or ways that teachers can approach [give name of innovation]. Teachers and teams can review their practice and ways they are implementing [give name of innovation] and compare it with those practices presented on the Map.
2. **Teacher peer observation and coaching:** Teachers can use the IC Map to observe colleagues. The Map serves as a guide for planning, for observing, and for follow-up dialogue about what is going on in the classroom.
3. **Planning for staff development:** The IC Map can be used by teachers, curriculum coordinators, and staff developers as a communication and diagnostic tool to help in clarifying and focusing on those aspects of [give name of innovation] that are most in need of attention.
4. **Program evaluation:** The IC Map can be used by principals, curriculum coordinators, staff developers, and other management personnel to evaluate the extent to which innovation components are being implemented.

Figure 3.9. *continued*

The IC Map SHOULD NOT be used for teacher evaluation. This is a diagnostic tool and one that can be used for professional development. An IC Map can be useful in thinking about current practice and for getting ideas about what could be done differently. It is not appropriate for teacher evaluation.

Acknowledgments

The developers of this IC Map are [give names of persons who developed map].

The developers wish to acknowledge the assistance and contribution of those teachers and principals who invited us to visit their classrooms and who offered suggestions for improvements in earlier drafts.

The Innovation Configuration Map is part of the Concerns-Based Adoption Model (CBAM). For more information, see the following publications:

Hall, G. E., & Hord, S. M. (2006). *Implementing change: Patterns, potholes, and practices (*2nd Ed.). Boston, MA: Allyn & Bacon.

Hord, S. M., Stiegelbauer, S. M., Hall, G. E., & George, A. A. (2006). *Measuring implementation in schools: Innovation Configurations.* Austin, TX: SEDL.

Property of [give name of school district or school and address]
Contact [give name of developer] for the latest version of this IC Map

Chapter Four
Data Collection and Analysis

As should be apparent from previous chapters, data collection and analysis are key to the process of using the Map for implementation assessment or other applications discussed in Chapter 2.

Data Collection

Major data collection typically involves applying the IC Map to a large sample of users. The sample size will depend upon how many are involved in implementing the innovation. The method of data collection will be dependent on the purpose of the collection, whether it is research, assessment, facilitation, or reflection. The researcher completing the analysis can use any combination of observations of innovation use, interviews with innovation users, and self-administered IC Maps to generate a database for use in analysis of components and delineation of configurations. The most reliable method of data collection for research purposes is observation, or observation supplemented with interviews.

Observations

For research purposes, the primary means of collecting data should be through direct observation. Observation has particular value when an innovation involves multiple user roles, or has components that call for an interactive process, such as teacher–student exchanges. Observation can also verify the presence and use of items and techniques required for the innovation: books, classroom organization, learning centers, and so forth. Combined with interviews and Map completion by the implementers, observation allows for a broader perspective of the innovation and a sense of the context, which can be helpful in interpreting users' responses. Observation also serves as a means to validate the information collected by interview or pen-and-paper methods.

Interviewing

For more intensive collection efforts in research studies, and for more complex innovations, the personal interview may become a necessity. However, if at all possible the interview should be combined with direct observation of the critical components. The interview allows for a breadth and depth of information not possible through a user-completed Map (discussed on p. 32). An interview allows the individual to define the innovation as he or she sees it, or in terms of his or her relationship to it, without having the initial restriction of component categories that is apparent when a user is assessing himself or herself. Keep in mind that there is an uncertainty about validity in the respondent's self-report during an interview.

In the interview process, the Map becomes a tool not only to focus the interview questions, but to record the information that the user provides. As in any research, gathering the needed information is highly dependent upon the interviewer's skill, style, and good judgment in questioning and probing. The interview should follow a conversational format with probing when possible or appropriate. It is important to put the user at ease and to take the time to build rapport and provide needed explanations.

Preparing for the interview requires that IC Map developers create some questions specific to each component of the innovation prior to the interview itself. This allows the interviewer not only to direct the flow of the interview, but to make distinctions about how the innovation is used. The interviewer should also seek specific examples, illustrations, and even artifacts to aid in determining how each component is being done. If the IC Map is used as a research tool, it is best that the interviews be recorded on a digital or tape recorder.

Questions should begin open-ended, then become more specific. Some examples include the following.

- General open-ended: "Would you please describe for me how you're using the [give name of program?"]
- Specific open-ended: "How do you determine students' mastery of the material?"
- Specific close-ended: "What are you using for those post-tests?" "If they do not score as a '3,' what do you do with them?"
- Seeking examples: "Can you give me an example of how you do [give component name or describe practice]?"

The intent of close-ended questions is to probe for details necessary to distinguish between component variations and to obtain specific behavioral examples of how the innovation is operating.

User Completion of the IC Map

User completion of the Map has the primary advantages of low cost and of making few demands on users' time and availability. It is best utilized with innovations that have components or component dimensions that can be described in the dichotomous format (discussed under the subheading "Simple Dimension Components" on page 20), so the user can respond with a yes/no or true/false answer to each item. The reason for this format is that self-raters are not likely to take the time needed to fully understand the distinctions between each variation. This lack of understanding easily results in an overly optimistic assessment. This becomes even more of a problem if the continua of variations are designed like most rubrics. If the continua simply decrease from the "a" variation of doing "all of it," to a "c" variation where they are doing "some" of it, to an "e" variation where they are doing none of it, self-raters may signify they are doing a lot. However, even with more complex innovations and Maps, if the user understands the language and formatting of the Map, he or she can complete it alone. *In all cases, it is inadvisable to have "ideal," "acceptable," and "unacceptable" variations demarcated on the Maps that the users will complete.* To check user understanding of how to complete the Map, it is necessary to pilot it before data collection proceeds.

As with any pen-and-paper measure, there may be some problems with self-report and reliability of data. Generally, we have found user-completed Maps to be useful descriptive measures that capture the gestalt of what an innovation is like in a school or larger context. If a great amount of detail is needed, or if certain components are value laden, then user-completed Maps probably should not be used.

The most powerful use of a user-completed IC Map involves self-reflection and consideration of how close one is to each component's "a" variation. In most situations, self-assessment should not be relied upon for research and evaluation studies.

Data Analysis

Standard analysis of IC data includes frequency counts, cluster analysis, and comparison with other data.

Frequency Counts

A simple yet useful analysis is to make a frequency count of the number of classrooms where each component variation was observed. Generally, a Map is completed for each user, with the component variations that the person is using marked. In the case of an innovation that entails group use, there may be components that describe what the group is doing, as well as the role of individuals. The frequency of each variation within a component can be tallied across teachers. Raw tallies or percentages can then be used to profile how a component is implemented by a teacher within a team, grade level, school, or district.

Interpretation of the frequency count analysis begins by looking for those component variations where there were high and low occurrences. Another useful analysis is to identify those components where there is higher frequency of use of the "a" and "b" variations, which represent classroom practices that are most consistent with the program's ideals. The analysis could focus also on identification of those components where there are higher frequencies of "d" and "e" variations.

Cluster Analysis

Computer analysis of IC Map data can begin with frequency counts. A more powerful and informative approach is to do some type of cluster analysis. In a cluster analysis, the objective is to identify those patterns of IC Map ratings that are most frequently found—i.e., which individual configurations are similar to others. CBAM researchers have established a hierarchical clustering technique and related analysis procedure for this purpose. An example, using data from the Hessen District, Department of Defense Dependents Schools (DoDDS) in Germany, is shown in Figure 4.1. In this set of data the completed IC Maps for 17 teachers were analyzed. The resultant clusters indicated that there were four groups of classrooms in terms of how mathematics was being taught. Group 1 classrooms ($n = 2$) had very few practices in place that were representative of the standards-based approach. This is indicated by the pattern of many "d" and "e" variations. Group 2 ($n = 6$) had low levels of implementation. Group 3 ($n = 3$) was medium. Group 4 ($n = 6$) had the highest levels of implementation, which is indicated by the preponderance of "a" variations.

A more detailed discussion of cluster analysis using a larger set of the DoDDS data is presented in appendix A. The appendix also includes the cluster printout and SAS program used.

Comparisons With Other Data

Of course, IC Map data can be compared with or correlated with other data. There could be an empirical determination of whether classrooms with more ideal (e.g., "a" and "b") component variations had greater student achievement than classrooms with the less desirable (e.g., "d" and "e") variations. For example, the different groups of classrooms presented in Figure 4.1 were analyzed related to student outcomes (George et al., 2000), which is discussed briefly in Chapter 5.

The IC Map data can also be correlated with Levels of Use (George, Hall, & Uchiyama, 2000), also as shown in Figure 4.1.

Unresolved Analysis Problems

There are several problems related to the analysis and interpretation of information on component use and Innovation Configurations. These are discussed briefly here.

- *Reliability of IC Map data.* To date, there has been no formal study of the reliability between IC Map data obtained through interviewing and IC Map data obtained through observation. The users of Maps should be aware of the possibility of discrepancies between the data collected through the different methods, particularly for components concerning teacher role, teacher–student interactions, and affective dimensions.
- *Relationship of information on the IC Map to past practice: the question of change.* The information derived from interview and observation characterizes what users are doing when they are implementing an innovation. The information does not indicate what

Figure 4.1. Example of IC Map Cluster Analysis With Teacher Levels of Use (LoU)* Ratings

Groups	IC Map Component Variations													LOU
	Component Numbers													
	1	2	3	4	5	6	7	8	9	10	11	12	13	
1. Some components, not others	b	c	b	e	a	d	d	c	a	b	c	e	a	III
	e	d	d	d	a	e	d	e	a	c	c	e	e	III
2. Lower fidelity	d	d	c	c	b	d	d	d	b	b	c	e	c	IVA
	c	c	c	d	c	d	d		b	b	c	d	c	III
	c	c	c	c	d	d	c	c	b	b	c	e	d	III
	c	c	b	c	b	c	c	b	c	c	c	e	d	IVB
	b	b	b	c	b	c	e	c	b	c	d	e	c	IVB
	c	c	b	d	b	c	c	d	a	b	c	e	c	III
3. Medium Fidelity	b	a	a	d	b	a	b	c	a	a	b	c	a	IVB
	b	b	b	b	a	b	b	b	a	b	b	c	a	IVA
	b	a	a	b	a	c	b	b	a	a	c	d	c	IVA
4. High Fidelity	b	a	a	a	a	a	a	a	a	a	b	b	a	IVA
	a	a	a	a	a	a	b	a	a	a	a	a	a	IVA
	a	a	a	a	a	a	a	a	a	a	a	a	a	IVA
	a	a	a	a	a	a	a	a	a	a	a	a	a	V
	a	a	a	a	a	a	b	b	a	a	a	b	a	IVB
	a	a	a	a	a	a	a	b	a	a	a	a	a	IVB

* For more information on Levels of Use, refer to the resources shown on pages 67–68 of this manual.

the user was doing prior to the adoption and implementation of the innovation, nor does it convey whether or not current practice is different from past practice, although in the course of an interview a teacher will probably share some information about what he or she was doing before implementing the innovation.

- *Relationship of information on IC Map to the rest of the learning context.* In considering the relationship of components and configurations to outcomes, it is necessary to recognize the importance of factors other than the behavioral parts of an innovation as influences on outcomes. Among these are the philosophy behind the innovation, professional development teachers receive in order to implement the innovation, administrative support of the innovation, teachers' Levels of Use and Stages of Concern, and a variety of instructional factors that may or may not overlap with the innovation—all of which contribute to teacher performance, which influences student outcomes. As was mentioned earlier, caution in attributing outcomes to the innovation is needed, along with more work in exploring the total learning context of the classroom.

Chapter Five
Current Research on and Uses of Innovation Configurations

The previous chapters of this manual describe what an IC Map is, how to develop an IC Map, and discusses ways to use it for research, evaluation, and improvement efforts. This chapter provides examples for Innovation Configuration use in different contexts and serves as a literature review.

For nearly 30 years, researchers have used Innovation Configuration Maps to study the process of change, just as they have the other two diagnostic tools of the CBAM model. As a concept, Innovation Configuration (IC) mapping has been used for research, evaluation, implementation, professional development and training, and assessment, as well as to support understanding of expectations for individuals in different roles within one innovation. Some of this research has been focused on innovations and people in change; some has been on the development and use of the concept itself. What follows are examples of research and application that illustrate use of Innovation Configuration Maps in different contexts and for different purposes. That use of the concept has broadened in recent years is testimony to its continued viability for understanding "what" the change is and provides continuing evidence of its strength as an evaluation and research tool.

From a research perspective, Innovation Configuration Maps can be applied to pre- and postmeasurements based on a clear definition, or Map, of the innovation. Longitudinal use can serve as a consistent comparison for behaviors described in the Map as they change over time. This approach requires that the researcher work with a developer, a designer, and program materials, as well as have a good example in place, to accurately describe expectations for use to measure against. IC Maps also can be used in conjunction with other CBAM tools, such as Levels of Use, to analyze where users are having difficulties, or, in larger data collections, to do a cluster analysis of data related to different components or different sites (see Alquist & Hendrickson, 1999; George, Hall, & Uchiyama, 2000). In addition, IC Maps can describe the relationship of use to standards or other criteria, the success of desired implementation, and the possible relationship of success of implementation to effects for students (George et al., 2000). Lastly, IC Maps can be used to define roles within an innovation and examine the effect of roles when taken in conjunction with other measures of effect.

In selecting literature to be included in this review, published material and research reports have been given first priority. Dissertations and theses, although they offer frequent and important examples of use of CBAM tools, are not included. The criteria for selection include scope of work, research orientation, implications for research and practice, and the quality of example. Overall, this review presents examples of Innovation Configuration use as it relates to the following:

- research and evaluation
- measuring, documenting, and assessing program implementation
- professional development and implementation support

- development of alternative tools for research and assessment

Innovation Configuration Mapping in Research and Evaluation

Application of the concept of Innovation Configurations was immediately evident to researchers after its introduction through the CBAM model (Hall, 1979; Hall & Loucks, 1978, 1981). In 1981, the CBAM research and development team produced a manual describing how to design and use Innovation Configurations for research, evaluation, and professional development (Heck, Stiegelbauer, Hall, & Loucks, 1981). Innovation Configuration mapping became an important piece of a nationwide study of the dissemination and implementation of innovations supported by the U.S. Office of Education's National Diffusion Network (NDN) initiative (Crandall, Bauchner, Loucks, & Schmidt, 1982; Crandall & Loucks, 1982). This study, called the DESSI (Dissemination Efforts in Support of School Improvement) study, examined the effects of implementing 61 NDN innovations in 146 districts across the United States (Crandall et al., 1982). It explored a number of factors affecting successful school improvement, including perceived benefits, degree of change, Levels of Use (LoU), and fidelity to the original innovation concept. An Innovation Configuration Map, outlining the innovation's components and variations, along with the developer's ideal, was created for each of the NDN programs examined. The findings of this study made a significant contribution to the development of theory related to school change (Crandall, Eisman, & Louis, 1986; Fullan with Stiegelbauer, 1991), as well as to understanding more explicitly what happens in a dissemination and change process.

Melle and Pratt (1981), working in Colorado, also used an IC Map, to assess the use of an elementary science program implemented in 81 schools over a 3-year period. The authors initially collected data on the degree of implementation in randomly selected schools, adding more schools yearly. As the study progressed, district facilitators involved principals in the data analysis and planning, increasing the impact of their support for local use. The design of support for implementation was based on CBAM principles (Pratt, Melle, Metzdorf, & Loucks, 1980). An IC Map of the science program was the consistent comparison piece for research and evaluation.

Hord and Hall (1986) examined the idea of institutionalization using the IC concept. Institutionalization means that the innovation is firmly in place and integrated into a school or organization's everyday life—that is, it becomes part of the institution. Institutionalization, ideally, would be the end product of implementing a program or process. Although the implementation process seems to be ever-present, institutionalization is not, given all the factors that may affect the process along the way. Hord and Hall's article describes five subprocesses (assessment of present practices, response adoption, initiation, implementation, and institutionalization) and uses the CBAM diagnostic dimensions (SoC, LoU, IC) as vectors from which to determine the degree of implementation and institutionalization. The authors conclude with implications for policy, intervention, and evaluation. With the IC in place, the goal of "what" is to be part of the institution became clearer and easier to work toward or measure against.

The theme of implementation and institutionalization is also reflected in Anderson, Stiegelbauer, Gérin-Lajoie, Partlow, and Cumins's (1990) government-sponsored evaluation of Project Excellence, a student-centered high school program conducted in northern Ontario, Canada. The Project Excellence case study was intended to assess the viability of the program for use in other settings and utilized an IC Map as the basis of assessment of teacher use over a 1-year period. One major finding of the study involved the complexity of the innovation for users and the lack of ongoing staff development to support new teachers, limiting its potential for consistency and institutionalization. Anderson and Stiegelbauer (1994) returned to Project Excellence 7 years later to test the status of implementation and institutionalization based on their original findings. The program was still in place and disseminating program elements that were particularly successful to other schools across Canada. The issue of staff renewal, however, remained a concern. Rather than being implemented as originally designed, the program had been adapted in part to better meet the needs of the school community.

Leithwood and Montgomery (1987), also in Canada, developed a concept parallel to that of Innovation Configurations, referencing CBAM research. They suggest improving classroom practice through clarity of program definition and expectation: "innovation profiles—detailed descriptions of what a teacher is actually doing as he or she implements increasingly effective classroom practices—offer a logical and systematic way of making innovation stick" (p. 76). They see innovation profiles, like configurations, as having multiple applications: to systemwide accountability and management of change, to designing professional development for teachers, to teacher support, and to improving principal effectiveness. They particularly comment on its value in determining a coherent and clear definition of use.

Hall and George (2000) also discussed the process and outcome value of Innovation Configurations in their update of IC Map development as a means to clarify the innovation in use. According to Hall and George, the six most common applications of IC Maps are (a) as a tool for self-reflection; (b) as a way to guide peer observation; (c) as an observation guide for principals and others who observe and coach those implementing an innovation; (d) as a staff development diagnostic tool to support training; (e) as a means to research, document, or evaluate implementation and degree of fidelity to original design; and (f) as a means of personnel evaluation or monitoring of growth in appropriate circumstances. Hall and George caution against the use of IC Maps for personnel evaluation. As mentioned in Chapter 2, use of an IC Map for such evaluation would require careful construction of the Map and testing its validity.

Despite similarities, there are perspective and goal differences between the CBAM (Hall & George, 2000; Hall & Hord, 1987, 2006) Innovation Configurations and Leithwood and Montgomery's (1987) innovation profiles. CBAM originally was designed around understanding and supporting teacher change in implementation; Leithwood and Montgomery view their model more as a means to help change managers evaluate and control the nature and degree of implementation (Anderson, 1997). Although in the end, both models have been used for similar purposes (facilitation and evaluation), they come from different orientations to a change process:

CBAM supports and evaluates implementation as a process, whereas Leithwood and Montgomery's profile focuses on fidelity and assessing incremental movement toward a preferred state of implementation. Their innovation profile is intended to provide more innovation-specific information to change managers.

Innovation Configuration Mapping for Measuring, Documenting, and Assessing Program Implementation

IC Maps have been used to describe and track program implementation and outcomes in numerous large-scale studies. For example, in a study of the degree of implementation of educational technology by teachers impacted by the Kentucky Education Reform Act (KERA) of 1990, trained data collectors used the Primary Component Configuration Map to assess the degree to which all of Kentucky's elementary schools were becoming nongraded, multiage, multiability primary schools (Bridge, 1995). In this study, a *random* sample of four teachers from each of twenty-four primary schools in eight regional service areas in the state was examined over the course of 3 years. The findings indicated (a) wide variation from teacher to teacher in the manner and degree in which components of the primary program were implemented; (b) little change between the first and second year in patterns of implementation; and (c) a decrease in percentage of teachers implementing the primary program in recommended ways.

IC Maps are frequently used as a baseline from which to evaluate or conduct research on programs and outcomes. The Appalachian Educational Laboratory (AEL), in a 2-year evaluation of Monongalia County Family Literacy, used an IC Map to define and assess program use and its impact on school readiness and adult literacy (Meehan, 1997). Kacer and Craig (1999) developed six IC Maps in a longitudinal study of educational reforms concerned with the implementation of technology in the context of the Kentucky Educational Reform Act. The Maps were a tool to assess the nature of the relationship between the level of implementation of educational technology and Kentucky's high-stakes assessment of academic achievement.

CBAM tools and the IC were the center-point of a number of studies of curriculum related to Department of Defense Dependents Schools (DoDDS) in Germany (George, Hall, & Uchiyama, 2000). Alquist and Hendrickson (1999) described mapping the configuration of standards-based mathematics teaching in 17 DoDD schools, including expectations for mathematics instruction for students and teachers. The data collection had a number of goals: first to analyze the degree to which teachers and students implemented classroom practices consistent with standards; second to find ways to increase the quality of mathematics teaching; third to suggest ways IC Map data could be used to test program effectiveness. The article includes both the IC Map itself and an IC Map cluster analysis with teacher Levels of Use (LoU) ratings. Comparison of findings from the IC data and LoU data suggests that implementing higher configurations of standards-based math requires more expertise than will be found among teachers in the early years of implementation. This is an important finding, as higher configurations of use mean more fidelity to standards and seem to result in better student outcomes (See also George et al., 2000).

George et al. (2000) also examined the extent of implementation of a standards-based approach to teaching mathematics and student outcomes in the same set of DoDD schools. One focus of this study was to examine student outcomes in relation to the extent that teachers addressed the desired program strategy in math. Looking at student test results, the authors were able to match 2,179 students who had the same teacher fall and spring. These students were in grades 2 through 8, in 14 different schools and with 107 different teachers. A number of types of analyses were conducted on the data: one on the IC Map and teacher use of the math program, and a second looking for relationships between IC Map ratings and student achievement. A cluster analysis was done based on the IC Map, and student achievement was described as a function of IC Map ratings. The data, although complex, indicated that support for fidelity of implementation resulted in better outcomes for students. Teachers who most fully implemented the program obtained the greatest student achievement gains, as measured by the tests. However, the study also recognized that it takes a number of years to develop group consensus on fidelity, or to have all teachers at the same level and quality of use. The study also raised questions about how much facilitation and support teachers would need to gain "fidelity" or ideal use with complex innovations, as well as which components on the IC Map are critical or really associated with higher or lower student learning.

Chinman et al. (2005) evaluated a program designed to build community capacity for the use of health-related preventative practices. Their research explored the gap between science and practice in community settings. The goal of their project was to evaluate the effectiveness of a community capacity-building effort in preventative medicine and, at the same time, enhance the capacity of local organizations in supporting preventative practice, especially as related to drug abuse prevention. An IC Map, in conjunction with Levels of Use (LoU), was used to rate the quality of implementation of all the practices known to be associated with high-quality prevention. The IC was used both to evaluate and to explain and clarify program strategies and expectations to community organizations involved with the project. Their study combines scientifically based research on preventative interventions with applied research intended to enhance community outcomes.

Howley-Rowe and Leopold's high school case study (2000), conducted as a part of the Appalachian Educational Laboratory's (AEL) research on the Quest Network, used an IC Map to describe the impact of Quest on changes in teacher and student behaviors. Quest is an applied regional research project that assists schools with educational reform efforts. The high school research showed some changes in faculty who had been involved in Quest events, but little in those not involved, indicating that Quest's school-improvement processes had not permeated the school as a whole. The IC Map was used to describe what the program would look like when implemented in the school. Administration, teacher, and student roles and behaviors were mapped and measured against an ideal or desirable application of the model.

IC Maps, often in conjunction with other CBAM diagnostic dimensions, have also been used in assessing technology utilization and program integration. Gershner and Snider (2001) used an IC to measure the integration of technology into curriculum delivery in a school district of 1,320 students, looking at 49 teachers' use of the Internet as an instructional tool. In this case, the IC Map was used both as a research baseline and as a training tool for turnkey trainers. The IC, in conjunction with Stages of Concern and Levels of Use, measured teachers' growth in use as they were supported in training and in their classrooms. Mills and Ragan (2000) used the IC as a tool for analyzing the implementation fidelity of a school-based integrated learning system. Their study relates implementation practices of teachers to quality of program use. Mills and Tincher (2003) used an IC Map to look at technology integration, comparing planned use with actual use. They also assessed teachers' growth in staged skill sets in conjunction with a professional development strategy. Similar to other discussions of technology integration and use, the data in this study suggest that technology use is a long-term developmental process. Mills and Tincher state that the data indicate that "when the practices for teaching and learning with technology are clearly defined and established, the professional skills of teachers will begin to exemplify the stated expectations" (p. 398).

The issue of fidelity to innovation goals and its relation to student outcomes was also a factor in studies conducted by Bridge (1995) and Koon (1995). Bridge examined the implementation of the Integrated Primary program in Kentucky. The desirable, or "a," variations were formulated using the state's reform initiative and the standards of the National Association for the Education of Young Children. The study showed that children did better with achievement in classrooms where there were more "a" and "b" variations of innovation practice. Koon, in studying the implementation of a program to introduce concepts of business and entrepreneurship to students, came to similar conclusions regarding closeness to an "ideal" or most desirable variation of practice and student outcomes. Both these studies are supported by the findings in the Department of Defense Dependents Schools described earlier (Alquist & Hendrickson, 1999; George et al., 2000) in which closeness in practice to innovation ideal variations produced better student outcomes ("a" and "b" variations, based on standards and best practice).

Innovation Configurations as a Support to Professional Development and Implementation Planning

The Innovation Configuration Map has been shown to be an effective tool to support professional development. A clear definition of the innovation, whether new or ongoing, allows participants to understand expectations and requirements for change. As part of early research related to the development of CBAM tools, Hall and Loucks (1981) and Hord and Loucks (1981) describe how the IC concept can be applied to the design and delivery of professional development as a form of "research into practice." Margarita Calderon (1981) applied IC as a way of measuring what aspects of a staff development training program are being put into practice. She presented a case study of application in a bilingual education trainer of trainers program in San Diego to see what aspects of the training were actually implemented by trainees.

Many of the studies reported previously have, in some capacity, used the IC both as a research and professional development tool, if only to clarify the innovation to users or to provide a baseline for researchers. Mitchell (1988) used Innovation Configurations as one strategy in her evaluation of three educational innovations in Portland, Oregon. She describes IC as important to defining program elements and interpreting related teacher concerns and use. She also describes how IC and Stages of Concern (SoC) data can guide program staff in monitoring use as well as in designing practical intervention strategies to support program use. The theme of Innovation Configuration use for both research and professional development/intervention planning persists through a number of the research studies described in the previous section. Kacer and Craig (1999), Alquist and Hendrickson (1999), and Howley-Rowe and Leopold (2000) all apply their research findings to the potential of professional support, if not directly to it.

Innovation Configurations have also contributed to the issue of clarifying and implementing state and national standards to teachers and school systems. Loucks-Horsley and Bybee (1998) use the IC concept to outline National Science Standards in terms of what they would look like in practice. As Hall and Hord state in *Implementing Change* (2006), one piece of the change puzzle is the issue of the relationship of new practices to organizational culture, and "the extent to which the innovation will be supported by the current culture and the extent to which it will affect changes in the culture" (p. 265). With the current emphasis on standards, a clear understanding of how standards can best be put in place in action terms goes a long way toward facilitating integration of them in the workings of school cultures (Hill & Crevola, 1999, with an Australian example).

Innovation Configurations and the Development of Alternative Tools for Research and Assessment

The concept of Innovation Configurations has also been used to develop rubrics and assessment tools for formative and summative program evaluation. As summative evaluation, it provides a baseline measure for assessment, as many of the studies discussed here have shown. As formative evaluation, it has contributed to developing professional development strategies and to planning supports for implementation. It can be used to describe practices, what users do as a general premise, and what they may do in terms of their individual roles within an innovation. The IC concept has been applied to teachers, administrators, students, and other individuals participating in a united change effort (Hall & Hord, 2006).

The National Staff Development Council (NSDC) created IC Maps of five role groups of educators (Roy & Hord, 2003) to describe expectations for their activities when conducting staff development that exemplified the 12 NSDC standards for staff development (National Staff Development Council, 2001). These role groups include teachers, principals, central office staff, superintendents, and school board members. Roy and Hord include in their description a "cross walk" that describes the desired outcomes or actions of each role group as they relate to one another. For instance, under the standard heading of "Learning Communities" supporting staff development, the cross walk looks as shown in Figure 5.1 (2003, p. 212).

Roy and Hord describe their effort with the cross walk as a means to "illustrate the systemic approach to professional development and the role that all educators play" (2003, p. 124). These NSDC IC Maps are intended to provide support for role development and also to illustrate the relative similarity and difference in roles of principals, teachers, district staff, and community, and how they might support one another. This work follows on an earlier example by Francis and Hord (1995) describing ways that the IC can be used as a vehicle for designing tools for authentic and alternative assessments.

Figure 5.1. Cross Walk for Learning Communities

Teacher	Principal	Central Office	Superintendent	School Board
Participates in learning teams, some of whose membership extends beyond the school	Participates with other administrators in one or more learning communities	Participates with others as a member of a learning team	Participates in learning communities that focus on continuous improvement	Supports individual, team, school, and systemwide learning at the local, regional, state, and national levels

Summarizing Innovation Configurations: The "What" in Change

When the initial work with the Concerns-Based Adoption Model began, research and development was focused on individuals in the process of change and what change facilitators do that supported the successful implementation of a change (Stages of Concern and Levels of Use: George & Rutherford, 1978; Hall, 1979). Individuals may describe working with an innovation, but when questioned more directly about what the innovation required them to do, it became clear that there were different variations in use. The idea of "variations" and different "configurations" of use existing within one implementation set led to concepts related to "fidelity," or the closeness of use to a developer's ideal. It also led to strategies for supporting implementation based on addressing innovation "components" in professional development and follow-up activities intended to promote "best practice" with the innovation (Hall & Loucks, 1981; Hord & Loucks, 1980).

The articles, reports, and studies presented here illustrate of the multiple ways that the concept of Innovation Configurations can be applied and used. Common to them all are the following questions:

- What *is* the innovation?
- What does it look like *in use*?
- What does use of an innovation, by individuals, schools, or systems, tell us about the *success of implementation and its effects* for students or others?

Studies of implementation have shown that innovations are typically implemented in a variety of ways, some good, some not so good, given the goals of the innovation and the response of users. This variation of use, and the tendency of individual users to adapt or modify use as they implement programs, is at the core of the Innovation Configuration concept and the questions outlined above. "An IC map is a way to precisely define quality and to measure fidelity" (Roy & Hord, 2003, p. 6), as one function; it is also a way to describe an innovation in operation, so that individuals know what is expected of them.

A number of themes emerge from reviewing the literature.

- First, research using IC Maps indicates that higher *forms of use, those forms of the innovation closer to the ideal or best practice, seem to be related to greater outcomes for students.* The research conducted on the

Department of Defense Dependents Schools (DoDDS standards-based math program (Alquist & Hendrickson, 1999; George et al., 2000) attest to this conclusion, as does the work of Koon (1995) and Bridge (1995).

- Second, IC Maps are useful in *describing and evaluating the implementation of reforms,* whether based on a fidelity model (Mills & Ragan, 2000) or when examining the difference between planned implementation and actual use (Alquist & Hendrickson, 1999; Anderson & Stiegelbauer, 1994; Anderson et al., 1990; Chinman et al., 2005; Crandall et al., 1982; Kacer & Craig, 1995; Meehan, 1997; Mills & Tincher, 2003; Mitchell, 1988).
- Third, the IC concept is a way to *describe best practice* and its potential variations to guide practitioners in professional development or establishing practice (Loucks-Horsley & Bybee, 1998; Roy & Hord, 2003).
- A fourth theme concerns IC as a way to *chart progress over years of implementation and contexts* (Anderson & Stiegelbauer, 1994; Bridge, 1995). This charting of progress includes the idea of *institutionalization,* or the optimal implementation and integration of the innovation within the school or context. Institutionalization might also result in best practice if it meets a tested developer's ideal, or if there is agreement within the context that all users are working together and that it is having positive outcomes. Crandall et al. (1982), Hord and Hall (1986), Anderson and Stiegelbauer (1994), and Gershner and Snider (2001) all include the idea of "When is the innovation institutionalized and what does that look like?" as part of their investigation and discussion.
- Finally, the IC concept has been used to *plan professional development* and to evaluate the progress of implementation to develop supports (Chinman et al., 2005; Melle & Pratt, 1981; Mitchell, 1988).

Innovation Configuration Maps are a way to describe an innovation, a new process, role, or way to do things. Whether an IC Map is used for research, evaluation, professional development, or definition of role, it "creates a mental image of the innovation" and helps users understand what it means when put in action. Thus, the IC Map is a tool that shares information and enables individuals to take the steps necessary in implementing new policies, programs, or processes" (Roy & Hord, 2003, p. 7). Similarly, for researchers, it provides a clear base from which to measure and chart outcomes, by themselves or in relation to other variables. Whatever the application, the goal of any good educational tool is to increase outcomes for students and others involved. The concept of IC Maps was developed with this in mind and continues to be applied to make change easier and more productive for individuals and systems.

Figure 5.2. Summary of Innovation Configurations Literature Reviewed

Date	Author(s)	Study	Focus/Innovation	Findings
1981	Melle & Pratt	Longitudinal, 3 years, mixed method, 81 schools	Implementation of Elementary Science curriculum	IC beneficial to program implementation, evaluation, and professional development support
1982	Calderon	Case study of implementation	Application of IC to trainer of trainers program	IC clarifies program expectations
1982	Crandall, Bauchner, Loucks, & Schmidt	Mixed method, evaluation, 61 NDN innovations used by teachers in 146 district sites	Dissemination of NDN innovations	IC used to define, evaluate, and test fidelity of NDN programs
1982	Crandall & Loucks	Summary overview, 146 district sites nationwide	Dissemination of NDN innovations	IC important part of clarifying understanding of NDN innovations
1983	Loucks		Adoption of special education programs	Describes steps for application of CBAM tools, including IC to support implementation
1986	Hord & Hall	Evaluation of implementation process using CBAM tools	Institutionalization of innovations	Institutionalization does not occur without clarity and long-term support
1987	Leithwood & Montgomery (Canada)	Sample(s) application of similar concept to classroom innovations in Canadian context	Improving classroom practice using Innovation Profiles	Describes a strategy for understanding innovations using method similar to IC
1988	Mitchell	Formative evaluation of implementation of 3 innovations	Application of CBAM tools for evaluation	IC helpful tool in clarifying innovation for study
1990	Anderson et al.	Case study of one school, mixed methods, IC used to describe program use	Project Excellence: Evaluation of a student-centered high school program	Complex project: evaluation of program to assess viability for other settings

Date	Author(s)	Study	Focus/Innovation	Findings
1994	Anderson & Stiegelbauer	Mixed methods, IC used as baseline for evaluation	Revisiting Project Excellence 7 years later: has program met its original goals, and how has it changed?	Program, still in place, has been adapted in response to school district, teaching, and community needs
1995	Bridge	Mixed methods, IC used to describe and measure innovation use	Implementation of Integrated Primary program in Kentucky	Closeness to innovation best practice (a and b variations) produced higher achievement
1995	Francis & Hord	Discussion of design; application study of IC	Designing tools for authentic and alternative assessments	Describes use of IC and scoring rubrics including validation tools
1995	Koon	IC used to describe and measure innovation use	Implementation of program to introduce business concepts to students	Closeness to best practice (a and b variations) produced higher achievement
1997	Meehan	Longitudinal, 2-year evaluation, mixed method	Monongalia County Family Literacy Program	IC used to describe and assess program use
1998	Loucks-Horsley & Bybee	Discussion of design and application of IC to standards	Implementing National Science Standards	IC used to describe what the standards would look like when in place
1999	Alquist & Hendrickson	Assessment of implementation of standards in math, 17 schools	Mathematics in Department of Defense Dependents Schools (DoDDS)	IC used to map use of math innovation
1999	Kacer & Craig	Evaluation of implementation	Use of technology reforms in Kentucky	Six IC maps were developed to describe and evaluate reforms
2000	George, Hall, & Uchiyama	Cluster analysis of IC data; correlation to student outcome data in 17 schools with 5,600 students	Extent of implementation of mathematics program and relation to student outcomes, Department of Defense Dependents Schools (DoDDS)	Implementation is a multiyear process; student achievement was higher when there was "high-fidelity" implementation
2000	Hall & George	Describes and updates IC Map development and use	Outlines uses of IC Maps	IC Maps have value in bridging the gap between program development and student outcomes

Figure 5.2. *continued*

Date	Author(s)	Study	Focus/Innovation	Findings
2000	Howley-Rowe & Leopold	Evaluation of implementation	Case study of one high school in the Quest Network, a school reform support process	IC used to describe innovation in use, found it was not part of how the school worked as a whole
2000	Mills & Ragan	Correlational study to validate measures	School-Based Integrated Learning	IC used to analyze fidelity of use in implementation
2001	Gershner & Snider	Evaluation study; professional development support, 49 teachers	Internet as instructional tool	IC used to measure Internet use by teachers
2003	Mills & Tincher	Comparison study, evaluation	Technology integration	IC map used to compare planned use with actual use
2003	Roy & Hord	Application of tool	Moving NSDC's staff development standards into practice	IC model used to describe NSDC standards in action: support for role development
2005	Chinman et al.	Evaluation of implementation	Community science research agenda: preventative practices	IC Map used to rate quality of implementation of community-based preventative practices

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Appendix A
Example of Cluster Analysis
(Data from the Department of Defense Dependents Schools Study, Germany)

The analyses begin with a cluster analysis in which the variables are grouped, rather than the teachers. In many cases this type of analysis reveals distinct groups of variables, of interest to those responsible for the innovation implementation, the IC Map developers, and researchers studying the change process. This particular cluster analysis has been applied to 15 items rated with letters (i.e.,"a," "b," etc.), as are typical on IC Maps. Prior to running these analyses, each item rating was converted to a number; "a" was converted to 4, "b" to 3, and so forth, through "e" to 0, "f" to –1, and "g" to –2. Using the highest number for the highest fidelity ratings makes the results easier to interpret.

A standard criterion, used here, for selecting the number of clusters to extract is to limit the "maximum eigenvalue" to 1.0. On page 58 (Cluster Printout) we see that two groups of variables emerge, as well as a single item that is distinct from these two groups. There are seven items in each of the two groups. The "R-squared" values in the second list or table indicate which items most clearly represent the group. For example, item 9 has an R-square of .7993 with the first group, the highest in the group. Item 7 has the next highest R-square, at .70. The implication is that items with high values have a lot in common, more so than the remaining items. Essentially, the teachers in this sample tended to have similar ratings on these two items. Read the labels on the right to understand what they have in common. The statements that correspond to the two highest values are item 9, "Encouragement of diverse investigation strategies," and item 7, "Teacher models science inquiry process."

The second scale is represented most clearly by items 12 (at .76) and 13 (at .66). These statements are "Student sources of affirmation" and "Student sharing and debriefing of findings." The first dimension seems to contain teacher behaviors, and the second, student behaviors. The third highest item on the first scale is item 5 (at .69), "Designing science investigations," which seems to reinforce the teacher vs. student behavior interpretation. However, the third highest item on the second scale is item 14 (at .64), "Teacher use of assessment," which does not seem to be a student behavior.

There is a three-by-three table on page 59, "Inter-Cluster Correlations," which indicates that the ratings on the two sets of items correlate fairly highly, .72. This means high ratings on one set are associated with high ratings on the other set. Even so, perhaps you can see a common thread in each of the two groups that ties each group of items together and is distinct from the other. Essentially, within this sample of teachers, "good practice" seems pretty uniformly present in all of these items.

The one exception is the item that did not "fit into" either group, item 11, "Teacher meets the needs of all students." The fact that this item stands alone indicates that ratings on it are not correlated very highly with ratings on the other items. Indeed, the correlations between this one item with the other two scales are very low, .10 with the first scale and .22 with the second. It appears that "meeting the needs of all students" does not seem to indicate, one way or the other, a high-fidelity implementation of the recommended practices for this approach to teaching science. Teachers rated highly on this item may or may not be using the innovation at a high level of fidelity.

Clustering of Teachers

The result of the cluster analysis applied in order to assign teachers to groups with common practices begins in the middle of page 59 of the cluster printout which follows, with the statement "Ward's Minimum Variance Cluster Analysis." Eigenvalues are mathematical properties of matrices and have long been used to indicate how many "meaningful" groups there seem to be in a set of data, based on the correlation matrix of the items. Here we see three eigenvalues above 1.0, the most common decision rule. This implies there are three groups of teachers, based on this sample of ratings, although the fourth eigenvalue is very close, at .995. In cases like this, it is necessary to examine the results carefully to see what the fourth cluster might reveal. Consider whether the ratings in that group differ markedly from the group into which it has been merged, making three groups.

The first dimension in this analysis is by far the most distinct, as the eigenvalue, 7.08, is so much larger than the others. This implies that there is, essentially, only one strong dimension in these ratings—i.e., essentially all the items align the teachers along a single continuum, from low to high implementation.

Detailed, step-by-step results of the cluster analysis are seen beginning on page 60. The "ID" variable indicates the teacher number in the first column, the 15 item ratings for that teacher next, followed by an overall "average" rating on the items. All of this is adjacent to a standard "icicle" diagram, designed to indicate the order in which the teachers were grouped together, one at a time. The cluster diagram is read from right to left. This display shows the clustering from the point at which the 62 teachers had been grouped into 45 clusters. Because we were ultimately looking for three groups, a few extra blank lines have been inserted into the display to indicate the separation between the final three clusters.

In the first group there are 21 teachers. The average overall scores are quite low, averaging about 2.0, which is a "c" rating on the IC Map. Thus, it is apparent that these teachers have been rated rather low on most items on the IC Map. We can refer to these teachers as the "low implementation" group. The second group contains 15 teachers, with an overall average rating of 3.7, which is very close to 4, an "a" rating on most items. This is the "high implementation" group. The third group contains 26 teachers; the overall average rating is 2.9, or about "b" across the items. This is the "middle implementation" group. Notice there are a wide variety of ratings on items within this group, ranging from "a" to "d."

On page 62, a profile is provided for each of the three groups. Analysis of the average ratings on each item may provide insights into the dynamics of the implementation process. For example, the “middle implementation” group scored quite low on item 5, 1.8. Apparently, “Designing science investigations” is challenging—only a few teachers have “a” ratings on this item. Looking at the icicle charts, you may be able to see that only two teachers (46 and 53) have “a” ratings in the “middle” group, and none in the “low” group have “a” ratings. Item 15 is similarly difficult, with very few “a” ratings outside of the “high” implementation group. “Student use of assessment” was observed only in the highest-fidelity group. (The one exception was teacher 44, in the “low” group.)

Conclusions and Implications

It is clear that this sample of teachers contains a broad distribution of implementation success. Approximately 34% were in the “low implementation” group, 42% in the “middle implementation” group, and 24% in the “high implementation” group. The ratings are fairly consistent across items—it appears that most items measure a singular underlying dimension. Item 11 seems to be an exception. This one item had mostly high ratings and did not correlate with other items. Overall, these analyses seem to provide a clear and consistent picture of the practices occurring in these classrooms.

Cluster Printout

```
                              Elementary School IC Map Cluster Analyses                                1
                                                                           15:07 Sunday, November 25, 2001

                            Oblique Principal Component Cluster Analysis

                                62 Observations        PROPORTION  =        0
                                15 Variables           MAXEIGEN    =        1


                                     Orthoblique Initialization

                                   Cluster summary for 3 cluster(s)

                                       Cluster      Variation     Proportion       Second
                  Cluster     Members  Variation    Explained      Explained     Eigenvalue
                  ------------------------------------------------------------------------
                        1           7    7.00000      4.36909       0.6242          0.7793
                        2           7    7.00000      3.82246       0.5461          0.9103
                        3           1    1.00000      1.00000       1.0000               .

                        Total variation explained = 9.191552 Proportion = 0.6128


                        R-squared with
                      ------------------
                         Own        Next      1-R**2
            Variable   Cluster    Closest     Ratio
Cluster    1----------------------------------------
             I03        0.3771     0.2108    0.7892    03 Knowledge construction
             I05        0.6876     0.3116    0.4537    05 Designing science investigations
             I06        0.6410     0.2108    0.4549    06 Selection and use of materials
             I07        0.7007     0.3495    0.4600    07 Teacher models science inq. process
             I08        0.6386     0.4282    0.6320    08 Teachers proc. learning during invest
             I09        0.7993     0.4132    0.3420    09 Encouragement of diverse invest strat
             I18        0.5246     0.3353    0.7151    18 Divergent thinking is encouraged
Cluster    2----------------------------------------
             I01        0.3395     0.0811    0.7188    01 Time allocated to science instruction
             I02        0.5172     0.3156    0.7054    02 Role of Science in integrated curr.
             I10        0.3498     0.2483    0.8650    10 Concept development
             I12        0.7574     0.3462    0.3710    12 Student sources of affirmation
             I13        0.6630     0.3593    0.5261    13 Student sharing / debriefing findings
             I14        0.6363     0.3126    0.5291    14 Teacher use of assessment
             I15        0.5592     0.3193    0.6476    15 Student use of assessment
Cluster    3----------------------------------------
             I11        1.0000     0.0485    0.0000    11 Teacher meets needs of all students


                                  Standardized Scoring Coefficients

      Cluster             1             2             3
      -------------------------------------------------
      I01           0.00000       0.15244       0.00000      01 Time allocated to science instruction
      I02           0.00000       0.18814       0.00000      02 Role of Science in integrated curr.
      I03           0.14056       0.00000       0.00000      03 Knowledge construction
      I05           0.18980       0.00000       0.00000      05 Designing science investigations
      I06           0.18324       0.00000       0.00000      06 Selection and use of materials
      I07           0.19160       0.00000       0.00000      07 Teacher models science inq. process
      I08           0.18291       0.00000       0.00000      08 Teachers proc. learning during invest
      I09           0.20463       0.00000       0.00000      09 Encouragement of diverse invest strat
      I10           0.00000       0.15472       0.00000      10 Concept development
      I11           0.00000       0.00000       1.00000      11 Teacher meets needs of all students
      I12           0.00000       0.22768       0.00000      12 Student sources of affirmation
      I13           0.00000       0.21301       0.00000      13 Student sharing / debriefing findings
      I14           0.00000       0.20869       0.00000      14 Teacher use of assessment
      I15           0.00000       0.19563       0.00000      15 Student use of assessment
      I18           0.16578       0.00000       0.00000      18 Divergent thinking is encouraged
```

Elementary School IC Map Cluster Analyses 2
15:07 Sunday, November 25, 2001

Oblique Principal Component Cluster Analysis

Cluster Structure

Cluster	1	2	3	
I01	0.28479	0.58270	0.24165	01 Time allocated to science instruction
I02	0.56175	0.71917	0.12242	02 Role of Science in integrated curr.
I03	0.61411	0.45909	-0.09340	03 Knowledge construction
I05	0.82923	0.55817	0.01582	05 Designing science investigations
I06	0.80061	0.45908	0.12126	06 Selection and use of materials
I07	0.83710	0.59116	0.09339	07 Teacher models science inq. process
I08	0.79915	0.65438	0.30125	08 Teachers proc. learning during invest
I09	0.89406	0.64284	0.05250	09 Encouragement of diverse invest strat
I10	0.49829	0.59142	0.02953	10 Concept development
I11	0.10437	0.22016	1.00000	11 Teacher meets needs of all students
I12	0.58842	0.87031	0.11267	12 Student sources of affirmation
I13	0.59945	0.81422	0.27192	13 Student sharing / debriefing findings
I14	0.55911	0.79770	0.24114	14 Teacher use of assessment
I15	0.56504	0.74779	0.11153	15 Student use of assessment
I18	0.72432	0.57903	0.05152	18 Divergent thinking is encouraged

Inter-Cluster Correlations

Cluster	1	2	3
1	1.00000	0.71508	0.10437
2	0.71508	1.00000	0.22016
3	0.10437	0.22016	1.00000

No cluster meets the criterion for splitting.

Elementary School IC Map Cluster Analyses 3
Cluster Analysis 15:07 Sunday, November 25, 2001

Ward's Minimum Variance Cluster Analysis

Eigenvalues of the Correlation Matrix

	Eigenvalue	Difference	Proportion	Cumulative
1	7.08080	5.61457	0.472053	0.47205
2	1.46623	0.43223	0.097748	0.56980
3	1.03399	0.03889	0.068933	0.63873
4	0.99510	0.18821	0.066340	0.70507
5	0.80689	0.22033	0.053792	0.75887
6	0.58656	0.01241	0.039104	0.79797
7	0.57414	0.09347	0.038276	0.83625
8	0.48068	0.03713	0.032045	0.86829
9	0.44354	0.05186	0.029570	0.89786
10	0.39168	0.08539	0.026112	0.92397
11	0.30629	0.04517	0.020419	0.94439
12	0.26112	0.02528	0.017408	0.96180
13	0.23584	0.03861	0.015723	0.97752
14	0.19723	0.05732	0.013149	0.99067
15	0.13991	.	0.009328	1.00000

The data have been standardized to mean 0 and variance 1
Root-Mean-Square Total-Sample Standard Deviation = 1
Root-Mean-Square Distance Between Observations = 5.477226

```
                    Elementary School IC Map Cluster Analyses                               4
                          Cluster Analysis              15:07 Sunday, November 25, 2001

                    Ward's Minimum Variance Cluster Analysis

                                                               Number of Clusters

                                                        111111111122222222223333333333444444
                                                123456789012345678901234567890123456789012345
                                                +++++++++++++++++++++++++++++++++++++++++++++
P  29        b b a d c d f d b c c d d e b  1.7 XXXXXXXXXXX..................................
A                                               XXXXXXXXXXX
T  12        b b b e c b b c a b c d b c b  2.5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX......
T                                               XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
E  20        b b a d b c c c b b c d c c a  2.5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX......
R                                               XXXXXXXXXXXX
N  51        b b c c c c c c b b c b d e a  2.3 XXXXXXXXXXXXXXXXXXXXXXXXXX...................
                                                XXXXXXXXXXXXXXXXXXXXXXXXXX
   4         a c b c c d c c b b b c c c b  2.4 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX...
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   45        a b c d c d c d b b c   d e b  2.0 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX...
                                                XXXXXXXXXXXXXXXX
   24        a b b b d c d d d b d e c e b  1.9 XXXXXXXXXXXXXXXXXXXXX........................
                                                XXXXXXXXXXXXXXXXXXXXX
   55        b c b b c b d b b b d d c d c  2.2 XXXXXXXXXXXXXXXXXXXXX........................
                                                XXX
   61        b b b d c c c d e a c d c e c  1.9 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX.........
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   38        b c b d c c c d c a d d c e c  1.9 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   62        b c a d c d d d c a d c c e c  1.9 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                XXXXXXXXXXXXXXXXXX
   14        b c d d c d d d b a d e d e c  1.5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXX................
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   19        b c c d c d d d c a c b d c b  2.0 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   44        b c c d c d c d c a d c c d b  1.9 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                XXXXXX
   3         a b c f e d c d b a d d d g c  1.5 XXXXXXXXXX...................................
                                                XXXXXXXXXX
   33        a d b d c d c d b a c c d e b  2.0 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX........
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   40        a d c f c d d d b a c c c c a  2.0 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX........
                                                XXXXXXXXXXXXXXXXX
   9         a b c e c d c d d a d d b b c  2.0 XXXXXXXXXXXXXXXXXXXXXXXXXXX..................
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXX
   41        a c c d c d c d c a d a b d a  2.3 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX....
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   34        a b c d c d c d c a d c c c b  2.1 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   47        a c c d c d c d c a d d c e b  1.9 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

                                                X

   35        b b a b b c a b b a b a b e a  3.1 XXXXXXXXXXXXXXXXXXXXXX.......................
                                                XXXXXXXXXXXXXXXXXXXXXX
   50        a a a b a a a a a a a a   e a  3.6 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   7         a a a b b b b a a a a a a c a  3.6 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   11        a a a b b b b b a a a a a c a  3.5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                XXXXXXXXXXXXXX
   25        a b a a b a a a a b b a b b a  3.6 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   48        a a a b b a a a b b a a a a a  3.7 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                XXXXXXXXXXXXXXXXXXXX
   49        a a a b a a a a a a a a a a a  3.9 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   56        a a a a a a a a a a b a a b a  3.9 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
   6         a a b b a a a b a a b a a a a  3.7 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

```
                         Elementary School IC Map Cluster Analyses                        5
                                     Cluster Analysis             15:07 Sunday, November 25, 2001

                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 59       a b b a a a a a a a b a a a a  3.8 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXXXXXXXXXX
 18       a b a b b a b b b a c b b b a  3.3 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 26       a b a b b b a b b a b a b   a  3.4 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 54       a a b b b a a b b a b b a b a  3.5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 22       a a b a b a b b b a a a a a a  3.7 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 58       a a a a b a b a b a b a a a a  3.7 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

                                                      XX

 8        a a   d b b b c a a a b b b a  3.2 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 21       a b c d b a c c b a a a b c a  3.0 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 10       a a c c c c b c a a b a b c b  2.9 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX.....
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 31       a b c d c c c d b a b c b c a  2.5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX.....
                                                      XXXXXXXX
 1        a a a d c b c b a a a a b b b  3.2 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX.
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 2        a a a c c c a b a a a a b b b  3.3 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 23       a a a b c d b b a a a a b b a  3.3 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXX
 5        a a b b d b a b a a b a b b a  3.3 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX..
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 16       a b a b c a a c a a a a b a a  3.5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX..
                                                      XXXX
 39       a c a d c a d c b a b b d d c  2.5 XXXXXXXXX....................................
                                                      XXXXXXXXX
 27       a a a d b c c b c a c a a c a  3.0 XXXXXXXXXXXXXXXXXXXXXXXX.....................
                                                      XXXXXXXXXXXXXXXXXXXXXXXX
 37       a a a c b c a d c a a a b b b  3.1 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX............
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 43       b a a c c c c d c a b b b b b  2.7 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX............
                                                      XXXXXXXXXXXXX
 42       a a b d c d c c c a b a b e b  2.5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX.......
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 60       a a b d c d c d c a d c a e c  2.2 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX.......
                                                      XXXXXXXXXXXXXXXXXXX
 15       a b b d c d d c c b b b a b b  2.5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX...............
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 28       a b b d c d d d b a c d b b b  2.3 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 32       a b a d c c d c c a c d a b b  2.5 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXX
 46       b a a c a a a b c a d c d e a  2.8 XXXXXXXXXXXXXXXXXXXXXXXXX....................
                                                      XXXXXXXXXXXXXXXXXXXXXXXXX
 53       a b b b a b b a b a d d d c a  2.9 XXXXXXXXXXXXXXXXXXXXXXXXX....................
                                                      XXXXXXX
 17       b b c d c d c b a a c c b e a  2.4 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX.............
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 30       a b b c c c b b b a b d b d b  2.7 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 36       a b b d c c c b a a c c b e a  2.6 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXX
 52       a b a c b c b b c b c d b c a  2.7 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX..............
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 13       a b b a c c b b b a b c b b a  3.1 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                                                      XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
 57       a b b b b c c b c a c d b c a  2.7 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
```

Elementary School IC Map Cluster Analyses 6
Cluster Analysis 15:07 Sunday, November 25, 2001

OBS	CLUSTER	_TYPE_	_FREQ_	AVGIC	I01	I02	I03	I05	I06	I07	I08	I09	I10	I11	I12	I13	I14	I15	I18
1		0	62	2.8	3.8	3.1	3.1	1.9	2.4	2.3	2.5	2.3	2.9	3.8	2.5	2.6	2.7	1.8	3.4
2	1	1	21	2.0	3.5	2.4	2.6	1.0	1.9	1.4	1.6	1.3	2.4	3.6	1.5	1.6	1.8	0.8	2.9
3	2	1	15	3.7	3.9	3.7	3.7	3.3	3.3	3.7	3.7	3.5	3.5	3.9	3.3	3.9	3.7	2.9	4.0
4	3	1	26	2.9	3.9	3.4	3.3	1.8	2.3	2.2	2.5	2.3	3.0	3.9	2.8	2.7	2.9	2.0	3.5

ARRANGEM	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Flexible Groups	36	58.1	36	58.1
Individual	3	4.8	39	62.9
Pairs	12	19.4	51	82.3
Whole Class	11	17.7	62	100.0

GRADE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
2	33	53.2	33	53.2
5	29	46.8	62	100.0

I01_TIME	Frequency	Percent	Cumulative Frequency	Cumulative Percent
a	47	75.8	47	75.8
b	15	24.2	62	100.0

I02_ROLE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
a	22	35.5	22	35.5
b	28	45.2	50	80.6
c	10	16.1	60	96.8
d	2	3.2	62	100.0

I03_KNOW	Frequency	Percent	Cumulative Frequency	Cumulative Percent
	1	1.6	1	1.6
a	25	40.3	26	41.9
b	21	33.9	47	75.8
c	14	22.6	61	98.4
d	1	1.6	62	100.0

I04_FELX	Frequency	Percent	Cumulative Frequency	Cumulative Percent
	11	17.7	11	17.7
Yes	51	82.3	62	100.0

I05_DESI	Frequency	Percent	Cumulative Frequency	Cumulative Percent
a	6	9.7	6	9.7
b	17	27.4	23	37.1
c	9	14.5	32	51.6
d	26	41.9	58	93.5
e	2	3.2	60	96.8
f	2	3.2	62	100.0

Elementary School IC Map Cluster Analyses 7
Cluster Analysis 15:07 Sunday, November 25, 2001

I06_USE_	Frequency	Percent	Cumulative Frequency	Cumulative Percent
a	7	11.3	7	11.3
b	17	27.4	24	38.7
c	35	56.5	59	95.2
d	2	3.2	61	98.4
e	1	1.6	62	100.0

I07_TEAC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
a	15	24.2	15	24.2
b	9	14.5	24	38.7
c	18	29.0	42	67.7
d	20	32.3	62	100.0

I08_PROC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
a	15	24.2	15	24.2
b	13	21.0	28	45.2
c	23	37.1	51	82.3
d	10	16.1	61	98.4
f	1	1.6	62	100.0

I09_DIVE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
a	9	14.5	9	14.5
b	20	32.3	29	46.8
c	12	19.4	41	66.1
d	21	33.9	62	100.0

I10_CONC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
a	18	29.0	18	29.0
b	24	38.7	42	67.7
c	17	27.4	59	95.2
d	2	3.2	61	98.4
e	1	1.6	62	100.0

I11_MEET	Frequency	Percent	Cumulative Frequency	Cumulative Percent
a	50	80.6	50	80.6
b	11	17.7	61	98.4
c	1	1.6	62	100.0

I12_SOUR	Frequency	Percent	Cumulative Frequency	Cumulative Percent
a	13	21.0	13	21.0
b	18	29.0	31	50.0
c	17	27.4	48	77.4
d	14	22.6	62	100.0

I13_STUD	Frequency	Percent	Cumulative Frequency	Cumulative Percent
	1	1.6	1	1.6
a	24	38.7	25	40.3
b	8	12.9	33	53.2
c	12	19.4	45	72.6
d	15	24.2	60	96.8
e	2	3.2	62	100.0

Elementary School IC Map Cluster Analyses 8
Cluster Analysis 15:07 Sunday, November 25, 2001

I14_TEAC	Frequency	Percent	Cumulative Frequency	Cumulative Percent
	1	1.6	1	1.6
a	14	22.6	15	24.2
b	26	41.9	41	66.1
c	11	17.7	52	83.9
d	10	16.1	62	100.0

I15_STUD	Frequency	Percent	Cumulative Frequency	Cumulative Percent
	1	1.6	1	1.6
a	7	11.3	8	12.9
b	16	25.8	24	38.7
c	15	24.2	39	62.9
d	5	8.1	44	71.0
e	17	27.4	61	98.4
g	1	1.6	62	100.0

I16_PAP	Frequency	Percent	Cumulative Frequency	Cumulative Percent
	19	30.6	19	30.6
Yes	43	69.4	62	100.0

I17_STUD	Frequency	Percent	Cumulative Frequency	Cumulative Percent
	35	56.5	35	56.5
Yes	27	43.5	62	100.0

I18_DIVE	Frequency	Percent	Cumulative Frequency	Cumulative Percent
a	33	53.2	33	53.2
b	20	32.3	53	85.5
c	9	14.5	62	100.0

I18	Frequency	Percent	Cumulative Frequency	Cumulative Percent
2	9	14.5	9	14.5
3	20	32.3	29	46.8
4	33	53.2	62	100.0

IC Cluster SAS Program

```
Title1 'IC Map Cluster Analyses';
options ps=71 ls=109 pageno=1;
filename icmap dde 'excel|IC Map Data!r1c1:r63c74' lrecl=3500;
data icmap; infile icmap dlm='09'x notab dsd truncover firstobs=2;
length ARRANGEM $18 LESSON_T $55 COMMENTS $55
       I01_TIME I02_ROLE I03_KNOW I05_DESI I06_USE_ I07_TEAC I08_PROC I09_DIVE
       I10_CONC I11_MEET I12_SOUR I13_STUD I14_TEAC I15_STUD I18_DIVE $1;

input OBSERVER $ DATE1    $ TEACHER    ARRANGEM $ N_STUDEN   GRADE    $ LESSON_T $
      I01_TIME $ I02_ROLE $ I03_KNOW $ I04_FLEX $ I05_DESI $ I06_USEF $ I07_TEAC $
      I08_PROC $ I09_DIVE $ I10_CONC $ I11_MEET $ I12_SOUR $ I13_STUD $ I14_TEAC $
      I15_STUD $ I16_OBS  $ I17_RULS $ I18_DIVE $ COMMENTS $ ;

     item_01 = I01_TIME; item_02 = I02_ROLE; item_03 = I03_KNOW; item_05 = I05_DESI;
     item_06 = I06_USEF; item_07 = I07_TEAC; item_08 = I08_PROC; item_09 = I09_DIVE;
     item_10 = I10_CONC; item_11 = I11_MEET; item_12 = I12_SOUR; item_13 = I13_STUD;
     item_14 = I14_TEAC; item_15 = I15_STUD; item_18 = I18_DIVE;

     label I01 = '01 Time allocated to science instruction';
     label I02 = '02 Role of Science in integrated curr.  ';
     label I03 = '03 Knowledge construction               ';
     label I05 = '05 Designing science investigations     ';
     label I06 = '06 Selection and use of materials       ';
     label I07 = '07 Teacher models science inq. process  ';
     label I08 = '08 Teachers proc. learning during invest';
     label I09 = '09 Encouragement of diverse invest strat';
     label I10 = '10 Concept development                  ';
     label I11 = '11 Teacher meets needs of all students  ';
     label I12 = '12 Student sources of affirmation       ';
     label I13 = '13 Student sharing / debriefing findings';
     label I14 = '14 Teacher use of assessment            ';
     label I15 = '15 Student use of assessment            ';
     label I18 = '18 Divergent thinking is encouraged     ';

     if item_01 eq 'a' then I01 = 4; else
     if item_01 eq 'b' then I01 = 3; else
     if item_01 eq 'c' then I01 = 2; else
     if item_01 eq 'd' then I01 = 1; else
     if item_01 eq 'e' then I01 = 0;

     if item_02 eq 'a' then I02 = 4; else
     if item_02 eq 'b' then I02 = 3; else
     if item_02 eq 'c' then I02 = 2; else
     if item_02 eq 'd' then I02 = 1; else
     if item_02 eq 'e' then I02 = 0;

     if item_03 eq 'a' then I03 = 4; else
     if item_03 eq 'b' then I03 = 3; else
     if item_03 eq 'c' then I03 = 2; else
     if item_03 eq 'd' then I03 = 1; else
     if item_03 eq 'e' then I03 = 0;

     if item_05 eq 'a' then I05 = 4; else
     if item_05 eq 'b' then I05 = 3; else
     if item_05 eq 'c' then I05 = 2; else
     if item_05 eq 'd' then I05 = 1; else
     if item_05 eq 'e' then I05 = 0; else
     if item_05 eq 'f' then I05 = -1; else
     if item_05 eq 'g' then I05 = -2;

     Etc.

     if item_18 eq 'a' then I18 = 4; else
     if item_18 eq 'b' then I18 = 3; else
     if item_18 eq 'c' then I18 = 2; else
     if item_18 eq 'd' then I18 = 1; else
     if item_18 eq 'e' then I18 = 0;
```

```
     avgic = mean(of I01 I02 I03 I05 I06 I07 I08 I09 I10 I11 I12 I13 I14 I15 I18);
     FORMAT avgic 3.1;
     AVC = INPUT(PUT(avgic,3.1),$3.);
     avgic = round(avgic);

     if I01 eq . then I01 = avgic;
     if I02 eq . then I02 = avgic;
     if I03 eq . then I03 = avgic;
     if I05 eq . then I05 = avgic;
     if I06 eq . then I06 = avgic;
     if I07 eq . then I07 = avgic;
     if I08 eq . then I08 = avgic;
     if I09 eq . then I09 = avgic;
     if I10 eq . then I10 = avgic;
     if I11 eq . then I11 = avgic;
     if I12 eq . then I12 = avgic;
     if I13 eq . then I13 = avgic;
     if I14 eq . then I14 = avgic;
     if I15 eq . then I15 = avgic;
     if I18 eq . then I18 = avgic;

     pattern = TEACHER ||' '||
               item_01 ||' '|| item_02 ||' '|| item_03 ||' '|| item_05 ||' '||
               item_06 ||' '|| item_07 ||' '|| item_08 ||' '|| item_09 ||' '||
               item_10 ||' '|| item_11 ||' '|| item_12 ||' '|| item_13 ||' '||
               item_14 ||' '|| item_15 ||' '|| item_18 ||' '|| AVC;

proc varclus data=icmap MINCLUSTERS=3; var i01-i03 i05-i15 i18;

PROC CLUSTER data=icmap METHOD=WARD STANDARD TRIM=0 K=6 PRINT=0;
     ID teacher; var i01-i03 i05-i15 i18;
     TITLE2 'Cluster Analysis';
PROC TREE HORIZONTAL SORT HEIGHT=N MAXH=20 SPACES=1;
     ID teacher;

DATA ICMAP; SET ICMAP;
     SCALE1 = MEAN(I05,I06,I07,I08,I09);
     SCALE2 = MEAN(I02,I12,I13,I14,I15);

     if teacher in(29,12,20,51,4,45,24,55,61,38,62,
                   14,19,44,3,1,33,40,9,41,34,47) then cluster = 1;

     if teacher in(35,50,7,11,25,48,49,56,6,59,18,
                   26,54,22,58) then cluster = 2;

     if teacher in (8,21,10,31,1,2,23,5,16,39,27,37,
                    43,42,60,15,28,32,46,53,17,30,36,
                    52,13,57) then cluster = 3;

proc summary data=icmap; class cluster; var avgic SCALE1 i01-i03 i05-i15 i18;
     output out=icstats                mean=avgic SCALE2 i01-i03 i05-i15 i18;
proc print uniform data=icstats;
     format avgic SCALE1 SCALE2 i01-i03 i05-i15 i18 3.1;

proc freq data=icmap; tables
      OBSERVER DATE1    TEACHER  ARRANGEM N_STUDEN GRADE    LESSON_T I01_TIME
      I02_ROLE I03_KNOW I04_FLEX I05_DESI I06_USEF I07_TEAC I08_PROC I09_DIVE
      I10_CONC I11_MEET I12_SOUR I13_STUD I14_TEAC I15_STUD I16_OBS  I17_RULS
      I18_DIVE COMMENTS / MISSING;
run;
```

Concerns-Based Adoption Model Resources and Professional Development

http://www.sedl.org/cbam/

This publication is one in a series of three technical manuals about the Concerns-Based Adoption Model (CBAM).

Evaluators, researchers, and change leaders may take advantage of both our publications and professional development to learn to apply the model appropriately in facilitating and measuring change.

CBAM Professional Development

CBAM training and professional development sessions will enrich your reading and learning experiences. SEDL's CBAM professional development sessions deepen participants' understanding of the model so they may apply the three dimensions of CBAM in their own schools and districts to facilitate and measure change. For administrators and educators who are acting as change leaders, SEDL also offers CBAM training-of-trainer sessions. Sessions are offered at SEDL's headquarters in Austin or you may arrange for professional development sessions onsite. The authors of this manual also welcome inquiries and offer professional development, separate from that offered by SEDL.

Additional Reading About the Concerns-Based Adoption Model

The SEDL publications department offers numerous resources related to the CBAM. Some of these have been published by other organizations but are distributed by SEDL. For more information on these publications, visit our online catalog at www.sedl.org/pubs/.

GEORGE, A. A., HALL, G. E., & STIEGELBAUER, S. M. (2006)

Measuring Implementation in Schools: The Stages of Concern Questionnaire

Austin, TX: SEDL

This publication explains the development of the Stages of Concern (SoC) dimension and how to measure the stages. It also discusses recent studies related to the SoC and includes a CD with tools for scoring the SoC Questionnaire.

HALL, G. E., DIRKSEN, D. J., & GEORGE, A. A. (2006)

Measuring Implementation in Schools: Levels of Use

Austin, TX: SEDL

This updated manual for the Levels of Use (LoU) describes the development of the LoU concept, which allows evaluators, researchers, and change facilitators to determine the extent of use of an innovation. The manual includes a pullout chart for identifying the Levels of Use.

HALL, G. E., & HORD, S. M. (2011)

Implementing Change: Patterns, Principles, and Potholes, 4th Edition

Boston: Allyn & Bacon

Implementing Change focuses on how the Concerns-Based Adoption Model gives school leaders a perspective for understanding, evaluating, and facilitating the change process. This second edition also describes three other change approaches: Diffusion, Systems, and Organizational Development. Also, a chapter is devoted to the development of Professional Learning Communities.

HALL, G. E., NEWLOVE, B. W., GEORGE, A. A., RUTHERFORD, W. L., & HORD, S.M. (1991)

Measuring Change Facilitator Stages of Concern: A Manual for Use of the CFSoC Questionnaire

Greeley, CO: Center for Research on Teaching and Learning.

Those who facilitate the change process have concerns about their role that are similar in dynamics to the front-line teachers implementing change. *Measuring Change Facilitator Stages of Concern* provides a Stages of Concern Questionnaire designed especially for principals, staff developers, or teacher leaders who are serving as change facilitators, but the frame of reference is the role of change facilitation rather than "my" use of the innovation.

HORD, S. M., RUTHERFORD, W. L., HULING, L., & HALL, G. E. (2006)

Taking Charge of Change, Revised Edition

Austin, TX: SEDL

Taking Charge of Change was written for working administrators and change leaders. It is one of the most readable introductions to the Concerns-Based Adoption Model that has been published. The lucid description of the CBAM gives educators concepts, tools, and techniques they can use to facilitate school change and improvement programs.

HORD, S. M., STIEGELBAUER, S. M., HALL, G. E., & GEORGE, A. A. (2006)

Measuring Implementation in Schools: Innovation Configurations

Austin, TX: SEDL

This publication describes the development of the Innovation Configurations (IC) dimension and how to determine the different ways an innovation may be implemented. The manual includes detailed descriptions of how to construct Innovation Configurations Maps for a single innovation or multiple innovations and provides numerous examples of IC Maps.

KILLION, J., HORD, S. M., ROY, P., KENNEDY, J., & HIRSH, S. (2012)

Standards into Practice: School-Based Roles: Innovation Configuration Maps for Standards for Professional Learning

Oxford, OH: Learning Forward

Standards into Practice: School-Based Roles: Innovation Configuration Maps for Standards for Professional Learning provides clear pictures of Learning Forward's Standards for Professional

Learning in practice and guides educators in increasing the quality and results of professional learning. This book presents innovation configuration maps for teachers, coaches/teacher leaders, principals, and school leadership teams.

Supplemental CBAM Resource

A supplemental resource in video format is available on the SEDL website at www.sedl.org/cbam/videos/cgi? The video includes an overview of the CBAM constructs as they may be applied to assessment of implementation of standards-based reform and accountability initiatives. The video features interviews with Dr. Gene Hall, Dr. Shirley Hord, and Dr. Archie George, three of the original CBAM developers and principal authors of this revised series.

Contact Us

We invite you to share your comments and questions about the CBAM, purchase the CBAM resources and other school improvement products, or talk with a SEDL staff member to arrange CBAM professional development sessions.

Call us:	800-476-6861
Fax us:	512-476-2286 (Please send to the attention of the Publications Department)
Send an e-mail:	services@sedl.org

Authors' Biographies

SHIRLEY M. HORD, PhD

Shirley Hord received her master's degree in curriculum and instruction and her PhD in educational administration from the University of Texas at Austin.

Her early roles as elementary school classroom teacher and university science education faculty at the University of Texas at Austin were followed by her appointment as co-director of Research on the Improvement Process at the Research and Development Center for Teacher Education at the University of Texas at Austin. There she administered and conducted research on school improvement and the role of school leadership in school change.

She served as a fellow of the National Center for Effective Schools Research and Development, and was the US representative to the Foundation for the International School Improvement Project, an international effort that develops research, training, and policy initiatives to support local school improvement practices.

Dr. Hord is currently scholar emerita at SEDL in Austin, Texas, where she has worked since 1986. At SEDL, Dr. Hord has worked on numerous leadership and school change projects. She was the program manager for the Strategies for Increasing Student Success program (1995-2000), and she continues to provide training for Leadership for Changing Schools and to support applications of the Concerns-Based Adoption Model. In addition, Dr. Hord designs and coordinates professional development activities related to educational change, school improvement, and school leadership in North America, Asia, Europe, Australia, and Africa.

Recent publications include the following:

Hall, G. E., & Hord, S. M. (2006). *Implementing change: Patterns, principles and potholes* (2nd ed.). Boston: Allyn and Bacon.

Hord, S. M. (Ed.) (2004). *Learning together, leading together: Changing schools through professional learning communities.* New York: Teachers College Press.

Roy, P., & Hord, S. M. (2003). *Moving staff development standards into practice: Innovation configurations.* Oxford, OH: National Staff Development Council and Southwest Educational Development Laboratory.

SUZANNE M. STIEGELBAUER, PhD

Suzanne Stiegelbauer received her PhD in social anthropology with a dual focus on Native American arts and the social context of education from the University of Texas at Austin. She has an MA in visual arts and education from the University of Illinois, Champaign-Urbana. Dr. Stiegelbauer began her career as a high school visual arts teacher. As a graduate student, she had the opportunity to participate as a member of the research staff at the University of Texas's Research and Development Center in Teacher Education. As part of the Concerns-Based Adoption Model (CBAM) team, she worked on the development of the CBAM tools as well as on ongoing research on school change. Upon the completion of her PhD, Dr. Stiegelbauer took a position as a professor at the Ontario Institute for Studies in Education at the University of Toronto (OISE/UT), where she worked with Michael Fullan on the 1991 version of *The New Meaning of Educational Change*, as well as on other studies and publications related to school reform, teacher education, and the arts.

Currently Dr. Stiegelbauer is an associate professor of educational leadership and school improvement at Texas State University–San Marcos and arts toolkit coordinator for the National Partnership for Quality Afterschool Learning, located at SEDL in Austin, Texas. She continues to work with OISE/UT and Texas State University–San Marcos on research related to leadership, school change, and the arts.

Recent publications include the following:

Gordon, S., Stiegelbauer, S., & Diehl, J., (2005, Fall). Year one of school improvement: Examples from nine schools. *Educational Considerations.*

Stiegelbauer, S. (2004). When teachers and artists hold hands: Partnerships in education. In D. Booth and M. Hachiya. (Eds.), *The arts go to school.* Toronto: Pembroke Publishers.

GENE E. HALL, PhD

Gene Hall earned his MA and PhD degrees in science education from Syracuse University. For the first 18 years (1968–1986) of his academic career, he was a faculty member and researcher at the University of Texas at Austin in the national Research and Development Center for Teacher Education. During that time he and his colleagues developed and conducted the initial verification studies for the Concerns-Based Adoption Model (CBAM). He then moved to the University of Florida as a professor of educational leadership. In 1988 he accepted the position of dean of the College of Education at the University of Northern Colorado where he also served as a professor of educational leadership. In 1999, he became the dean of the College of Education at the University of Nevada, Las Vegas. Following his 5 years as dean, he again assumed a faculty position as a professor of educational leadership. Throughout Dr. Hall's career, the primary focus of his research has been based in application of, consulting about, and evaluation of change processes from a concerns-based perspective.

Dr. Hall also has had a parallel academic career regarding innovation in and national accreditation of teacher education.

Recent publications include the following:

Hall, G. E., & Hord, S. M. (2006). *Implementing change: Patterns, principles and potholes* (2nd ed.). Boston: Allyn and Bacon.

Hall, G. E., Gollnick, D., & Quinn, L. (in press). *The joy of teaching.* Boston: Allyn and Bacon.

Johnson, J., Musial, D., Hall, G. E., Gollnick, D., & Dupuis, V. (2005). *Introduction to the foundations of American education* (13th ed.). Boston: Allyn and Bacon.

ARCHIE A. GEORGE, PhD

Archie George earned his PhD in measurement and evaluation from the University of Texas at Austin. During his 7 years at UT–Austin (1973–1980), he was a researcher at the Research and Development Center for Teacher Education. It was during this time that he and his colleagues developed and conducted the initial verification studies with the Concerns-Based Adoption Model (CBAM). He then moved to the University of Idaho as an analyst in the management information systems department. In 1989 he was promoted to assistant director, and in 1998 accepted the position of director of institutional research and assessment at the same university.

Throughout Dr. George's career, the primary focus of his collaborative research has been based in application of, consulting about, and evaluation of the change process from a concerns-based perspective.

Recent publications include the following:

Alquist, A., Hendrickson, M., Johnson, M., Thornton, E. A., Uchiyama, K., West, C. E., Hall, G. E., & George, A. A. (1999). Mapping the configuration of mathematics teaching. *Journal of Classroom Interaction, 34*(1), 18–26.

George, A. A., Hall, G. E., & Uchiyama, K. (2000). Extent of implementation of a standards-based approach to teaching mathematics and student outcomes. *Journal of Classroom Interaction, 35*(1), 8–25.

Hall, G. E., and George, A. A. (1999). The impact of principal change facilitator style on school and classroom culture. In H. J. Freiberg (Ed.), *School climate: Measuring, improving and sustaining healthy learning environments.* Philadelphia: Falmer Press.