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ABSTRACT

Mastery learning is both a philosophy about student learning and a set of instructional implementation techniques. This volume presents 10 case studies of instructional programs identified as mastery learning or outcome-based education. The programs are organized according to whole-class mastery, flexible grouping, flexible grouping/continuous progress, and continuous progress approaches. Also included is a case study of an instructional management program. None of these programs was found to comply fully with program models described in the educational literature. This is not surprising, since the translation of outcome-based ideas within a time-based school organization structure is bound to yield imprecise results and compromises. The last chapter reviews the 10 sites and outlines some program and maintenance issues. The first section discusses seven obstacles to program implementation and maintenance. The final section presents a general design for implementing any of the instructional organization models. Two fundamental activities are involved: (1) establishing a mastery-oriented belief system; and (2) developing a comprehensive building level plan for program implementation and support. A description of the case study methodology and the survey instruments are appended. (44 references) (MLH)

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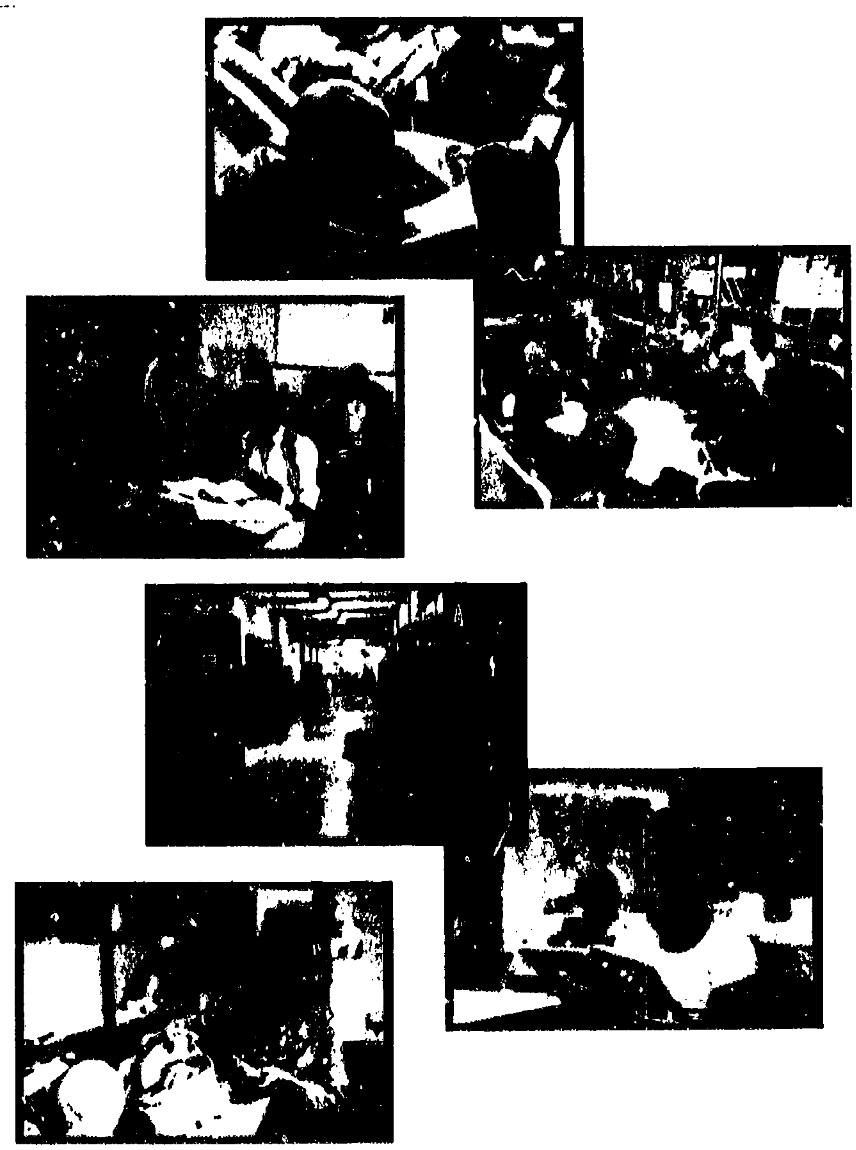
Robert Burns



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Dr. Brian Rowan was co-principal investigator on the Excellence in Instructional Delivery Systems Project from its inception until April, 1986. He was involved in conceptualizing the project and methodology, reviewing and discussing initial drafts of the case studies, and completing the analysis of the phone survey of outcome-based education programs. The final case studies reflect some of what I learned from his insights into schools as organizations.

Penny Jones coordinated much of the work for the Excellence Project. She also conducted the phone survey and wrote initial drafts of the case studies for the two schools she visited. Brenda LeTendre, Larry Robertson, and Bob Polkinghorn were site visitors and also wrote an initial draft of a case study. In addition, Bob Polkinghorn assisted in completing the final versions of the case studies. Martha Harrington was a site visitor on the Computer Math Project, a year-long case study comparing two teaching approaches.

Dr. David Squires, Supervisor of Curriculum and Staff Development at Red Bank Public Schools, co-authored the Red Bank case study. Charlotte Danielson, former Director of Curriculum Planning in Mukilteo School District, helped develop the model of mastery learning and outcome-based education presented in Chapter Seven.

Carrie Kojimoto edited all ten case studies and provided critical remarks and suggested many improvements in the substance of the case studies. The casebook is greatly improved because of her ability to write in a clear manner and organize arguments concisely. Linda Nelson also edited all ten case studies and made valuable suggestions. Sandra Kirkpatrick and Mabel Henderson had the difficult task of producing the casebook. Ann Wallgren provided typing assistance and kept my other business from folding altogether during work on the casebook.

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This casebook owes a great deal to all these individuals.

April 1987 — *Robert Burns*

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CHAPTER ONE

Mastery Learning and Outcome-Based Education

Introduction

This casebook presents ten case studies of instructional programs identified as "mastery learning" or "outcome-based education." Our purpose is to describe how these instructional programs came to be implemented and what these programs look like in practice.

This has not been an easy task to accomplish. We have attempted to take relatively detailed snapshots of the instructional programs, but instructional programs are not amenable to easy description. Many of the critical features of mastery learning or outcome-based programs are not tangible. Instructional programs are loosely organized policies that are interpreted, implemented, and modified by teachers and administrators as the program occurs. The intent of a program can often be stated as a rule which outlines formal policy and expected teacher and student behavior. But the real program is often closer to "Yes, sometimes we do that, but other times we do it this way, and other times we do it another way, it just depends." Compromises are made, and local routines are developed to handle special conditions. Local routines are difficult to tease out during site visits because local school personnel seldom recognize these unique adaptations.

Still, we have been able to compile relatively rich descriptions of instructional programs. While we have structured the majority of the case studies around a fixed set of questions, we have attempted to describe program operation in the words of the teachers and administrators involved in the program.

This chapter briefly outlines the concepts of mastery learning and outcome-based education. Four instructional models that provide a general framework for organizing the case studies are presented. We have included a bibliography at the conclusion of the casebook for readers interested in further study of the mastery and outcome-based concepts. We do so because despite a wealth of literature on mastery and outcome-based ideas, some educators continue to define these ideas as simple "teach to objectives" instruction. As the case studies make clear, this narrow interpretation is far from what mastery and outcome-based ideas are in practice.

What Are Mastery Learning and Outcome-Based Education?

Outcome-based education is rooted in two systematic approaches to instruction and assessment. One is known as mastery learning (Block, 1971, 1974; Block and Anderson, 1975; Block and Burns, 1977; Bloom, 1968; Guskey, 1985; Levine, 1985), an approach to individualized instruction in which students are allowed the time necessary to master units of curriculum before proceeding to the next learning unit. The other is known as competency-based education (Mitchell and Spady, 1978; Spady, 1977, 1978; Spady and Mitchell, 1977), a general term applied to instructional and assessment efforts aimed at defining and evaluating student performance.

The fundamental feature of mastery learning is the recognition of time as a variable in school learning.

While the roots of outcome-based education lie in mastery learning and competency-based education, the organizational barriers to applying these concepts at the school, district, and state levels provided the impetus, in 1980, to form the Network for Outcome-Based Schools under the auspices of the American Association of School Administrators (Spady, 1982). The network, composed primarily of school practitioners, has focused on organizational as well as instructional issues surrounding mastery learning ideas.

Spady, Filby, and Burns (1986) have recently outlined two fundamental principles shared by all outcome-based education (OBE) programs. The first OBE principle is that instructional practice is designed around *clearly defined outcomes* that all students must demonstrate. Instructional decisions about what a student is to learn next are based on successful attainment of learning outcomes. The second OBE principle is that schools must provide the *opportunity* for all students to reach the learning outcomes. This means that OBE programs have organizational arrangements that give teachers flexibility in making instructional decisions regarding use of time, grouping arrangements, teaching methods, and materials. These two principles enable OBE programs to match closely the student and curriculum.

To describe OBE programs, it is useful to consider five dimensions or components of an instructional program. The five dimensions are philosophy, curriculum structure, instructional practice, assessment procedures, and organizational arrangements.

Philosophy

OBE programs have an optimistic philosophy of education derived from mastery learning theory. This philosophy asserts that instruction can be organized so that virtually all students can learn the information, concepts, and skills embodied in the curriculum. The philosophy also asserts that teachers can teach in such a way as to ensure that virtually all students achieve high levels of learning. The belief system generated by this philosophy provides a firm foundation for the commitment that is required to implement mastery learning and outcome-based education.

Curriculum Structure

In OBE programs, the curriculum is organized around learning outcomes that have been established at the district or school levels. The outcomes determine what should be taught and how the curriculum should be structured into learning units, courses, or programs of study that will best achieve those outcomes. Typically, curriculum segments have (a) outcomes defined in terms of goals and objectives, (b) standards of student performance which directly embody the goals and objectives, and (c) curricular materials sequenced in a logical fashion to support attainment of the outcome goals and objectives. The alignment of outcomes, standards, and materials ensures that what is taught is what is tested.

Instructional Practice

OBE programs use instructional practices based on mastery learning ideas. Mastery procedures require that students demonstrate high levels of learning before advancing to the next learning unit. Because students have the necessary prerequisites for future learning, students and curriculum are better matched, and students are more likely to have successful learning experiences. In addition, OBE programs also draw upon the research on teaching and instruction to organize pedagogical practice into systematic models of mastery teaching and learning.

A fundamental feature of mastery learning is the recognition of time as a variable in school learning. Mastery learning, as initially developed by Bloom (1968) and Block (1971, 1974), was based on John Carroll's (1963) model of school learning. A feature of Carroll's model was the conceptualization of aptitude for learning not as a fixed capacity determining the level to which students could achieve but as the time students needed to learn to some fixed level. The direct recognition of student differences in time needed for learning has led to more flexible use of time in mastery and outcome-based programs and ways to accomodate such differences in students.

Assessment Procedures

OBE programs use assessment procedures that provide evidence of student attainment or nonattainment of the mastery standard established for the curriculum segment being learned. This assessment evidence is the basis for making instructional decisions based on outcomes and not time. This evidence also provides the basis for grading student performance, which in mastery learning models includes only marks for mastery or nonmastery. In addition, since time does not define when learning is over, the grading of students is completed periodically. Grades can be changed to reflect higher performance.

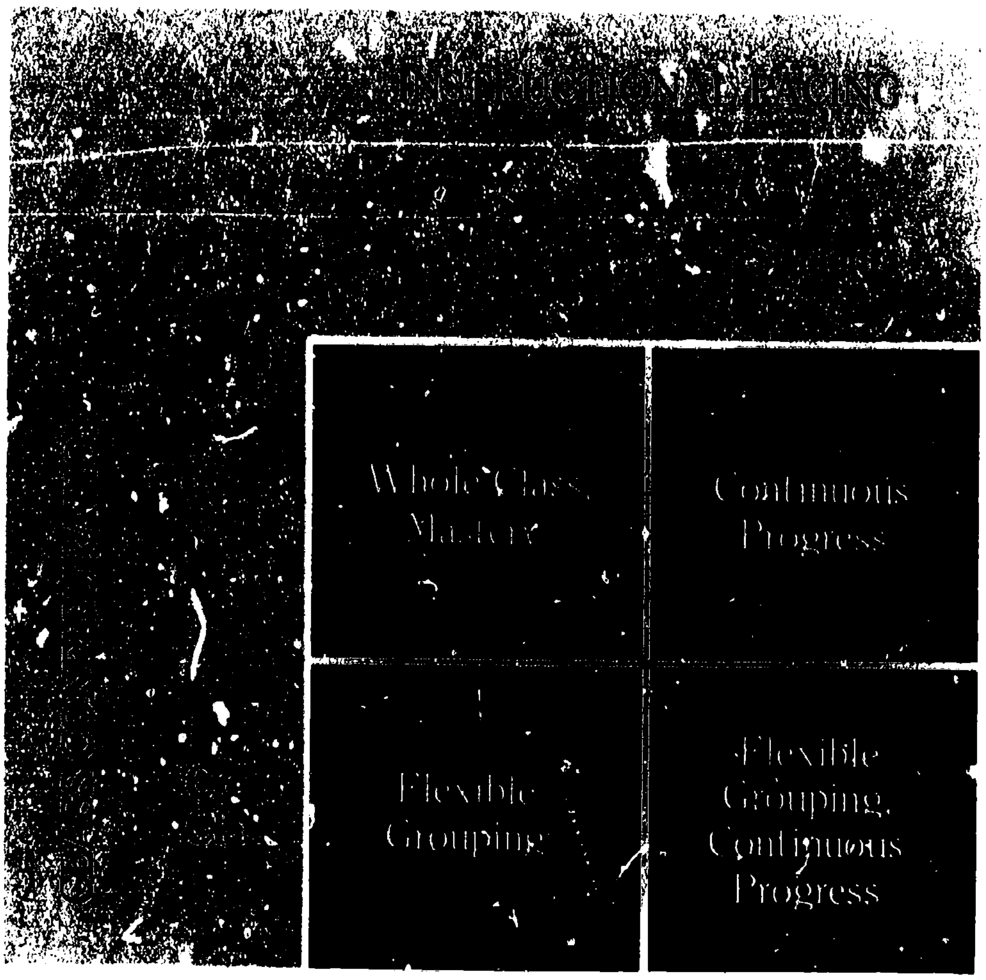
Organizational Arrangements

Since learning outcomes are the basis for instructional decisions about what students will learn next, student advancement in an OBE program may vary according to when and how fast students achieve the outcome. Consequently, OBE programs use organizational arrangements that provide the necessary support teachers require to make such decisions. The organizational arrangements vary according to the type of OBE program under consideration.

Based in part on our work on this casebook, we have identified four general classes of OBE instructional programs, organized according to two dimensions. One dimension is instructional pace, which refers to whether the teacher or the student paces instruction. The other dimension is classroom configuration, referring to whether single or multiple teachers are required for the program. Figure 1 presents the four different models, each of which is described below:

- WHOLE-CLASS, MASTERY models attempt to bring all learners in a classroom up to high levels of learning before allowing the entire class to progress to the next learning unit. Instruction is paced by the teacher. And while whole-class mastery is most effective when teachers cooperate in a systematic school program, mastery learning can be carried out by individual teachers in self contained classrooms.
- FLEXIBLE GROUPING models provide alternative curriculum segments designed to fit identified student prerequisites. Periodically, usually every three or four weeks, all students are reassigned to a new class where they are taught the learning unit best suited to their prior learning. Instruction is paced by the teacher, but timing of instruction is important: regrouping must be scheduled for several classes of students at the same time. These models require several teachers to teach the subject at the same time as well as good coordination among teachers.

Figure 1
Four OBE Instructional Organization Models



- FLEXIBLE GROUPING, CONTINUOUS PROGRESS models provide alternative curriculum segments to fit identified student prerequisites in a student-paced format. Students progress at their own learning rate through the curriculum. All teachers in the program must teach at the same time each day, with each teacher responsible for some small set of objectives. Individual students are reassigned to new classes periodically (every several days for faster students) following demonstrated mastery on prerequisite objectives. A testing center, a computer-based management system, and well- specified curriculum and assessment instruments are required.
- CONTINUOUS PROGRESS models allow students to progress at their own learning rate. Continuous progress models can be implemented by single teachers. Because students are spread out in the curriculum, a computer-based management system and a well-specified curriculum are required.

The Organization of the Casebook

We have organized the ten case studies of this casebook around these four models (see Table 1). Chapter Two presents four whole-class mastery learning examples—Johnson City Central Schools, Red Bank Public Schools, Mariner High School, and Johnson Elementary. Chapter Three presents examples of three flexible grouping models—Conrad Ball Junior High, Explorer Elementary, and Barcelona School. Chapters Four and Five each present a single site—North Sanpete School District has a flexible grouping, continuous progress program in mathematics and George Dilworth Junior High School has a continuous progress program in mathematics. The final case study presented in Chapter Six—Cooper Mountain—does not fit any of the four models. It is an instructional management program included because of the widespread use of computer management systems in supporting and managing mastery and outcome-based programs. The casebook concludes in Chapter Seven with a cross-site analysis.

Table 1

A Summary of the Ten Case Study Sites

Site	Type of Program	Subjects	Number of Schools	Grade Level	Site Visit Date
1. Johnson City Central Schools	Whole-Class Mastery	All Subjects	4	K–12	November 1986
2. Red Bank Public Schools	Whole-Class Mastery	All Subjects	2	K–8	October 1986
3. Mariner High School	Whole-Class Mastery	All Subjects	1	10–12	November 1985
4. Johnson Elementary	Whole-Class Mastery	All Subjects	1	K–6	November 1985
5. Conrad Ball Junior High	Flexible Grouping	Mathematics	1	7–9	November 1985
6. Explorer Elementary	Flexible Grouping	Mathematics	1	K–6	November 1985
7. Barcelona School	Flexible Grouping	Mathematics Language Arts	1	K–8	November 1985
8. North Sanpete School District	Flexible Grouping/ Continuous Progress	Mathematics	6	K–8	April 1986
9. George Dilworth Junior High School	Continuous Progress	Mathematics	1	7–8	1984–1985
10. Cooper Mountain Elementary	Instructional Management	Mathematics Language Arts	1	K–6	November 1985 April 1986

CHAPTER TWO

Whole-Class Mastery Approaches

This chapter presents four examples of whole-class mastery approaches. The four examples, Johnson City Central Schools, Red Bank Public Schools, Mariner High School, and Johnson Elementary, provide interesting contrasts.

Mastery learning is both a philosophy about student learning and a set of instructional techniques to implement that philosophy. These two aspects of mastery learning are emphasized differently in Johnson City and Red Bank. Johnson City places a strong emphasis on institutionalization of the philosophy of mastery learning while Red Bank emphasizes the mechanics of mastery learning techniques. While both districts are effective, they have gone about the implementation of mastery learning in different ways and emphasize different aspects of mastery learning. These two small districts are excellent contrasting examples of mastery learning.

Mariner High School and Johnson Elementary contrast, to some extent, implementation of mastery learning at the elementary and secondary levels. However, we have chosen to focus on difficulties in staff development approaches to implementing mastery learning in the Johnson Elementary case study. Because of this, the contrast between elementary and secondary level implementation is less explicit. The issues raised in the Johnson Elementary case study apply to all the sites in this chapter and suggest potential threats to mastery learning implementation at all levels of education.

Johnson City Central Schools: Outcome-Based Education as Long-Term School Improvement

Introduction

"Unlike the way things happen in fairy tales," writes Larry Cuban in the *Harvard Educational Review*, "school reform requires more than a kiss to convert a frog into a stunning prince" (1984, p. 131). In no place is that better understood than in the Johnson City Central Schools, Johnson City, New York. School reform efforts in the district have been organized around mastery learning and outcome-based education since 1971. In June 1985, Johnson City had the first comprehensive approach to school improvement approved by the Joint Dissemination Review Panel of the National Diffusion Network. Fourteen years of hard work were required to turn the frog into a prince.

The foundation for school improvement in Johnson City is its Outcomes-Driven Developmental Model (ODDM), a comprehensive, 20-component program outlining board, district, school, and classroom policies and procedures for improvement efforts (see Figure 1). In the words of the current superintendent, Dr. Albert Mamary, the model "gives teachers and administrators the framework to make decisions. All our decisions and all our thinking are based on the model. When we have a problem, we go there. We don't have to look outside. The answers and solutions and direction are within the model."

Implementing a comprehensive program such as ODDM requires an extensive school improvement plan. Accordingly, the district has developed a three-stage training process. During the preparatory stage, a district leadership team must complete initial awareness and planning activities. The implementation stage requires thirteen days of teacher and administrator training, five during the first summer followed by eight training days during the first implementation year. The third and final self-direction stage requires ten additional days of training, five during the second summer and five during the second implementation year. Such extensive training demands a great deal of commitment and effort on the part of administrators and teachers. As Assistant Superintendent Larry Rowe characterized the purpose of ODDM, "What you are really doing is trying to change the normative structure of the school, and that takes time."

This school improvement effort is guided by four questions which together produce what district administrators call a "vision of education." The four questions are outlined below:

1. What Do You Know? The foundation of any school improvement effort, according to ODDM, should rest on existing knowledge about what works in schools. As Mamary described it, "In this district, knowledge is power. We place a high premium on knowledge, so teachers know that knowledge is rewarded, and knowledge can start with anybody."

Although the work of mastery learning specialists like Benjamin Bloom, James Block, and Lorin Anderson have been emphasized in Johnson City, Mamary also cited the work of William Glasser's reality therapy on how to get children to take responsibility for their learning, the work of Madeline Hunter in the area of teaching

OUTCOMES-DRIVEN DEVELOPMENTAL MODEL

RESEARCH LITERATURE

MISSION: ALL STUDENTS WILL LEARN WELL WHAT SCHOOLS WANT THEM TO LEARN

PHILOSOPHICAL BASE

PSYCHOLOGICAL BASE

TRANSFORMATIONAL LEADERSHIP

ADMINISTRATIVE SUPPORT SYSTEMS	BOARD OF EDUCATION	SCHOOL SUPPORT SYSTEMS
STAFF DEVELOPMENT MODEL	BOARD POLICY	INSTRUCTIONAL PROCESSES
COMMUNICATIONS NETWORK	BOARD SUPPORT	CURRICULUM ORGANIZATION
PROBLEM SOLVING MODEL	COMMUNITIES	INTENTIONAL SCHOOL PRACTICES
CHANGE FACTORS & PROCESS	NETWORKING	INTENTIONAL CLASSROOM PRACTICES
CLIMATE IMPROVEMENT MODEL		ORGANIZATIONAL STRUCTURES

DESIRED STUDENT EXIT BEHAVIORS

a. Self-Esteem As Learner And Person
b. Cognitive Levels - Low To High Levels
c. Process Skills
   - problem solving
   - communication
   - decisionmaking
   - accountability
   - group process
d. Self-Directed Learner
e. Concern For Others

Developed by Albert Mamary

skills, the work of Bernice McCarthy on whole-brain activities, and the work of Jere Brophy and Tom Good on teacher expectations as contributing to the overall foundation of ODDM.

2. What Do You Want? ODDM suggests that teachers and administrators must articulate what it is that they want students to know when they leave a classroom, a school, or the district. In Johnson City, Mamary and Rowe have identified and defined five fundamental outcomes for its students:

a. **Self-esteem**. All students should feel good about themselves as learners.

b. **Cognitive Levels**. All students should learn at all cognitive levels, irrespective of the student's rate of learning.

c. **Process Skills**. All children should develop problem-solving, communication, decision making, accountability, and group process skills.

d. **Self-directed Learner**. All children should develop skills that enable them to learn on their own.

e. **Concern For Others**. All children should develop social awareness skills and concern for those around them. These exit outcomes are what teachers should strive to develop during each lesson, learning unit, and course.

3. What Do You Believe? Every school system is grounded on a set of beliefs about education. The Johnson City belief system, a set of shared attitudes about children and schooling, is pivotal for the decision-making process. As one high school teacher described ODDM, "It has a philosophy of how things should be done, so when you have a decision about something, you can go back to what do we believe as a school district before making that decision."

The fundamental attitude of Johnson City faculty is that virtually all students can learn the curriculum, and all teachers can teach so that students learn. Adopting this belief was perhaps the single most important result of the staff development work. The consensus of purpose evident in the district comes from this outlook and helps generate their success-oriented system. One seventh grade English teacher told us, "I go home at the end of the day, and I know that I taught better than I've ever taught before. I know that my students have learned better than they ever learned before, not because of me but because we're in a system."

Several other attitudes characterize the belief system as well. In Johnson City, staff believe that talent can and should be *developed* by schools rather than identified and selected. One mission of education, stated Dr. Frank Alessi, director of gifted and compensatory education, is "to discover and develop the unique gifts and talents of every single child." The main way teachers strive to realize this goal is through the "bubble-up" process and "investigations" activities, which are described in a later section.

The fundamental attitude of Johnson City faculty is that virtually all students can learn the curriculum, and all teachers can teach so that students learn.

Another guiding belief is that schools should be inclusive rather than exclusive. "We didn't want to get into the business of saying who's gifted and who's not because we don't think it's necessary and it's pretty harmful," according to Alessi. The attitude that no student should be excluded from any part of the school program extends beyond the classroom as well. For example, if a child wants to play in the band, Johnson City staff are committed to finding some means for that student to do so.

4. What Do You Do? The final question follows directly from the previous three: Given what you know, what you want, and what you believe, what are you going to do to bring about the necessary changes?

Mamary asserts that responsibilities for students, parents, teachers, administrators, and board members must be clearly delineated and that ODDM provides the framework for orchestrating these responsibilities.

Johnson City has attributed a number of benefits to this comprehensive and structured model. First, the model provides a common framework and language system for school improvement. "It makes it possible to talk about education itself," one high school teacher noted. New staff development activities are undertaken with the purpose of expanding the model, not replacing it. Mamary noted that teachers in the district may say "slow down," but you would not hear them say "here we go again." Furthermore, he continued, "I think just about everybody in the organization can tell you what the mission is, what our beliefs are, and where this district is going." That mission and belief system provides a common starting point for developing consistent instructional practice.

The model also assists the district in long-term planning. Implementing large-scale changes requires planning beyond the impending school year. Larry Rowe explained:

> *To set up a district requires one to think three to seven years down the road. For a leader to develop that sense of mission for the long-term as opposed to the short-term is a very difficult thing to do. A lot of people shy away from a total system model because it takes a lot of hard work. How do you transform intention into reality and then sustain it? That's really the question that we all have to ask ourselves. And that's what we're saying with ODDM. If you attend to and intentionally manage these components, you can sustain growth and development.*

Not only does the model provide a guideline for planning, it is the impetus for school improvement. "You bring up one problem and then all of a sudden three other problems emerge," said Rowe. But in Johnson City, teachers and administrators do not treat these contradictions disconcertingly. Rowe continues: "ODDM creates that internal conflict among the whole staff and the organization that gets people to sift out what it is that we're really all about and what it is that we're willing to commit to." People are forced to think through what it is they want their schools to look like. The on-going change process has become familar and less threatening to the Johnson City staff, noted the middle school principal. "Change is one of those things staff in this district now accept as the rule rather than the exception."

Finally, the heart of the model, the mastery-based instructional process, can produce good results in student learning. Table 1 presents grade-equivalent scores on the reading and mathematics subtests of the California Achievement Test from 1977 to 1986. While caution must be exercised not to read more into grade-equivalent scores than such scores allow, the data generally show Johnson City students score above grade level in grades 1–8.

Student achievement carries over into high school. According to the guidance coordinator, James Vaughn, "it's difficult to be unsuccessful in Johnson City. What I have seen happen is that mastery learning really says to kids in very subtle ways, 'We want you to be successful and we're going to do a lot to make you successful.' I think that's a powerful message to kids." Apparently, teachers have effectively communicated that message to their students. According to Vaughn, the New York average for obtaining the Regents high school diploma, which has requirements beyond those of a general diploma, is close to 45 percent; at Johnson City, 77 percent of high school students obtained the Regents diploma in 1986.

Johnson City faculty credit their success to the application of ODDM. Outcome-based education has "simply put us all on the same path of good, sound education," according to one teacher. Or as Garnita Cole, a basic skills coordinator at one of the elementary schools said, "I think that in outcomes-based education, we have at last taken time to consider what we really wanted to teach and then looked at the whole science and art of teaching. And we have found that when we systematically and consistently do these things, our children learn."

Table 1

Grade-Equivalent Scores in Reading and Math for 1977–1986

Subject	Grade	Norm	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Reading	1	1.8	1.7	1.9	2.0	1.9	2.1	2.1	2.1	2.2	2.3	2.2
	2	2.8	3.0	3.0	3.2	3.1	3.1	3.2	3.4	3.6	3.4	3.8
	3	3.8	4.1	4.1	4.1	3.9	4.0	4.1	4.5	4.2	4.4	4.7
	4	4.8	5.5	5.7	5.6	5.7	5.7	5.6	5.8	5.8	6.3	6.3
	5	5.8	6.6	6.7	7.3	7.8	7.6	7.1	7.0	7.2	6.9	7.5
	6	6.8	7.7	8.3	8.0	8.1	8.5	8.3	8.3	8.2	8.4	8.6
	7	7.8	8.7	8.8	9.3	9.4	9.7	10.0	10.0	10.0	9.6	10.0
	8	8.8	10.1	10.0	10.2	10.8	10.6	11.0	11.1	11.1	10.7	10.6
Math	1	1.8	1.8	2.1	2.2	2.0	2.1	2.2	2.3	2.4	2.6	2.5
	2	2.8	3.2	3.3	3.5	3.3	3.3	3.2	3.3	3.4	3.4	3.5
	3	3.8	4.1	4.3	4.4	4.3	4.4	4.3	4.6	4.4	4.6	4.7
	4	4.8	5.3	5.6	5.8	5.7	5.5	5.4	5.5	5.9	5.9	6.2
	5	5.8	7.0	6.8	7.4	7.5	5.5	5.4	5.5	5.9	7.2	7.5
	6	6.8	7.5	8.2	8.0	8.1	8.4	8.2	8.1	8.1	8.3	8.7
	7	7.8	8.5	9.0	9.3	9.2	10.0	10.0	9.8	10.0	9.4	9.9
	8	8.8	10.7	10.0	11.1	12.5	11.9	12.5	12.5	12.5	11.6	11.1

Note: Scores are for the California Achievement Test.

Program Implementation

Setting

Johnson City, a small village of 18,000 and a suburb of Binghamton, is located in south central New York. Along with the nearby village of Endicott, the tri-city area was, until the 1970s, one of the largest shoe manufacturing areas in the world. With the decline in the shoe industry, the village now depends on local businesses and the light industry in the area.

Originally populated largely by Eastern European immigrants who relied on the shoe industry to provide jobs, the area is now enjoying modest growth, in part because of the reputation of the schools. Johnson City has also received a recent influx of Asian immigrants, attracted by its affordable housing. Students come from primarily middle-class and lower middle-class families.

There are four schools in the district, two K–5 elementary schools (Harry L. Johnson and Lincoln), a 6–8 middle school (C. Fred Johnson), and a 9–12 high school (Johnson City High School). Despite the age of the red-bricked elementary and middle schools (all are over 50 years old), the buildings are well-maintained and comfortable. The sixteen-year-old high school, which also houses the district offices, appears new. The guidance counselor pointed out that "the facilities are a testimony to the program. We've never had any vandalism, we don't have graffiti, and we don't have the kinds of problems you see in other schools."

There are 188 teachers in the district. Approximately 1200 students are enrolled at the two elementary schools, 670 in the middle school, and 940 in the high school. Student turnover in the district has averaged 13 to 15 percent for the past ten years, although Lincoln School, in a lower-income neighborhood, has experienced turnover rates closer to 40 percent.

About 23 percent of the K–8 student population are classified as Chapter I students; the same percentage of students receive free or reduced-price lunches.

Implementation History

Albert Mamary divides the fifteen-year history of school improvement at Johnson City into three five-year periods or generations of development.

The first generation began in 1971, when Dr. Jack Champlin assumed the superintendency. Champlin and Mamary had worked together in another district, where Champlin had been an assistant superintendent and Mamary had been a district mathematics coordinator. When Champlin moved to Johnson City, Mamary joined him as his assistant superintendent.

It was Benjamin Bloom's 1968 article "Learning for Mastery" that led the district to implement a mastery learning program. Six volunteer elementary teachers spent the summer discussing mastery learning and working on ways to apply the ideas in the classroom. According to Mamary, "When they redefined aptitude not as capacity but as rate, that was the major difference. It was a notion that drove a belief system that everybody can learn, some just need more time." Over the next several years, more teachers became involved with mastery learning. Mamary characterized this period as the "idea" stage.

The second generation of development began around 1976, when the district went from a conceptualization stage to a "science of planning and teaching" stage. Administrators and teachers spent several years developing a consensus about a mastery learning instructional process model that organizes curriculum and instruction in a consistent manner. "I can't tell you how important it is for schools to agree on an instructional model," Mamary said. "It provides a framework for all new staff development work whereby new work can build on old work rather than attempt to replace it."

The third generation, which began around 1980, is characterized by Mamary as the "complete outcomes-driven" stage. 1980 marked the founding of the Network for Outcome-Based Schools, a national organization of teachers, administrators, and educators whose purpose is to promote work in mastery learning and outcome-based education. Johnson City, under Mamary's leadership, began hosting Network-sponsored conferences during this period. These conferences helped spawn the full-scale development of the Outcomes-Driven Developmental Model.

The long-term school improvement process behind the creation and refinement of ODDM was articulated by John Champlin in an article written for *The School Administrator*:

> *While Mastery will eventually challenge and perhaps reshape almost all the important aspects of a district's operations, these things will not happen all at once but through an evolutionary cause and effect sequence. The full benefit of a Mastery program can only result from its holistic application to the total instructional system.*

Program Description

The ODDM is a comprehensive district improvement model, encompassing many components of district operation. Here we will focus primarily on the instructional component and how it operates in the four schools. However, it should be noted that instructional procedures vary because of subject matter and school organization differences inherent among elementary, middle, and high schools.

Philosophy

The educational philosophy at Johnson City Central Schools is rooted in mastery learning theory and practice. Mastery learning assumes that virtually all students are capable of learning what schools have to teach. Over the years, this general premise has been stated in a variety of ways by the administration and faculty in Johnson City. In the Winter 1983 issue of *Outcomes*, Mamary outlined eight elements that underlie staff development and program implementation activities. In abbreviated form, these eight elements are

1. Almost all students are capable of achieving excellence in learning.
2. The instructional process can be changed to improve learning.
3. An essential function of schooling is to ensure that all students perform at high levels of learning and experience opportunities for individual success.
4. An effective instructional process varies the time for learning according to the needs of each student and the complexity of the task.
5. Success influences self-concept; self-concept influences learning and behavior.
6. Staff and students share responsibility for successful learning outcomes.
7. Assessment of learning is continuous and directly determines instructional placement.
8. Credit is awarded and recorded when learning is assessed and validated.

This philosophy statement and others like it are discussed with new teachers during a mandated, week-long summer workshop. However, it is the district mission statement that administrators believe is most important for teachers to endorse. That mission statement, "All students will learn well what schools want them to learn," along with the five exit behaviors of the ODDM (self-esteem, cognitive outcomes, process skills, self-directedness, and concern for others), is what Johnson City faculty adhere to during their instructional planning and decisionmaking. Their importance was underscored by Rowe's statement, "If I went to another district, I'd start with those two things, what are we going to commit to and what are we going to produce that will make us good."

These beliefs will not be internalized by building level staff, however, unless district administrators actively solicit their participation in conceptualizing the joint mission. "Districts make a big mistake," according to Mamary, "when they write a philosophy statement and give it to teachers. That's foolish. They say they have their beliefs; they have it for the desk but nobody has internalized them except a handful of people." In addition, Rowe emphasized that districts must educate faculties first. "Some districts get people together and say, 'Okay, now tell me what you want.' Usually they have no understanding or background to answer that question. So I think one of the things that leadership has to do is to make sure that people are ready to talk about what they want. The way you ready people is through a systematic way of providing them with knowledge." Both Mamary and Rowe were quick to point out, however, the importance of formalizing philosophy statements slowly.

"Districts make a big mistake," according to Mamary, "when they write a philosophy statement and give it to teachers. That's foolish."

Curriculum

What Curriculum Is Taught? In New York, there are state-mandated curriculum outlines for every subject and grade level. These guidelines provide the starting point for organizing curriculum in Johnson City, as they do for all districts in the state.

At the school level, curriculum is based, for the most part, on standard textbook series. For example, in the elementary schools, Holt is used in mathematics and Scott-Foresman in reading and language arts. Although elementary mathematics is based on Holt, there are non-textbook objectives specified and criterion-referenced tests are available. All students take the same summative tests for each learning unit between grade 1 and grade 5. In elementary reading and language arts, teachers use the objectives and criterion-referenced tests of the reading series.

How Is the Curriculum Structured? Curriculum in Johnson City is packaged in learning units. A district curriculum unit guide, complete with model learning units, has been developed to assist teachers in organizing curriculum into learning units. The nature of the units vary with teacher and grade level; some might include an elaborate two-week unit on Anglo-Saxon literature; others might be time estimates for completion of chapters in the high school textbook used in mathematics.

A lesson guide and model lessons supplement the curriculum guide. The guide suggests a standard lesson structure that closely parallels the outline for a unit structure. Each lesson is organized into four segments: cue setting/motivation, best-shot teaching, guided practice, and independent practice. The lesson guide also recommends that formative assessment, correctives, extensions, and closure should be ongoing features of all lessons. The instructional process model, to be discussed shortly, is a combination of both the curriculum unit guide and the lesson guide.

Johnson City teachers have had considerable experience writing learning units. Consequently, the writing of a unit takes only one to two days according to Garnita Cole, one of the original six teachers who started mastery learning in 1971. "In our early unit writing, we truly got carried away," recalled Mrs. Cole. "The teachers were extremely creative. They came up with fantastic ideas and ways to teach and good materials. But you can't spend a whole year teaching a unit on sentences. So we had to put the whole program in perspective."

How Are Students Placed in the Curriculum? Student placement is heterogeneous by grade level. At the elementary and middle school levels, students are assigned to a teaching team and identified by the appropriate grade level designation. At the high school, grade level is determined by the usual number of credits earned.

Instruction

How Are Students Organized for Instruction? Teaming is a major feature of instructional organization at the elementary and middle schools in Johnson City. Art Chambers, one of the elementary school principals, told us, "We feel in this district that teaming makes the difference between success and nonsuccess in carrying out the instructional process."

Teaming occurred in different configurations in the three schools. For example, one of the elementary schools had the following teams: a kindergarten team (3 teachers), a first-grade team (5 teachers), a 2-3-4 team (3 teachers; students feed into a single self-contained fifth grade classroom), a 2-3-4-5 team (4 teachers), a 2-2-3-3 team (4 teachers), and a 4-4-5-5 team (4 teachers). Each team has a common 40-minute planning period during the day. This particular configuration was determined by the faculty and set up partly because of past collegial work. The other elementary school was not as elaborate in its teaming structure.

Because of the teaming arrangements at the elementary schools, teachers found it easier to provide blocks of time for corrective and enrichment activities. They also found it easier to regroup students. According to Chambers, "Vertical teaming gives you a more seamless curriculum and more continuous progress, cumulative learning. The groups are fluid and flexible, ever changing as kids are changing." Teaming overcomes some of the isolation and lack of power teachers sometimes feel in traditional self-contained classrooms. Mrs. Cole noted that "one of the best things we see happening is teachers sharing ideas and materials. They are thinking in terms of what can *we* do rather than what can *I* do."

At the middle school, teaming is done for academic subjects and is mainly horizontal; there are two sixth grade teams, a sixth-seventh grade team, a seventh grade team, and two eighth grade teams. Outside of the sixth grade teams, which are not departmentalized, each team has one teacher each from mathematics, science, social studies, and English. A correctives and enrichment study hall can be used by each team to increase time flexibility lost by the scheduling of 45-minute periods. As one teacher commented, "It's not interdisciplinary teaching. The teaming here is for time management, to be able to get the kids that we need when we need them."

The middle school principal, Joe Meehan, noted that "the teaming structure gives these kids something more than academics. It gives them a feeling of belonging to a certain core of people. They get a feeling of team camraderie." He felt this was important for students making the difficult transition from the child-centered approach of the elementary school to the academic emphasis of the high school.

How Are Students Taught? The core of Johnson City's instructional program is the instructional process that teachers follow. This instructional process has been formalized into the model presented in Figure 2. The model represents one of four slightly different versions obtained during the site visit.

The model is divided into three phases, beginning with planning and ending with summative assessment. The instructional process represented in the model provides an outline for teachers. One teacher said the model "organizes you and makes you more deliberate." Another teacher described how the model changed her teaching: "My quickest way to explain what I do that's different is that everytning I do between the time I get the idea of what I want to teach and the time the unit is completed, all of that, is in a straight line." Still another teacher pointed out its common sense approach, "There's nothing magical about the instructional process model. A lot of people do those kinds of things, whether or not they are in mastery learning. The thing is, I think we're more intentional about it."

The Johnson City faculty have been refining the corrective enrichment part of the model. Their efforts to make enrichment activities more than "work that keeps students out of trouble" have produced what they call the "bubble up" process. Students who demonstrate either exceptional performance or motivation are encouraged to pursue further learning of a particular topic, either with guided help or independently. For example, at one of the elementary schools, a group of students were doing a unit on local history. Eight of the students showed a particular interest in learning more about Harry L. Johnson, the person whose name their school bears. Initially some students conducted what the staff calls "guided investigations," exploring further the life of Mr. Johnson. From that group, students might "bubble up" even further to undertake independent study projects or "full-fledged investigations."

The investigations activities are a key part of the self-directed learner component of ODDM. A major purpose is to get students to "take charge of their learning" rather than to be dependent on teacher direction. Elementary school students find this a novel idea and are beginning to see that "they can have some influence on what they're learning," according to Mrs. Cole. Because of the flexibility in time use at the elementary level, the investigations activities are more easily conducted at this level than at the middle and high school levels.

These enrichment activities usually take place during two of the three types of learning that have been identified by the district. Essential learning is the learning that occurs during regular instruction. Enriched and exceptional learning represent more advanced stages of learning. In accordance with their belief that all children are talented and gifted, the goal of Johnson City schools is to have every student participate at some time in investigations.

Assessment

How Are Students Advanced? Instruction in Johnson City is group-based and teacher-paced at all grade levels. Depending on the level, there are different ways to provide students the necessary time for mastery.

At the elementary level, the team configurations allows for flexible grouping and the movement of students among existing instructional groups. To accomodate differences in learning time requirements, some students might be given additional instruction during the school day, in effect receiving a "double dose" of instruction. Classwork can also be done after school, as late buses run three times a week.

At the middle school level, the corrective and enrichment study hall allows students time to complete make-up work on learning units that have not been mastered. It is the students' responsibility to arrange make-up work with teachers to complete learning units. As one teacher noted,

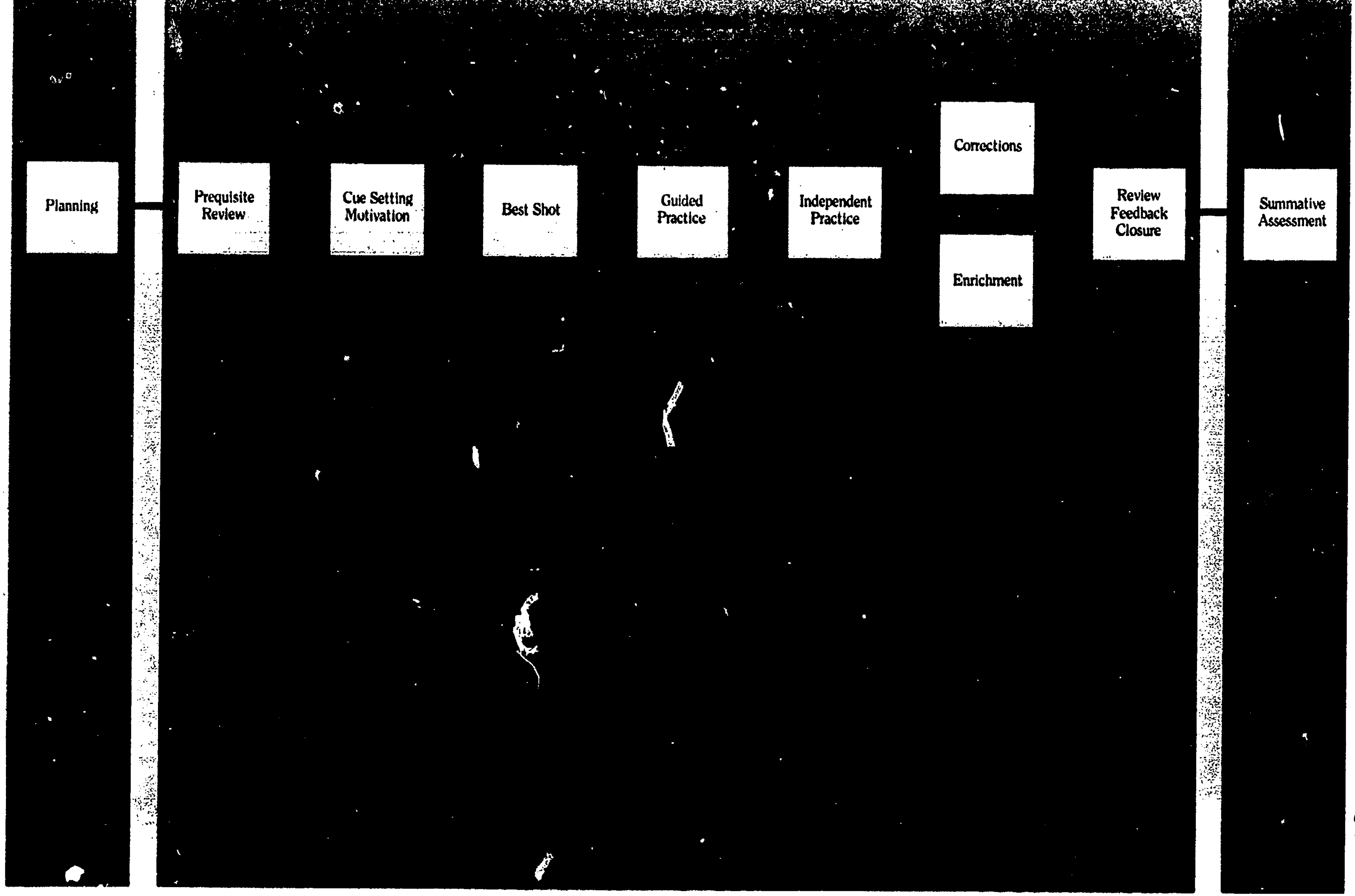

Planning
Prequisite Review
Cue Setting Motivation
Best Shot
Guided Practice
Independent Practice
Corrections
Enrichment
Review Feedback Closure
Summative Assessment

Figure 2

"You have to keep everything on a schedule, you have to have deadlines, and you have to teach them what their responsibilities are. If they pass a deadline, there's a consequence."

There is more variability at the high school level, depending on the academic department and teacher. Time cannot be used as flexibly as it can at the middle or elementary levels, which makes it more difficult to find the time necessary for mastery. In many cases, it is up to the teacher to find procedures for moving students through the curriculum. One department coordinator explained, "You have philosophy here and the real world here," holding his hands apart, "and we're trying to close that gap. It's one of our problems right now."

How Is Student Progress Monitored? The curriculum organization does not require an elaborate system to monitor student progress. A computer maintains records of objectives mastered in elementary mathematics, but teachers, for the most part, have devised their own record-keeping system to keep track of student learning. "Very often teachers use sheets with grids on it, in which they just number the objectives or put down a word or two which describes what it is," according to Mrs. Cole. "Each teacher has their own system of either a check, a plus, a specific number, or just an M for mastery. At a glance, they can establish who has mastered the objective and who hasn't. It's not terribly difficult."

Some students are beginning to monitor their own learning, according to one high school teacher. "When students have not mastered something, they're very quick to come to you and say, 'What do I have to do to correct that? What do I have to do to get a mastery mark?' They are starting to ask questions that teachers may not normally deal with day to day. They seem to be learning a process. As we get kids who have been in the system longer, these questions are more frequent. They know that if they don't master something, there's a corrective process. They know that if they do master something, then they have an opportunity for enrichment. They have developed a new style of learning."

How Are Students Graded? It is district policy that students do not receive failing grades. Mastery is set at 80 percent; if performance is below 80 percent, students are issued an incomplete for that unit or grading period. According to the middle school principal, an incomplete means "that a youngster has not completed something that needs to be completed and will not receive a grade until that piece of work is completed." While it varies from teacher to teacher, the policy seems to be that even one incomplete on a learning unit will be reason for an incomplete on the ten-week report card.

At the elementary level, report cards reflect letter grades, not numerical grades. Students receive a rating of either M for mastery, NM for nonmastery, or I for incomplete. There are also fifteen academic qualifying statements teachers can use to embellish the grades. Examples of these evaluative statements are "Works well on own—a self directed learner," "Consistently attains high test scores," "Often needs reteaching and retesting," "Chooses to do more challenging activities," and "Often does work carelessly." At the middle and high school level, all grades are numeric.

Organizational Arrangements

ODDM requires, first and foremost, a strong commitment on the part of a district to support school improvement. Thus, a major factor contributing to Johnson City's success has been the leadership provided first by Jack Champlin and Albert Mamary from 1971 to 1982, and then Albert Mamary and Larry Rowe from 1982 to the present. The administration has been supportive of all work consistent with ODDM. For example, staff development is conducted on school time, which improves staff morale. As Mrs. Cole said, "It's saying that we are putting our money where our mouth is, that we think it important enough to provide time for the training."

Moreover, the administration actively encourages the faculty to experiment and explore. As Larry Rowe noted, "An intelligent leader never allows people to get together who are going to share ignorance. It's the leader's responsibility to set up the conditions for people to become aware and develop the need to change."

Another organizational factor that has contributed to the program's success has been the low teacher turnover in the district. This has allowed for a consistency in instructional process not available in many other districts. It has also allowed teachers to become proficient in areas outside of mastery learning since the district has not had to expend staff development energy maintaining the mastery skill level of its faculty. Consequently, a consistent, collective knowledge has accumulated in the district.

Still another factor has been the success teachers have experienced because of their mastery learning skills. Teachers have been able to hone their mastery learning skills to a point where they are experiencing a great deal of success. The middle school principal summarized this idea when he said, "I think outcomes-based education in this district has made our teachers feel that not only what they do is successful and works for kids, but that they're good classroom teachers because of all their own learning." That sentiment was echoed by another teacher, "It's a system that once you understand it and see it working, you can't find one better. There is no other approach I can imagine that could achieve more in what my goal is as a good teacher."

Summary: Long-Term School Improvement

Johnson City Central Schools have probably been involved with mastery learning ideas as long or longer than any other school district in the country. Because of their protracted success, Johnson City has been host to literally thousands of educators in the last ten years. They have received about 300 visitors in the past two years alone, not counting conference participants.

Yet despite their reputed reforms, their instructional practice remains fairly traditional. Apart from the teaming arrangements in the elementary and middle schools, there are no elaborate curricular or instructional management systems in place. Instructional practice looks much like practices in other districts.

What Johnson City does have is widespread adherence to a belief system. In its simplest terms, this belief system is enacted in classrooms through the rule of "give students a second chance to learn if they are willing to accept the responsibility." It is this additional opportunity for students that carries instruction beyond its traditional practice—and that is, by the way, difficult to observe in action. Indeed, the institutionalization of mastery learning ideas in Johnson City is what makes it unique among the many districts and schools that are using or have used mastery learning.

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Red Bank Public Schools: Increasing Test Scores Through Whole-Class Mastery Learning

Introduction

A great deal of attention has been devoted to mastery learning since Benjamin Bloom wrote the first contemporary paper on mastery learning in 1968. The popularity of Bloom's "Learning for Mastery" approach has emanated, in large part, from reports of mastery learning effectiveness (for example, see Block and Burns, 1977; Bloom, 1986; Burns, 1979; Guskey and Gates, 1986). While the reports vary as to just how effective mastery learning is, all agree that mastery learning instructional models can improve student learning.

In Red Bank, New Jersey, a mastery learning program has been implemented in the district's two schools. In a district where many of the students come from disadvantaged backgrounds, mastery learning has been a major factor in improving standardized test scores from below grade level to above grade level. Since the 1979–80 school year, when the program was first implemented in reading, language arts, and mathematics, test scores on the Metropolitan Achievement Test have risen slowly but steadily (see Table 1).

Red Bank teachers follow a teach–formative test–reteach–extend–mastery instructional model using teacher-paced, whole-class instruction. As a class, students proceed through preplanned learning units in each subject area. Once the initial teaching is finished, the formative test is administered. The formative test does not count toward students' grades; rather, the test provides teachers with a standard way of ascertaining whether students can demonstrate success on the unit's objective. On the basis of the formative assessment, enrichment activities are provided for those who have mastered the material, and corrective activities are prescribed for those students not demonstrating mastery. A mastery test is administered to all students at the end of the unit in order to certify learning. Special sessions with remedial teachers or additional work are provided for those students not mastering the material the second time.

In this mastery learning approach, which closely follows that of Block and Anderson (1975), instruction is individualized only when necessary, during the corrective phase following formative

Table 1

Average Total Grade-Equivalent Scores on the MAT for 1980 and 1986

GRADE	NORM	YEAR	
		1980	1986
1	1.8	1.7	2.4
2	2.8	2.8	3.9
3	3.8	4.0	4.5
4	4.8	5.0	6.4
5	5.8	6.1	6.7
6	6.8	7.2	7.8
7	7.8	8.1	8.5
8	8.8	8.8	10.2

Note: MAT = Metropolitan Achievement Test

This case study was written by David Squires and Robert Burns.

testing. This corrective phase is the heart of mastery learning. Instruction is individualized by providing additional instructional time for nonmasters and allowing faster students to complete enrichment activities. During the initial instruction, however, the typical whole-group teaching techniques are used, even in reading and mathematics.

Providing teachers with the skills necessary to develop mastery learning classrooms and maintain mastery learning curricula requires considerable investment of time. How the mastery learning program is managed and maintained at Red Bank is the subject of this site report.

Program Implementation

Setting

Red Bank, New Jersey, a prekindergarten to eighth grade school district with two schools, serves about 850 students with 70 certified staff. A coastal community of 16,000 in central New Jersey, Red Bank is about an hour and a half commuting distance from New York City. The primary school serves students who are three years old through grade four in self-contained classrooms. The middle school has self-contained classrooms for grades five and six, and a departmentalized structure for grades seven and eight. Sixty-five percent of the students are black, thirty percent white, and five percent Hispanic or Asian. Forty-five percent of the students are on free or reduced lunch programs.

Implementation History

Red Bank's interest in mastery learning began in 1978 after Superintendent Joan D. Abrams heard a speech on mastery learning by Benjamin Bloom. Dr. Abrams, then superintendent in Red Bank for five years, felt it was time to focus attention on the task of raising student test scores, which were averaging below grade level. After site visits by school board members and the superintendent to Denver and Chicago, the board decided to adopt mastery learning for the 1979–80 school year. A mastery learning consultant was hired to provide teachers with approximately 12 days of inservice during the year with additional sessions for administrators. By the end of the 1979–80 school year, all regular classroom teachers had constructed and taught a learning unit in either reading or math using the mastery learning model described previously. During the 1980–81 school year, teachers were required to teach all objectives in reading, language arts, and mathematics using the mastery learning model. This implementation schedule was too ambitious and created tension and animosity among teachers, although some of the feelings may also have been generated because district-wide objectives or a prescribed instructional model had previously never been specified for any subject or grade level. Indeed, an implicit but critical assumption of mastery learning is that teachers are accountable for a defined curriculum and a specific way of organizing instruction. Implementing mastery learning procedures concurrently in three subjects at all grade levels changed district practices dramatically.

Prior to 1979, teachers taught whatever they felt was appropriate. There was no district-wide curriculum in any subject, no one person responsible for curriculum coordination or articulation, and no single textbook series in any subject area. Put simply, there was no structure to the schools' curricula. Thus, for teachers to be held to a specific set of objectives to be taught during a set period of time using a "new" approach to instruction significantly changed the norms of the organization and, in hindsight, created a predictable amount of teacher resistance. The teachers' association filed a series of grievances to block further implementation of mastery learning. The most important case went to the Commissioner of Education in New Jersey and dealt with the right of the school board to determine curriculum versus teachers' right to academic freedom. The Commissioner upheld the school board's right to determine the curriculum for the district. Over the past few years, most teachers in the district have become comfortable with the mastery learning program. Many factors led to this change of attitude: teachers became more familiar with mastery learning procedures; teachers became more involved in planning and revising the mastery learning units and the curriculum; district practices that encompassed mastery learning became part of the everyday life of the organization; written curriculum and evaluation documents provided a focused direction; the school board supported continued implementation despite initial problems; a curriculum director was hired to monitor the program; and early success with increasing test scores provided tangible evidence that the program was working. All these factors helped win over initial resistance by many Red Bank teachers to mastery learning.

Program Description

Philosophy

"All children can master the curriculum of the school," summarizes the district's educational philosophy and mission. The purpose of schools is not to sort students but to foster their development. Education is approached with the attitude of "what makes schools work, how can we make them work better, and how can we get all children to learn well?"

This philosophy is put into practice by attending to two fundamental variables, instructional time and prerequisite skills. By teachers making the best use of instructional time through the teach— formative test—reteach—extend—mastery test model of instruction, students not learning the first time get a second opportunity to learn. This helps teachers assure students have the prerequisite skills for future learning. Thus, not only do students get a second chance to learn, but teachers get a second chance to teach.

Curriculum

What Curriculum Is Taught? Mastery learning unit objectives have been developed in all subject areas across all grade levels (see "A History of Curriculum Development in Red Bank"). In Red Bank, unlike many school districts, the curriculum is not determined primarily through textbook adoptions. Rather, the curriculum is summarized in "Unit Objectives" for each subject area and each grade level. The unit objectives focus instruction over a several week period, with textbooks, workbooks, and other instructional activities and materials supporting the unit objectives. A seventh grade teacher, for example, uses three different basal texts, one for coverage of basic math concepts, one for pre-algebra concepts, and the last one for geometry.

In Red Bank, unlike many school districts, the curriculum is not determined primarily through textbook adoptions.

How Is the Curriculum Structured? The curriculum for reading, language arts, mathematics, science, social studies, and other subjects is organized in learning units, a set of units forming a course of study guided by a subject area rationale. Each of these components—learning units, courses of study, and subject area rationales—is discussed below.

The Learning Unit. The learning unit is the building block of the curriculum. A learning unit consists of a series of lessons of 30—60 minutes in length covering two to four weeks of material. A learning unit generally has a topic title and is followed by a unit objective stated in a sentence or two (see "Some Learning Units in Third Grade Reading"). Learning units can also be thought of as a chapters in a textbook or what happens between major grades in a teacher's grade book. This unit definition is convenient as teachers already think about and structure their instruction in similar terms.

Teachers have developed a guide to writing units called "Unit Specifications." The guide defines each step in the instructional model (to be described shortly) and provides a suggested format for recording instructional activities appropriate for each step of the model. Each unit, when written according to the unit specifications, provides a teacher's edition to guide instruction during the unit.

One benefit of the learning unit organization is that lesson planning is simplified because instructional activities are included in the unit guide. For example, teachers might write in their plan book: "Monday—Main Idea Unit, Guided Practice Activities 2 and 3." The activities and copies of instructional materials are included in the unit. Copies of each unit are kept by the teacher using the unit, while a file copy maintained by the curriculum director assures a complete document, year to year.

Learning units are working documents that are continually being refined. If there are five subject areas per grade level, 15 units per subject area, and eight grade levels, then the district curriculum contains 600 mastery learning units. With each unit update occurring every five years, then 120 units need annual revision. If one unit takes 20 hours to revise, the district needs 2,400 hours to maintain the curriculum in good repair.

This yearly updating keeps the units fresh and flexible as the written curriculum gradually reflects teachers' increased awareness of subject matter structure, instructional techniques, their own intuitive notion of mastery, and students' increased competence in prerequisite skills. For example, a first grade unit on shapes and colors is no longer used as students are now mastering this content in kindergarten. As students' mastery of prerequisite skills increases, units are modified or upgraded yearly.

In the fall, teachers receive the unit objectives, meeting in grade level groups to determine approximately when each unit will be finished. This calendar is recorded and kept on file in the central office. As teachers finish a unit, student performance information on formative and mastery tests is recorded. In the spring, grade level groups can revise, delete, or define unit objectives in all subject areas, providing changes are consistent with district standards, provide for an appropriate scope and sequence across grade levels, and achieve consensus at that grade level.

The unit objectives have become increasingly complex and difficult as students enter each successive grade level having mastered more prerequisite skills. Over the last three years, for example, seventh and eighth grade math courses have been upgraded to include beginning algebra concepts in at least four units, where there had been no units previously. Standardized tests have also influenced

A History of Curriculum Development at Red Bank

1979	Initial teacher staff development in mastery learning.
1980	Implementation of learning units in reading, language arts, and mathematics. Initial curriculum supervisor hired.
1981	New curriculum supervisor organizes structure for curriculum development efforts. Refined classroom observation form.
1982	Developed subject area rationales in reading, language arts, and math. Developed science rationale and objectives. Implemented student mastery management system.
1983	Developed social studies rationale and objectives. Wrote unit specifications pamphlet. Developed art rationale and objectives.
1984	Developed industrial arts and home economics rationale and objectives. Developed physical education and health rationale and objectives. Developed early childhood rationale and objectives. Developed algebra objectives. Developed library rationale and objectives.
1985	Developed Spanish rationale and objectives. Board funded summer curriculum development work by 15 teachers. Developed English as a second language rationale and objectives.
1986	Enlisted 40 teachers for second summer of curriculum development. Revised early childhood report card. Revised unit specifications booklet to include parent activities.

the yearly review of unit objectives. Test results are scrutinized for patterns of student achievement that may suggest the need for unit revision. For example, if third grade students don't score well in geometry and measurement, then teachers would review the appropriate units and suggest changes. The curriculum director provides the quality control function by helping teachers discuss issues and reach consensus before formally approving changes. Once agreed upon, the revised units guide instruction for the coming year. During the summer, grade level recommendations receive priority for unit revision.

Courses of Study. A course of study encompasses the ten to twenty units and their objectives for each of the eight grade levels. Teachers pay close attention to when each unit is taught so all students will complete the curriculum by the end of the year. Teachers are required to report, through the principal, to the central office when each learning unit is completed. Completion of the curriculum ensures that all students have the prerequisite skills for the next grade level.

Courses of study can also be examined across grade levels, to insure curriculum continuity as students learn more complex topics in a subject. For example, Table 2 provides the learning unit sequence for the topic of main idea in reading.

Subject Rationales. Learning units and their objectives need to be generated according to publicly held standards. In Red Bank, the subject rationales do exactly this by answering the questions "What do we teach?" "Why do we teach it?" and "How much time do we spend teaching it?" Subject rationales outline the major content areas appropriate for the subject, justifying the choice of content with expert advice and supporting the justifications with available research (Squires, 1984).

Subject rationales represent an overlap of content, concepts and skills in district instructional materials (such as textbooks), standardized tests, content area expert's structures and recommendations, district assessment measures, a child's developmental level, and community expectations (see Figure 1). Most importantly, district standards should approximate the best thinking from teachers explaining their own intuitive notion of mastery for particular subject areas.

Some Learning Units in Third Grade Reading

Unit I Recalling Sequence R3.01 We will use comprehension skills when completing unfinished stories using sequence clues. We will read stories and practice recalling.

Unit II Noting Important Details R3.02 We will practice comprehension when identifying and recalling the important details of stories and nonfiction. We will compose a paragraph, including examples of important details.

Unit III Main Idea R3.03 We will practice comprehension when identifying the main idea of stories and nonfiction articles when stated and inferred. We will summarize the main ideas in stories and books orally and in writing.

Unit IV Reality and Fantasy R3.04 We will use comprehension skills when distinguishing between real and make-believe when reading stories. We will compose examples of each type.

Unit V Character Analysis R3.05 We will practice comprehension skills by interpreting a character's emotion in stories and plays. We will write a paragraph to illustrate the motives of a certain character from one of the stories we read.

Unit VI Cause and Effect R3.06 We will use comprehension skills to determine cause and effect relationships when reading stories. We will compose stories showing real or imagined cause and effect events.

Unit VII Interpreting Events and Drawing Conclusions R3.07 We will use the clues given in stories to interpret and draw conclusions about the unstated information in a story. We will complete unfinished stories by using inference skills to interpret events and draw conclusions.

Unit VIII The Play Form R3.08 We will recognize the play form by reading plays orally with attention to stage directions. We will practice role playing in order to compose and perform at a school assembly.

Unit IX Biography and Autobiography R3.09 We will recognize biographical and autobiographical literature and distinguish between the two. We will compose a biographical sketch of a famous person.

Unit X Nonfiction R3.10 We will recognize nonfiction literature as being about real people and events, or as giving information, by reading samples of nonfiction. We will write a paragraph about a real event.

Unit XI Fairy Tales R3.11 We will recognize fairy tales by identifying their qualities (faraway lands, indefinite time in the past, rescue or challenge, magical creatures or events, happy endings) when reading stories. We will write fairy tales.

Unit XII Poetry R3.12 We will recognize poetry as a form of literature which tells about one certain feeling or thing by reading poems. We will distinguish between poetry and prose by noticing line arrangement, rhythm and rhyme. We will write an original poem.

Unit XIII Labeling Types of Literature R3.13 We will recognize and name plays, biography, autobiography, nonfiction articles, fairy tales and poetry when presented without labels.

For example, in order to develop the reading/language arts rationale, a curriculum committee proposed seven content areas which defined excellence in reading and language arts: reading; literature; writing; listening and speaking; rhetoric, logic and thinking skills; media production and analysis; and study skills. The committee wrote a justification of each area, citing research and experts' opinions to illustrate the content's importance. The subject rationales provide a way to judge the balance within a particular curriculum and to index objectives to see that all standards have been actually addressed in instructional units. New Jersey, for example, recently mandated a high school proficiency test that required a writing sample. Rather than create a new composition program, teachers reexamined the reading/language arts rationale and learning units that included writing and recommended changes in learning units in several subject areas.

The subject rationales are expected to have a lifespan of ten years. The overall structure of subjects change slowly and research results accumulate at a similarly gradual pace. Individual learning units, on the other hand, may change on a yearly basis as long as they are aligned to the subject area rationales.

How Are Students Placed in the Curriculum? Students are assigned to grade levels by age. Classes are intentionally heterogeneous, based on the idea that students learn best in mixed groups. Ability grouping, which tends to institutionalize low expectations for some while not measurably helping the more able, is avoided (Oakes, 1985).

Table 2

Main Idea Sequence of Learning Units Across Grade Levels

Grade	Learning Unit
1	We will practice comprehension skills by recalling details and identifying the main idea in a story.
2	We will identify the main idea expressed in a paragraph.
3	We will practice comprehension when identifying the main idea of stories and nonfiction articles when stated and inferred. We will summarize the main ideas in stories and books orally and in writing.
4	We will practice comprehension skills in identifying details and main ideas in paragraphs, stories, articles, and the novel *The Wacky World of Alvin Fernald*. We will practice comprehension by applying skimming/scanning techniques, reviewing sequencing skills and by writing summaries based on the novel *The Summer of the Swans*.
5	We will recognize the main idea and supporting details in stories and paragraphs, and construct and edit a paragraph where the details support the main ideas.
6	We will analyze, select, and write the best summary of a reading passage from the book, *Island of the Blue Dolphins* justifying the choice from the passage's supporting details. We will write and edit an expository paragraph where the details support the main idea.
7	We will learn to skim and scan nonfiction articles using the SQ3R approach to recognize the main idea and to read for important details. We will produce written summaries.
8	We will analyze, summarize, and create the plot of a story. We will explain the author's point of view in stories and novels and create, write, and edit a classroom book of stories from different points of view.

Instruction

How Are Students Organized for Instruction? Students learn in self-contained classrooms. Instruction is teacher-paced, with a strong emphasis on teacher-directed, whole-class lessons. Thus, all students receive the same instruction as a class until the formative test. After the formative test, instruction is more individualized and students are grouped according to whether they require additional instruction or are ready for enrichment activities.

How Are Students Taught? All learning units are taught using the mastery learning instructional model. An outline of the model is provided in Figure 2. A fundamental feature of this approach to instruction is that students are provided with two chances to understand the unit's objectives.

The mastery learning model outlined in the figure is for a fifteen-day unit. The first two weeks are group instruction, with characteristic lesson activities. The initial group instruction culminates in a formative assessment on day ten. Following the formative assessment, grouping is required to provide students with additional instruction or enrichment activities. If students don't pass the formative test, corrective activities using different materials and techniques are provided. Students who demonstrate understanding on the formative assessment move on to activities usually reserved for "gifted" students. Because groups are formed on the basis of a formative assessment, the groups remain flexible and based on need, rather than on less precise, and more global, measures of student achievement or ability.

Reteaching and enrichment activities, the individualized portion of the unit, lasts four days, as shown in the figure. Following this phase of instruction, all students take the mastery test together. Results are recorded and all students in the class move on to the next unit of instruction. If some students do not pass the mastery test, they receive additional instruction from remedial teachers on a pull-out or in-class basis. (The remedial instructors are funded primarily through Chapter I or State Compensatory Education programs.)

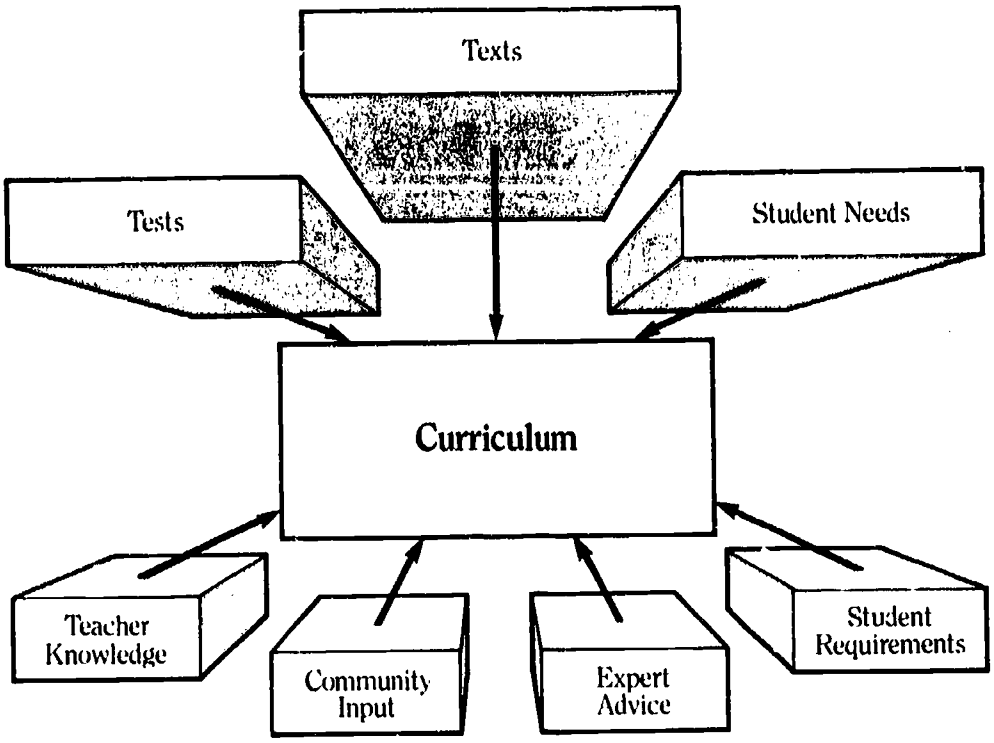
Overall, then, the instructional model provides time and opportunity for all students to master each unit of the curriculum. Because students move through the curriculum units as a class, they avoid the disruption of constantly restructuring groups and are provided with a stable environment in which the teacher and students know each other well.

What does mastery learning look like when implemented in a classroom in Red Bank? In each classroom there is a chart listing the steps of the instructional model. At the beginning of the year, teachers review the chart with students. As teachers use the vocabulary—input, guided practice, formative test—students learn how to learn. For current units, objectives are also posted around the room to remind students and teachers about the focus of learning. Students can routinely answer the question, "What are you learning today?" by restating the displayed objective in their own words. Teachers use the unit guide to help plan and direct their instruction.

Whole class instruction characterizes initial instruction, even in reading. Teachers are at the front of the classrooms directing discussions, demonstrations, and other activities. Grouping is evident

Figure 1

Influences on Curriculum



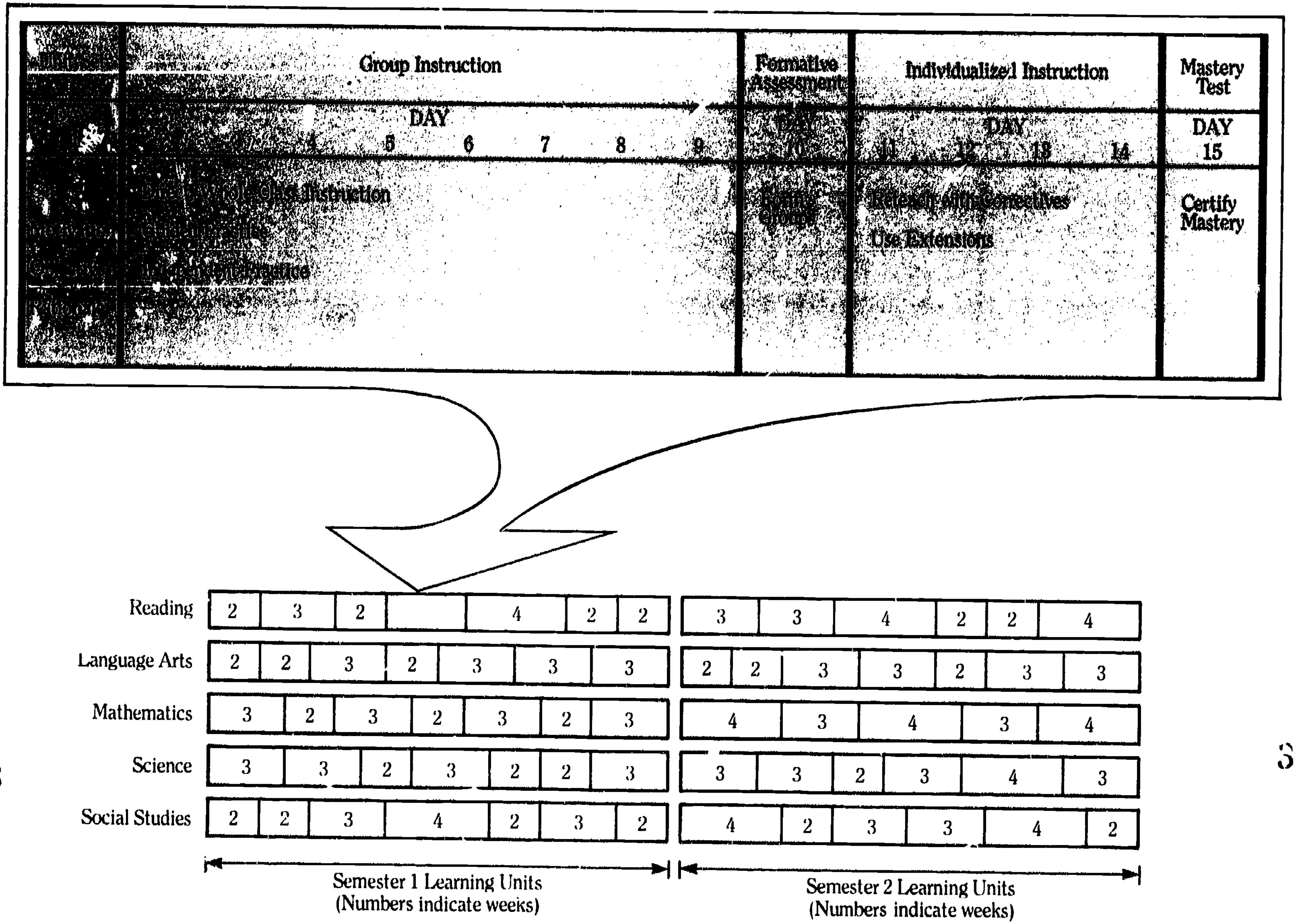
when the class has progressed past the formative test. During instruction in reading/language arts or math, the Chapter I (remedial basic skills) teacher may be in the classroom working with the students needing correctives while the classroom teacher directs the students participating in extension activities.

Assessment

How Are Students Advanced in the Program? Classroom teachers are the first to use the results of the formative and mastery tests to make decisions about grouping and remediation. For example, if few students passed the formative test, teachers may decide to review instruction used during input or the content or the format of the formative test to determine ways in which students can be more successful. Teachers might also check to see that their assumptions about necessary prerequisite skills were realized in previous units or grade levels.

Teachers also report their mastery test results to the principal. The principal reviews the results, checking to see that teachers are not falling too far behind, summarizing the results across subject areas and teachers, and reporting the findings to the central office in a regular monthly report. Principals are held accountable by the superintendent for teachers' progress through the curriculum.

Figure 2
Red Bank's Mastery Learning Instructional Model



How Is Student Progress Monitored? Formative and mastery tests are designed by teachers and reviewed by other grade level teachers before the tests are used. The tests generally reflect teachers' intuitive notion of mastery, and are used to confirm the teachers' judgment that students have mastered unit objectives.

How Are Students Graded? Students are graded on a combination of class assignments, homework, reports, and mastery tests (formative assessments are not graded). Teachers assign letter grades in each subject area based mainly on mastery test results. Included with the report card is a sheet that lists the unit titles for reading, language arts, and mathematics for the entire school year. Although numerical scores had been included in the report card for each unit in the past, this was time consuming for teachers, and parents did not find the information of significant value. Consequently, numerical scores are no longer provided.

Organizational Arrangements

Red Bank offers a model of a connected curriculum in which unit objectives are tied to the time needed for mastery and to district standards which assure curriculum balance. This connected curriculum works because of the support provided by the organization.

Increased coordination requires more organizational support. When mastery learning began in 1979–80, the school board created a new position, supervisor of curriculum and staff development, which was also responsible for funded programs and affirmative action. In addition, there was one teacher from each school who was released full time to assist the principal in implementing and coordinating the new program.

School schedules had to be arranged so that all teachers on a grade level were released for their planning period at the same time. This allows grade level teachers to meet and plan for upcoming instruction and reach consensus on instructional materials and strategies incorporated in the units.

Classroom observation forms have also been revised to support mastery learning. On one part of the observation form, the principal records evidence of mastery learning—posted objectives, use of the unit guide, and use of the vocabulary of the instructional model with students. Teacher evaluation procedures monitor whether teachers turned in the calendar of grade level objectives, assessed students using formative and mastery tests, and completed the grade level units by the end of the year.

School schedules had to be arranged so that all teachers on a grade level were released for their planning period at the same time.

Job descriptions were revised to use the terminology of mastery learning and emphasize aspects of teacher and administrators' positions that would improve student achievement. The superintendent implemented a management by objectives system for administrators which provided accountability for program implementation. Each administrator designed a series of goals to support teachers in implementing mastery learning. A portion of administrative raises was determined by accomplishing these goals. The school board also held the superintendent responsible for attaining mutually agreed on goals for the school system as a whole. The school board also supported mastery learning by allocating money for unit development and staff development to produce units and upgrade teaching skills. For example, during 1986, $14,000 was allocated for summer unit development work, with over 40 out of 70 staff members participating.

Teacher-school board agreements were configured to support curriculum efforts. For example, the teachers' association and the school board agreed on an hourly salary that teachers would receive for writing units and performing other program development functions. This was accomplished without having to negotiate a job description and a salary for each individual task. Consequently, teachers are being remunerated for spending more time on program development activities.

Program Results

We suggested at the beginning of this site report that mastery learning had been one of the factors affecting rising test scores in Red Bank. Here we will present more detailed test score data over the past eleven years for the subtest scores on the Metropolitan Achievement Test in reading and mathematics. Scores are presented in Table 3 for each of the eight grade levels for five years prior to mastery learning and the six years since the first mastery learning work began (see "Interpreting Grade-Equivalent Scores").

One comparison of interest is between 1979 and 1986, before and after the mastery learning program started. In reading, students were below grade level at all grade levels except grade seven in 1979. In 1986, they were above grade level in all grade levels except grade three. In addition, all 1986 scores are above all 1979 scores. In mathematics, a similar pattern is seen. It is clear that Red Bank scores have improved virtually across the board, in all eight grade levels and in reading and mathematics. And it is quite likely that the mastery learning program at Red Bank contributed to the rising test scores.

What is less clear is *the extent* to which the mastery learning contributed to the increase in test score performance. It is difficult to answer this question since other factors, like the increased attention education has received in recent years, could have contributed to the higher test scores. One important factor, however, for which there are Red Bank data (see Table 4), is the change in student composition over the years. Influxes of economically disadvantaged or advantaged students can have dramatic effects on a school's test scores since economic background is moderately related to test score performance.

In Red Bank, there has been about a ten percent drop in the white population and a ten percent increase in the Black population. Since many Black students historically have come from more economically disadvantaged backgrounds than whites in Red Bank, the rising test scores appear to have occurred despite changes in student composition. If anything, the increase in economically disadvantaged students over the same period that test scores have been increasing makes a good case for the potency of mastery learning.

Thus, Red Bank students appear to have benefited from the mastery learning program. They are now demonstrating above average test score performance where they were demonstrating below average performance prior to mastery learning.

Interpreting Grade-Equivalent Scores

Grade-equivalent scores are often interpreted incorrectly. Consequently, a word of caution is in order.

From a psychometric point of view, grade-equivalent scores form a poor metric for reporting student achievement. Despite their apparent simplicity, there are problems with these scores. For example, they cannot be added or subtracted. While tempting to do so, the results are not meaningful. To understand why this is the case, we must describe what information grade-equivalent scores contain.

A grade equivalent score for a student on some test is based on how that score compares to other students' scores in some identified norm group who also took the test. A grade-equivalent score of 4.2, for example, is assigned to all students who had the same raw score on the test as the average student in the second month of the fourth grade in the norm group. Since the differences between grade equivalent scores are arbitrary, being based simply on how the norm group performed, it is not legitimate to add or subtract them; the units between scores are not equal. This problem is compounded as we move between grade levels and different tests and norm groups must be used.

Having said all this, it is still true that higher grade equivalent scores do indicate better test score performance; we just do not know how much better. We suggest that the scores in Table 3 be interpreted only as indicators of how well Red Bank students performed as a group, relative to the norm group for the test.

Table 3

Grade-Equivalent Scores in Reading and Math Before and After Mastery Learning

Subject	Grade	Norm	Pre-Mastery Learning					Post-Mastery Learning						
			1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Reading	1	1.8	1.6	1.7	1.5	1.5	1.5	1.7	1.9	2.1	2.1	2.1	2.3	2.2
	2	2.8	2.1	2.2	2.1	2.1	2.1	2.5	2.8	3.2	3.4	3.5	3.3	3.2
	3	3.8	2.6	2.6	2.9	3.0	3.0	3.3	3.5	3.4	3.6	4.1	3.9	3.6
	4	4.8	3.2	3.4	3.4	3.4	3.8	4.0	4.4	4.3	4.8	5.2	5.2	5.9
	5	5.8	4.8	4.8	5.2	4.8	4.8	5.8	6.5	5.5	6.3	6.0	6.1	6.1
	6	6.8	6.4	5.7	5.9	6.0	6.4	7.0	7.2	7.8	8.1	7.4	7.9	8.3
	7	7.8	7.0	7.7	6.7	7.4	8.0	7.5	8.6	8.1	8.5	8.2	8.6	8.2
	8	8.8	8.3	8.0	8.8	8.0	8.3	8.9	9.4	9.6	10.0	10.3	10.2	10.2
Math	1	1.8	2.0	2.0	1.8	2.0	1.8	2.0	2.0	2.3	2.4	2.5	2.7	2.6
	2	2.8	2.7	2.8	3.1	2.9	3.0	3.2	3.5	3.2	4.1	4.2	4.3	4.3
	3	3.8	3.4	3.3	3.7	3.9	4.0	4.5	4.5	5.1	5.7	5.5	5.3	4.5
	4	4.8	4.5	5.0	4.6	4.4	4.6	5.5	5.4	5.1	6.0	6.2	5.9	6.0
	5	5.8	5.0	6.3	6.3	5.7	5.7	6.1	6.5	6.2	6.2	6.4	6.2	6.8
	6	6.8	6.6	7.0	7.0	7.6	7.3	7.4	7.5	8.1	7.5	7.5	8.2	7.7
	7	7.8	7.4	7.9	7.8	8.4	8.6	9.2	8.7	7.7	9.4	9.3	9.0	8.5
	8	8.8	9.3	8.0	9.5	9.0	9.9	9.0	10.4	9.6	11.6	12.2	12.9	11.5

Note: 1975-1979 used 1970 Edition of MAT; 1980-1986 used 1978 Edition of MAT. Pre-1980 scores have been converted to 1978 norms.

Table 4

Student Composition in Red Bank by Ethnic Group (in percentages)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
White	39	39	35	36	35	33	32	32	32	30	27
Black	51	52	57	58	57	59	59	58	57	60	62
Hispanic	8	7	6	5	5	6	7	7	9	9	9
Asian	2	2	1	1	2	2	2	2	2	2	2

Note: Percents may not add to 100 due to rounding.

Summary: Mastery Learning and Student Achievement

The Red Bank Public Schools chose to emphasize the mechanics of mastery learning in implementing its program. As a result, their entire curriculum is organized into mastery learning units that revolve around clearly articulated district standards. Teachers are required to teach to mastery in their classrooms, and all students are expected to achieve mastery. Although this current level of program development was not easily attained, the extensive work involved has been critical to Red Bank's success in increasing student achievement.

Red Bank's success can be attributed to their change process, which concentrates on the factors that make a difference in student achievement. In all subjects, teachers focus on how students are taught, what they are taught, and for how long they are taught. The district administration supports that emphasis by expecting everyone's participation in mastery learning. The change process is also supported by a staff development program, whose continuity over the years has allowed teachers and administrators to develop expertise in mastery learning practice. Their work is now paying dividends.

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Mariner High School: Confronting the Difficulties of Mastery Learning and Outcome-Based Education

Introduction

School improvement efforts are difficult even under the best of conditions. Crandall, Eiseman, and Louis (1986, pp. 21–22) suggest that schools "operate in a context of confused priorities, buffeted by political forces and community crosscurrents" which call into question an individual school's capacity for reform. School improvement efforts are "too often aborted, falling victim to administrative turnover, reassignment of trained teachers, or shifting priorities responding to the siren call of tomorrow's hot topic," they write. "The individual school can perhaps be excused if it seems to adopt a defensive posture."

School reform is especially difficult at the secondary level. Larger and more fragmented faculties, often with conflicting goals, make consensus about educational priorities difficult to reach. To implement an instructional program as demanding as mastery learning and outcome-based education at the secondary level requires administrators and teachers to confront and overcome numerous difficulties.

One high school that has done this is Mariner High School in Mukilteo School District No. 6, Everett, Washington. Opening in 1968, Mariner High School has had an 18-year history of innovative practices beginning with its participation in the Model Schools Project of the National Association of Secondary School Principals. Mariner High School is currently one of the few high schools implementing mastery learning and outcome-based education. "We've had a lot of problems doing [mastery learning]," according to Dr. Suzanne Simonson, Mariner's principal, "but it's worth it. We have a good school climate.... I'd want to go to school here, I'll tell you that."

School improvement efforts are "too often aborted, falling victim to administrative turnover, reassignment of trained teachers, or shifting priorities, responding to the siren call of tomorrow's hot topic."

A major feature of the program is its curriculum development. Objectives and criterion-referenced tests are organized into learning units for the majority of courses. This in itself is a major undertaking for a comprehensive high school which offers the wealth of courses that Mariner does.

Another feature of the program is its emphasis on the mastery of those objectives. Students are required to meet learning unit objectives before course credit is awarded, and efforts are extended in a variety of ways to ensure that the student rate of success is high. This includes a learning support center, an advisor-advisee program, an extended day program, and an unusual 15-15-6-week school year organization with the final 6-week mini-term providing flexibility in course scheduling.

A third feature of the program is the diversity of instructional delivery models at Mariner. Each of the three major content divisions of the school—mathematics and science, humanities, and practical vocational—use delivery systems suited to the structure of the subject matter. For example, in some practical vocational courses, student self-pacing and continuous progress delivery models are used. In the humanities, more group discussion and teacher-directed instruction occurs. The principal described the influence subject matter has on instructional delivery, "You can more easily individualize in math, and provide reteaching activities. It is more difficult in English and social studies. You want more interaction between the teacher and students."

Together, these features contribute to a comprehensive high school program different from many other high schools. At the cornerstone of this program are the beliefs shared by the staff that shaped their priorities for school improvement. In the words of Charlotte Danielson, the district curriculum coordinator, "The feel at

Mukilteo School District Policy No. 2113

Student learning objectives shall be the format for describing all curricular offerings. The development, approval, publication and revision of student learning objectives is the responsibility of the District administration.

The student learning objectives are to be published annually.

Inherent in and flowing from these student learning objectives is a system of continuous progress, mastery learning based on these stated learning outcomes with the following components:

1. Publicly determined and stated learning outcomes for all students.
2. Derived from these learning outcomes, a criterion-referenced assessment system which documents, records, reports, and awards credit for student attainment.
3. Derived from these learning outcomes, objectives-based core and alternative curricula.
4. Derived from these learnin, objectives, a systematic process for planning and providing instruction appropriate to each student and for engaging the student until learning outcomes are attained. This systematic process includes:
   a. assessing current student skills/learning for instructional assignment;
   b. analyzing the content of each objective so that instructional strategies match assessment;
   c. when appropriate, sequencing tasks into a hierarchy of learning skills to maximize the effectiveness of instructional delivery;
   d. orienting students to the objective(s) to be learned;
   e. initial teaching to the objective(s) which provides varied approaches, adequate practice time, and multiple opportunities for learning and success;
   f. assessing student mastery of the objective(s) to determine the need for movement to a new instructional objective, extension/enrichment, or correctives;
   g. for those who attain mastery, progressing to the next objective or offering extension/enrichment; and
   h. for those who do not attain mastery, providing correctives, using different teaching strategies, until outcomes are attained.
5. A criterion-referenced information management system at the classroom and building levels for coordinating timely instructional planning, student assessment and placement, instructional delivery, and program evaluation.
6. An evaluation/certification system which allows students to demonstrate and receive credit for improved levels of performance at any time.
7. A program evaluation component which guides instructional planning by comparing the learning outcomes of program graduates with the performance demands of postschool roles.

The district will seek to implement these components in its development of curriculum and instruction.

Mariner is quite different than in many schools. It's that caring is a pervasive attitude. There is a commitment on everybody's part and it's an assumption of responsibility that it's my job as a teacher to help you learn."

This does not mean that the program is a complete mastery learning or outcome-based education. There is still work to be done. According to Simonson, the primary resource needed to maintain and improve the program is time for teachers to continue to make improvements in curriculum and instruction. This release time is essential if teachers are to continue developing the curriculum and working together to solve problems. The principal elaborated on the goals set by her staff:

> *If we wanted to have the program the way we envision it, we'd have the curriculum more fully developed. We'd have a test item bank which would allow for the development of several forms of tests. We also need to provide timely reteaching and relearning opportunities for students by using different materials and methods.*

Program Implementation

When Mariner first opened in 1968, individualized instruction was the innovation of choice. Around the country, continuous progress instructional programs received considerable attention, and management systems that would allow variable rates of learning were popular. Allowing students as much time as they needed to learn was seen as a way to accommodate diversity in learning skills and abilities. Instruction at Mariner was organizedon a continuous progress model. According to the principal, what this concept meant in practice was that, "In all subject areas, teachers handed out packets of materials and then taught students individually."

As the years went by, teachers were unable to adequately solve the problems inherent in trying to coordinate the individual efforts (or lack of effort) of some 1300 students. Eventually these problems led to Mukilteo School District Board of Directors calling for an extensive review of instructional practice. According to the superintendent, Dr. Rodney Hermes, the review started with a survey by educators from outside the district but familiar with Mariner's philosophical base. Several citizen and faculty study committees were also formed. In 1981, as a result of these efforts, the board adopted policies that advocated the philosophy and operating procedures of outcome-based education (from the Network for Outcome-Based Schools). Policies 2000 and 2113 (see Mukilteo School District Policy No. 2113), which established an "outline for excellence," led to the development of a five-year district plan.

The five-year plan included three major projects scheduled for the 1983–84 school year. The thrust of the revision was to move away from instruction based on individual packets to teacher-centered instruction. The three projects were (1) an extensive revision of the K–12 mathematics curriculum that would allow flexible grouping and continuous progress of students; (2) a secondary humanities, language arts, and social studies program that would form instructional groups for basic, core, and challenge students, and (3) a district-wide, computer-based instructional management system to track student progress. In addition, graduation requirements at Mariner High School were upgraded and advanced academic endorsement opportunities were created for students. This meant that advanced study in all required subjects as well as computer studies and fine arts were available.

Initially, the implementation of the projects caused a great deal of turmoil in the district. A local newspaper, the *Seattle Times*, outlined some of the problems in a July 25, 1984 article. The newspaper reported that "Wholesale changes in philosophy and approach have rocked the

Mukilteo School District and angered parents, teachers and students. A totally new lineup was introduced to the community at the start of the 1983–84 school year. Included was a mastery learning program, a computerized grading system, stiffer graduation requirements and a new student discipline system." The major complaint was that the district was "moving too fast, too soon—that the programs should be phased in gradually instead of starting them all at once."

District and school personnel suggested, in hindsight, that had there been further staff development to demystify mastery learning, more people would have developed the philosophical commitment to carry it out. Inservice activities were seen as critical to building the foundation for mastery learning. "People have to have a belief system to start with, and a lot of people don't believe that all students are capable of learning," commented one administrator. Another stated, "Teachers must develop ownership and a belief system that all kids can learn and that they can teach all kids to mastery."

Had there been further staff development to demystify mastery learning, more people would have developed the philosophical commitment to carry it out.

Eventually, the turmoil died down. Dr. Simonson met regularly with her teachers to deal with their concerns about mastery learning, outcome-based education, and all the other changes that had been implemented. "We came up with plans on each of six areas of concern, some of which ended up going to the school board that following summer where we got some things adopted to meet the teachers' needs. It worked out well." The progress guidelines for student work (which are discussed later), for example, was one area where policy was set by the board that helped teachers manage the program.

Program Description

Setting

Housed in a modern, spacious facility complete with indoor swimming pool, Mariner has an experienced teaching faculty of 55 full-time and nine part-time teachers and a support staff (aides, clerks, and secretaries) of 20. There are three administrators (a principal and two assistant principals), a part-time vocational director, three counselors, two learning support faculty, and a librarian.

Currently the school enrolls approximately 1300 students in grades ten to 12. The student population is predominantly white (96%) with a sprinkling of Asian (2.5%) and Black (1.5%) students. Economically, student backgrounds are diverse; 40 percent come from professional families, 40 percent from semi-skilled or unskilled families, and close to 20 percent from families on unemployment benefits.

The school faculty is organized into four divisions—support services, practical vocational, mathematics and science, and humanities—each with a division chairperson to coordinate and schedule the program. The faculty teaches six out of seven periods per day, beginning at 7:30 and ending at 2:10. Teachers also meet twice a week with advisee groups.

The school year is organized into two terms, each 15 weeks in length, and a mini-term at the end of the year lasting six weeks. Each course is divided into units and credit is awarded based on the number of units successfully completed. In most classes, 20 units equals two credits and is accomplished in two terms. During mini-term, five units are completed for 0.5 credits.

Graduation is based on the acquisition of 53 credits in standard subject areas like English, social studies, mathematics, science, and foreign language. The Mariner diploma satisfies the requirements for four or two-year colleges, vocational school, or job entry. An advanced academic endorsement is also available for students pursuing the more challenging curriculum.

Philosophy

Mariner High School is guided by the Mukilteo School District's statement of philosophy. Modified most recently in 1981, it adopts the philosophy statement developed by the Network for Outcome-based Schools. The following statements from Mukilteo School Board Policy No. 2000 form the framework within which the instructional programs at Mariner operate:

1) Almost all students are capable of achieving excellence in learning the essentials of formal schooling;
2) Success influences self-concept; self-concept influences learning and behavior.
3) The instructional process can be changed to improve learning.
4) Schools can maximize the learning conditions for all students by

   a. establishing a school climate which continually affirms the worth and diversity of all students;
   b. specifying expected learning outcomes;
   c. expecting that all students experience opportunities for personal success;
   d. ensuring that all students experience opportunities for personal success;
   e. varying the time for learning according to the needs of each student and the complexity of the task;
   f. having staff and students both take responsibility for successful learning outcomes;
   g. determining instructional assignment directly through continuous assessment of student learning; and
   h. certifying educational progress whenever demonstrated mastery is assessed and validated.

Mastery learning, defined at Mariner as "the belief that almost all students can learn, and learn well, under the right conditions," has been adopted by the staff as its *modus operandi*. The essential elements of Mariner's program include establishing learning objectives or outcomes that are measurable for students in every subject area; teaching to these objectives using a variety of activities and resources; reteaching where necessary using different materials and methods; and testing to indicate student mastery of the objectives.

Curriculum

What Curriculum Is Taught? Since 1968, teachers at Mariner have organized the curriculum into objectives. This was the initial step in developing individualized learning packages which formed the bases for instruction. Thus objectives are in place for all subject areas, no small feat when one considers that almost 200 courses are offered during the regular two terms and almost 300 during the mini-term.

In 1981, the school board formally adopted Policy No. 2113, the policy statement that made learning objectives the basic unit for organizing curriculum. This policy statement incorporated many of the operating features of mastery learning and outcome-based education.

Thus objectives are in place for all subject areas, no small feat when one considers that almost 200 courses are offered during the regular two terms and almost 300 during the mini-term.

How Is the Curriculum Structured? Most of the 200 or so courses at Mariner are divided into 20 units, with each unit containing specified objectives and activities to attain the objectives. Course credit is awarded to students on the basis of 0.5 credits for completion of five units. Each unit typically lasts approximately one and a half weeks, and ten units is equivalent to one 15-week semester. Thus, satisfactory mastery of a typical two-semester course would generate two credits.

Within each of the divisions, courses are organized in different ways. In mathematics and science, for example, there are two performance groups. Each course is divided into ten to tw... units and ranges in credit value fr... a two to two and one-half credits. Students are grouped on prerequisite and learning rate needs. In the humanities division, each course is divided into three group—basic, core, and challenge—each with different activities to meet established objectives.

Students with an identified need are assigned to basic courses, where they receive more individual attention and time to complete the work. For example, those students who read below an eighth grade level might be enrolled in a basic group. Students cannot choose to be in the basic group. The core course is where most students enroll. The challenge course is designed for those academically motivated students who desire more depth and challenge. Topics in the challenge group are the same as those in the core group, but are studied at a more advanced level using different materials.

"I've found in four years that at the high school level strict sequencing and movement based on the mastery of a specific sequence is not applicable for all subjects."

Approximately 300 courses are offered during the six-week mini-term at Mariner. Only students who complete their two-semester courses are eligible for new course offerings in mini-term. Students who have not completed their semester courses continue with them during mini-term. This unique segment of the school year fulfills three functions: (1) reinforcement, for students who have not completed 20 units in a required course during the first two terms, they *must* continue working on those units during mini-term; (2) enrichment and continuation, for those students who have completed the required 20 units in their courses and want to take advanced courses in areas of special interest. For example, students may enroll in a class on the comparative history of China; and (3) exploration, for those students who have completed the required 20 units in their courses and want to study new areas of the curriculum. Examples of such courses are backpacking and introduction to LOGO.

How Are Students Placed in the Curriculum? Students are eligible for certain courses based on their grade level designation, the prerequisite courses they have completed, and their progress toward completing the graduation requirements. However, outside of standard course sequences in math and science, there are no rigid curriculum sequences which makes student placement decisions critical. In fact, the principal was quick to point out that course sequences are not as important in some subjects as for others: "I've found in four years that at the high school level strict sequencing and movement based on the mastery of a specific sequence is not applicable for all subjects. The pure master model is much more appropriate at the elementary level where students are exposed to basic skills for the first time."

While not an explicit component of placement, the advisor-advisee program at Mariner provides additional support and advice to students. Every member of the full-time professional staff meets with his or her advisees twice a week t : conduct a number of activities that would typically be performed by homeroom teachers or counselors in other schools, activities such as orientation, course planning, and monitoring of graduation requirements.

The program also strengthens the opportunities for students to establish a significant relationship with an adult. Frequently students with a personal or academic problem will consult their advisor, and advisors often act as advocates for students. Parents are also strong supporters of the program.

The number in each group varies, with no more than 27 students assigned to an advisor. Student-completed questionnaires are used to match incoming tenth graders to teacher advisors. Most students remain with the same advisor throughout their three years at Mariner, although changes are made when requested.

Instruction

How Are Students Organized for Instruction? As in most comprehensive high schools, Mariner students can select from a wide variety of courses. There are college and noncollege courses available, each with their own requirements. However, the mini term, the learning support center, and the extended day program (to be discussed below), allow for more flexibility in the use of instructional time than what occurs in most high schools.

How Are Students Taught? Instruction at Mariner has become more teacher-directed rather than student-centered over the years. Even so, "some of the philosophical premises are the same, like accomodating different learning rates," noted the principal. "We try to structure our school to accomodate individual differences. It's just difficult to do."

Classroom instruction is mainly whole-class and teacher-paced, although teachers are free to use whatever approach they think works best for them. Subject matter also influences the techniques used. For example, there may be more individualized instruction for those students who progress at a faster rate in an accounting class or a mathematics class, whereas this strategy would rarely occur in English.

Learning units are organized to follow a teach-test-reteach cycle. Retesting is done inside and outside of regular class time. In addition, students are expected to assume responsibility for their learning and seek assistance (or reteaching) on their own initiative.

The main source of additional instruction is the Learning Support Center (LSC). Located in the center of the building in the same area as the library and counselors' offices, the LSC plays a predominant role in the success of Mariner's program. According to one teacher, "We couldn't run this system without the LSC."

Approximately 300 students use the LSC daily, which operates before, during, and after the normal school day. Students who initially failed to master a unit receive additional instruction there before taking the retest (within five days). The LSC can also be used by students who missed a unit test because of illness and by some students who are enrolled in study hall and report regularly for assistance.

There is one teacher for humanities and one teacher for math and science, and two aides in the LSC. Both teachers work closely with the teachers in their division. The humanities teacher helps regular classroom teachers by developing study guides and working with students who have been unsuccessful at mastering an objective in the classroom following initial instruction and testing. Similarly, the math teacher does short-term instruction not only with students who failed to master the first time through, but also with advanced students who want to accelerate their learning. Besides teacher assistance, there are some peer tutors and a small bank of computers and appropriate software materials to help with reteaching and retesting students.

The mini-term, the Learning Support Center, and the Extended Day Program allow for more flexibility in the use of instructional time than what occurs in most high schools.

The after school extended day program also provides an additional opportunity for students to make up credits or complete their work. According to *The Natsilane*, the student newspaper, an average of 15 students attend the program from 2:20 to 4:20 in the afternoon. Late buses are provided by the school.

In summary, there are a number of instructional opportunities for students to master their coursework. As one teacher reminded us, "When we say 'you have to learn,' then we need to provide some backup like mini-term." Increasing instructional options has other benefits as well. According to the principal, "There's a much closer relationship between teachers and students. I think that relates to the mastery issues, trying to help kids learn rather than giving information and failing them. All the learning support lets kids know they can get additional help, even beyond their teachers."

Assessment

How Are Students Advanced in the Program? Students are advanced from one grade level to the next based on the

Excerpts from Progress Guidelines for Grades 7–12 (Regulation File No. 2414b)

2. The unit grade will be a percentage grade in the range of 0–100 and will reflect the student's achievement of the objectives within the unit.

3. A 5-unit block grade will be the average of each unit within the block. In addition to a percentage grade, a letter grade will be assigned on the following scale:

4.0	95–100%	A
3.7	90–94%	A– Honors Credit
3.3	87–89%	B+
3.0	84–86%	B
2.7	80–83%	B– Merit Credit
2.3	77–79%	C+
2.0	74–76%	C
1.7	70–73%	C– Satisfactory Credit
1.3	69 %	D+
1.0	68%	D Passing
—	67% and below	F No Credit

4. Class and homework assignments, quizzes, and class participation may be part of the grade if defined in the course syllabus distributed to students during the first week of the course. This will be no more than 25% without specific approval.

7. Within each course, for a period of five school days following unit assessment, and during times will be made available at teacher discretion, a student scoring below 70% may demonstrate through teacher-directed assigned study (i.e., homework, 0 or 8 period, LSC) that he/she is prepared to retake the unit exam. The maximum score on a retake will be 70% unless an alternative form of the exam is available, in which case the student may receive the higher grade.

8. Students in high school English and social studies who do not complete a five unit block of work to at least a 68% level, must redo the entire block. In other courses, students who do not complete a block of work at the 68% level may retake specific units to bring the five unit block to passing level. This is considered reinforcement work and will ordinarily be taken in mini-term or summer school.

11. Enrichment learning is encouraged through the independent completion of enrichment units or independent courses. Credit will be granted for successful completion of such units or courses. Enrichment units or courses will not be permitted to substitute for required course content or required courses.

number of course credits earned. The typical sophomore, junior, and senior designations are followed at Mariner. At the course level, advancement is tied to completion of learning units. Division policies, established by the school board, outline procedures to be taken when students do not master learning units or begin to fall behind the rest of the class.

How Is Student Progress Monitored? Student progress was originally monitored only by scores on the criterion-referenced tests over learning units. Because there were no deadlines, students could take unit tests whenever they pleased and earned credit when they passed the test. "In the individualized model students would learn whenever they were ready and could redo a unit of instruction up to four years later to complete credit," according to the principal. "Well, that doesn't work for teachers." Consequently, new guidelines were written for the 1984–85 school year that required students to complete their work by specific deadlines (see "Progress Guidelines for Grades 7–12"). According to one of the division chairpersons, the progress guidelines have "really made a difference. It's been a major improvement in the program."

These guidelines have important implications for student monitoring. One implication has to do with how credit is earned. For example, in humanities (see guideline number 8), one-half credit blocks of five units must be passed at 68 percent or better or the entire block must be repeated. In mathematics, however, it is possible to earn credit by passing individual units. The only stipulation is that two of the four required credits for graduation be earned by completing one entire two or two and one-half credit course.

The progress guidelines also permit teachers to use assignments other than the criterion-referenced test results to grade students. "In pure mastery, you just teach and test. If they pass the test, they get the credit. Well, teachers have a hard time with that," stated the principal. "High school teachers see discussions, homework assignments, and other classroom activities as important and believe they should be figured into grades. Teachers have found that if this is not done, some students just won't do the work. And they're right." At present, up to 25 percent of a student's final mark in a course may be based on items other than test performance (see guideline 4). Thus, most teachers include class discussion and homework assignments in their determination of student grades.

A third implication of the progress guidelines concerns procedures to follow when students fail a unit test the first time. Students who do not pass the unit test (at least 68 percent) are encouraged to come in for extra help or to use the LSC within the five days allotted for study before the test must be retaken (see guideline 7). If a different form of the test is available, the student receives the highest of the two grades. However, if an alternative form is not available, the same test is retaken but the student is limited to 70 percent as the highest possible score. Thus, most of the relearning and retesting is accomplished outside of regular classroom time.

How Are Students Graded? Progress reports to parents are distributed five times per year. The report card is unique, reflecting the learning unit organization of the curriculum (see Figure 1). The reporting system has also caused problems with some parents and the community because they do not understand the format. Others, however, appreciate the specificity of the report card.

Numerical grades are provided for each of the 20 learning units which have been completed to date. Letter grades, the average of the five units making up each quarter grade, and the credit earned are also provided. In mathematics, the name of each unit attempted is listed and the numerical grade and number of credits earned is given. Other information provided include class absences, total credits earned for the report period, and the cumulative total credits earned while at Mariner.

Before the 1985–86 school year, the grading policy only allowed grades of A, B, C, or X (no credit). These grades were defined as 90–100 percent, 80–89 percent, 70–79 percent, and below 70 percent, respectively. New state administrative codes, however, mandated that all schools use a grading system which includes the D grade and the F grade. The new grading system (see guideline 3) now includes the more typical grading scale, including the use of plusses and minuses. This change has made the reporting system at Mariner more traditional.

Organizational Arrangements

The organizational arrangement at Mariner that is obviously different from most schools is the mini-term. The mini-term provides an enormous amount of flexibility into the scheduling of instructional time. Unfortunately, the continued existence of the mini-term has recently been threatened by new state administrative codes requiring more contact hours than what students currently get in their two 15-week semesters.

Most of the relearning and retesting is accomplished outside of regular classroom time.

A second organizational requirement is that the curriculum be arranged into units and objectives of instruction. This has allowed the grading system to reflect unit performance, and has provided administrative avenues for granting credit during the mini-term. The curriculum organization at Mariner grew out of the learning packages that had been developed earlier when the instructional program was student-paced. This has provided the teachers at Mariner with a significant head start on the curricular work necessary to organize along learning unit lines.

Although not an administrative requirement, a third feature of Mariner that has contributed to the overall program is the organization of the school into divisions rather than departments. Division chairpersons are appointed by the principal, and while they are not formal administrative positions requiring a degree, they do provide release time for two courses and include a stipend. The original intent of the divisions, according to one of the division chairpersons, was to bring the staff closer together and increase communication. While problems still arise, the faculty groups are less fragmented than with departmentalization.

Mukilteo SCHOOL DISTRICT NO. 6

STUDENT PROGRESS REPORT

STUDENT NAME:

SCHOOL:

STUDENT NUMBER:

REPORTING DATE:

PRINCIPAL:

ADVISOR:

SCHOOL PHONE NUMBER

	COURSE/CODE/TEACHER/PERIOD NO.	COURSE/CODE/TEACHER/PERIOD NO.	COURSE/CODE/TEACHER/PERIOD NO.	COURSE/CODE/TEACHER/PERIOD NO.
	☐	☐	☐	☐
UNITS	GRADE / CREDIT — GRADE / CREDIT	GRADE / CREDIT — GRADE / CREDIT	GRADE / CREDIT — GRADE / CREDIT	GRADE / CREDIT — GRADE / CREDIT
UNITS	GRADE / CREDIT — GRADE / CREDIT	GRADE / CREDIT — GRADE / CREDIT	GRADE / CREDIT — GRADE / CREDIT	GRADE / CREDIT — GRADE / CREDIT
	COURSE AVERAGE GRADE — COURSE CREDIT TOTAL	COURSE AVERAGE GRADE — COURSE CREDIT TOTAL	COURSE AVERAGE GRADE — COURSE CREDIT TOTAL	COURSE AVERAGE GRADE — COURSE CREDIT TOTAL
ENRICHMENT UNITS	ENRICHMENT GRADE / CREDIT	ENRICHMENT GRADE / CREDIT	ENRICHMENT GRADE / CREDIT	ENRICHMENT GRADE / CREDIT
	ABSENCES TO DATE	ABSENCES TO DATE	ABSENCES TO DATE	ABSENCES TO DATE
COMMENTS				
	☐	☐	☐	☐
UNITS	GRADE / CREDIT — GRADE / CREDIT	GRADE / CREDIT — GRADE / CREDIT	GRADE / CREDIT — GRADE / CREDIT	GRADE / CREDIT — GRADE / CREDIT
UNITS	GRADE / CREDIT — GRADE / CREDIT	GRADE / CREDIT — GRADE / CREDIT	GRADE / CREDIT — GRADE / CREDIT	GRADE / CREDIT — GRADE / CREDIT
	COURSE AVERAGE GRADE — COURSE CREDIT TOTAL	COURSE AVERAGE GRADE — COURSE CREDIT TOTAL	COURSE AVERAGE GRADE — COURSE CREDIT TOTAL	COURSE AVERAGE GRADE — COURSE CREDIT TOTAL
ENRICHMENT UNITS	ENRICHMENT GRADE / CREDIT	ENRICHMENT GRADE / CREDIT	ENRICHMENT GRADE / CREDIT	ENRICHMENT GRADE / CREDIT
	ABSENCES TO DATE	ABSENCES TO DATE	ABSENCES TO DATE	ABSENCES TO DATE
COMMENTS				

90 - 100% = A = HONORS CREDIT 80 - 89% = B = MERIT CREDIT 70 - 79% = C = SATISFACTORY CREDIT BELOW 70% = X = NO CREDIT CO = CREDIT ONLY NO GRADE GIVEN	CREDITS EARNED CURRENT YEAR TO DATE		GRADE POINT AVERAGE CURRENT YEAR TO DATE	
	CUMULATIVE CREDITS EARNED		CUMULATIVE GRADE POINT AVERAGE	

MATHEMATICS

COURSE/TEACHER/UNIT TITLE	UNIT NO.	Grade	CREDIT

PARENT OR GUARDIAN

HOW TO READ THE PROGRESS REPORT

This progress report explains far more than a conventional grade alone would convey, please read the following explanation carefully

TYPE OF COURSE
Indicates whether course is sequential (S) non-sequential (N), or unit-by-unit (U) Course type determines how credit is awarded

COURSE/CODE/TEACHER/PERIOD NO.
Indicates course, period number and teacher instructing course. Parents are encouraged to contact teacher regarding their child's progress.

UNIT NUMBER
This identifies the number of the unit to which the unit grade applies.

UNIT GRADE
Displays the percentage grade for each unit of instruction (0-100%).

GRADE/5 UNIT AVERAGE
Shows the average percent grade and corresponding letter grade for 5 units. These are transferred to the student's transcript. In unit-by-unit courses no grade will appear in this space.

CREDIT AWARDED
Indicates the credit awarded for completion of units. Most courses require completion of a 5 unit block for award of 0.5 credit.

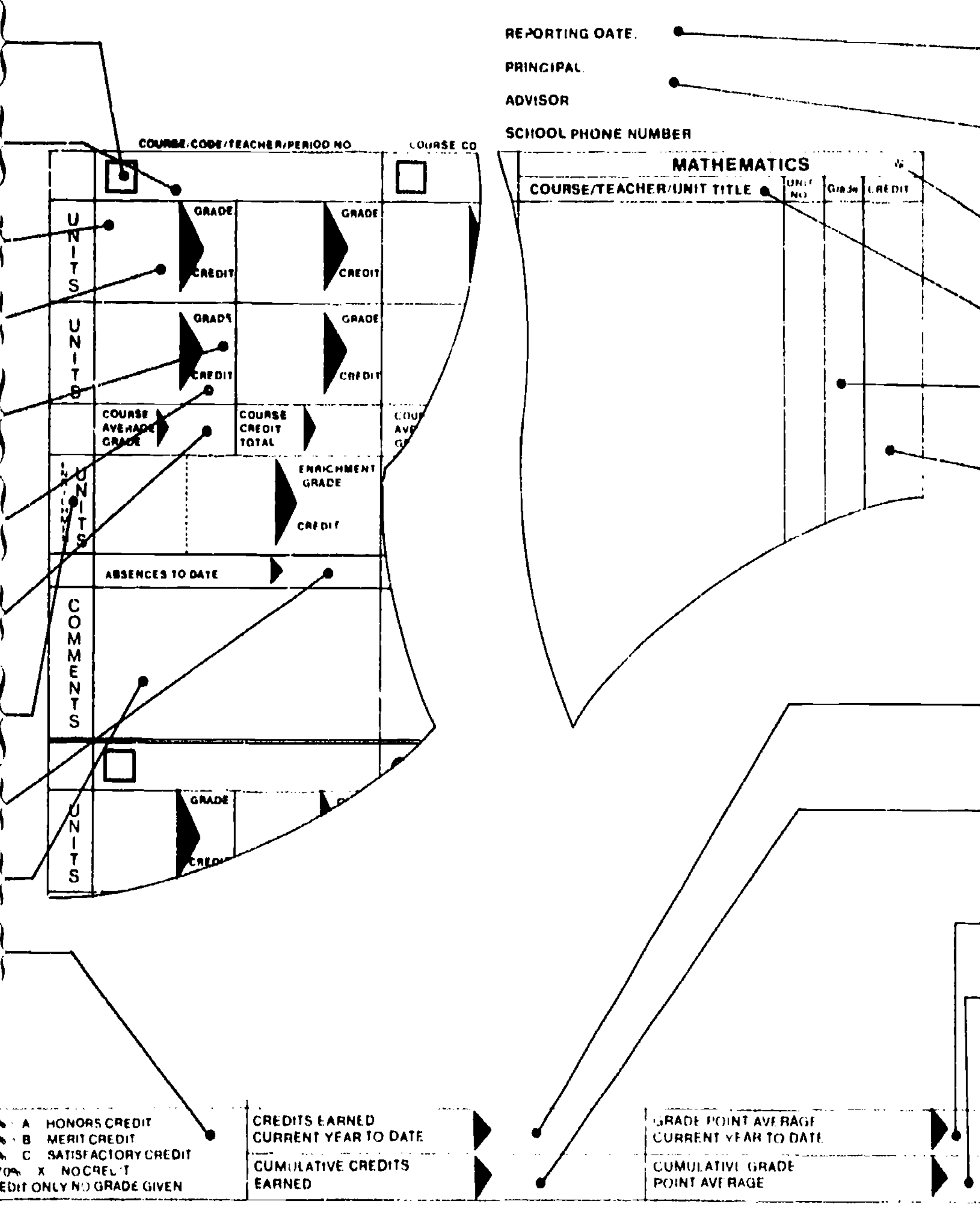
COURSE AVERAGE GRADE
Indicates the percent average and letter grade earned in this course.

ENRICHMENT UNITS
In some courses, enrichment units are offered for additional credit to be applied toward elective graduation requirements. 0.1 credit will be awarded for each enrichment unit mastered.

ABSENCES
This shows absences to date in this course.

COMMENTS
Teacher's comments are listed in this section of the report.

GRADE
This legend indicates the percent grade and the corresponding letter grade.



REPORTING DATE
Shows progress as of date indicated

PRINCIPAL/ADVISOR
You are encouraged to call the principal and/or advisor at the school phone number provided

MATHEMATICS
All math courses including BASIC MATH, ADVANCED MATH and high school ELECTIVE MATHEMATICS are reported in this section

COURSE/TEACHER/UNIT TITLE
This section designates the course, teacher instructing and unit title

GRADE
Indicates the percentage grade for each unit of instruction.

CREDIT
A credit value for each unit is shown here. Credits for math are transferred to the student's transcript for those units mastered

CREDITS EARNED CURRENT YEAR TO DATE
Shows the total number of credits earned current school year

CUMULATIVE CREDIT
Shows the total number of credits earned, to date, counting toward high school graduation. 56 credits are required for graduation. To meet this schedule a student should earn 14 credits each school year.

GRADE POINT AVERAGE
Grade point average for all credits earned during current school year

CUMULATIVE GRADE POINT
Shows the average grade point for all high school credits earned to date.

THIS PROGRESS REPORT REFLECTS STUDENT PROGRESS AS OF THE REPORTING DATE INDICATED. STUDENTS AND PARENTS ARE ENCOURAGED TO CAREFULLY REVIEW THIS REPORT AND CONTACT THE SCHOOL SHOULD ANY QUESTIONS ARISE

Summary: Closing the Gap Between the Ideal and the Practical

We suggested at the beginning of this case study that educational reform was difficult even under the best of conditions. To implement a difficult mastery learning program and attempt to maintain its integrity while still making it work is even more difficult. As the program at Mariner High School has shown, however, the problem is not insurmountable.

A fundamental requirement is the establishment of a long-term plan. "You need to prioritize your efforts," stated Dr. Simonson. "We tried to change everything [at once] and this caused confusion and conflict with teachers. Is curriculum the most important or is it just improving instruction in the classroom? Or is changing the structure of the school most important? You can start in a million different places."

A second requirement is to establish a philosophical foundation by fostering a mastery-oriented belief system. This does not come about simply by writing a mission statement; rather, it is done by teachers confronting their own beliefs about education, schooling, and students, and making deliberate decisions about themselves as educators. Inservice activities that lead teachers and administrators to view education in different ways are important. As described by Simonson,

> *You have to have a belief system in place so you need inservice programs. Before that you have to have the leader with the mission and a vision. Then you have to have the resources to support the people, and you have to be flexible, to know that it doesn't have to be done in one way. There are many ways to implement or to even define outcome-based education. That's not as important as having the people believe what they're doing is making a difference.*

Well-conceived, long-term plans and established belief systems are not always sufficient, even under the best of conditions. The ideal and the practical mastery or outcome-based system may not be one and the same. The vision of what "ought to be" certainly can and should provide the motivation for attempting to bring reality more in line with what is possible. "But it's that balance that is so difficult to obtain," said Simonson, who distinguished between the "pure" mastery system and what has been achieved so far at Mariner. Closing the gap between the ideal and the practical is what school improvement is all about.

References

Crandall, D., Eiseman, J., & Louis, K. (1986). Strategic planning issues that bear on the success of school improvement efforts. *Educational Administration Quarterly, 22,* 21–51.

Johnson Elementary: A Staff Development Approach to Mastery Learning

Introduction

Block and Anderson's (1975) book outlining mastery learning philosophy and practice has greatly contributed to the adoption of mastery learning in schools. Block and Anderson advocate a group-based, teacher-paced approach to mastery learning which requires teachers to reorganize curriculum into learning units of two or three weeks duration. These learning units define instructional objectives; specify appropriate curriculum and suggested teaching techniques; operationalize unit mastery by the construction of nongraded, formative tests and standards; and outline possible enrichment activities for students demonstrating mastery on the formative tests and corrective activities for students not demonstrating mastery.

The teacher implements the learning unit by using the teacher's normal teaching style and suggested activities outlined in the learning unit. Once the learning unit is finished, say after 11 or 12 days of instruction, the formative test is administered. On the basis of the test results, enrichment activities are provided for those who mastered the material. Corrective activities are prescribed for students not demonstrating mastery. A second form of the formative test is then administered to certify mastery for those not mastering the material in the initial allotted time for instruction. In our example, this enrichment and corrective phase might take three or four additional days. Special sessions or additional work are indicated for students not mastering the material the second time.

In this approach to mastery learning, instruction is individualized only during the corrective phase following formative testing. This corrective phase is the heart of mastery learning. Instruction is individualized by providing additional instructional time for non-masters and allowing faster students to complete enrichment activities. During the initial instruction, however, the typical group-based techniques are used.

In this approach to mastery learning, instruction is individualized only during the corrective phase following formative testing. This corrective phase is the heart of mastery learning.

Providing teachers with the skills necessary to develop a mastery learning instructional program requires considerable staff development time. At Johnson Elementary, the subject of this site report, the principal provided weekly inservice sessions to his teachers in mastery learning. The training was extensive enough that Johnson Elementary has been known as a mastery learning school since 1976, the year the staff development work began.

From its inception, the staff development program at Johnson, from all appearances, was successful. A 1980 case study (see Little, 1981, 1982) characterized the school as being extremely successful in implementing mastery learning. Little (1981) wrote in the introduction to her case study:

> *Mastery learning has taken hold at Johnson. There is simply no escaping its presence; it pervades the language of teachers when they talk to each other about improving the performance of non-English-speaking children ("We could do a mastery learning unit . . ."). It pervades the talk of teachers to strangers seeking to understand th_ school: "We apply mastery learning here." It is the basis of the school's recognition in a broader community: during the time of our observations, the school was celebrated in a local television broadcast, was visited by a team of teachers from another state, and the project was mentioned in a New York Times article on mastery learning. Teachers think about and talk about Johnson as a "mastery learning school." (p. 2)*

The emphasis was on staff development in mastery learning, not implementing a mastery learning instructional program through staff development.

While the principal, teachers, and students undoubtedly profited from the staff development program, it is important to distinguish between the staff development program and the instructional program implemented as a result of the staff development efforts. They are not necessarily isomorphic. In fact, as we will see in this case study, there are many threats to getting a mastery learning instructional program implemented and operating as intended through staff development work.

Although teachers at Johnson Elementary were required to develop mastery learning units, the focus during staff development was more on developing teacher skills than developing an instructional program per se. The teachers appeared to view the process of developing a learning unit not a means to an end but as the end itself. As a result, the emphasis was on staff development in mastery learning, not implementing a mastery learning instructional program through staff development.

We did not find at Johnson Elementary a sequential series of mastery learning units, each with a formal feedback and correction phase. What we did finu were teachers following a Madeline Hunter lesson structure. Although the emphasis on the daily lesson structure provided a useful framework for teachers to organize instructional delivery, it may have also allowed them to place less emphasis on or altogether eliminate the formal feedback and corrective phase of mastery learning. And while the instruction we observed was good instruction, the mastery learning program looked very much like most elementary school programs whose curriculum is based on standard textbook series and whose students are organized into grade levels for instruction.

Because teacher/staff development is one of two major vehicles for implementing mastery learning (the other is materials/curriculum development, see Guskey, 1980, 1985), it is important to understand the factors that influence the implementation of mastery learning. Consequently, in this case study, we are deviating from the outline and format of the other case studies to examine some of these factors. In so doing, we have focused on some of the difficulties experienced at Johnson rather than on their achievements.

We want to be clear, therefore, that this case study should not be viewed in any way as a negative statement about the principal, teachers, or instructional programs at Johnson Elementary. On the contrary, our overall impression of the school and staff was one of professionalism and excellence. We spoke to many dedicated teachers and observed excellent instruction during our visit to the school. A similarly positive statement could be made about the work of those involved in the staff development program. Our purpose is simply to shed some light on potential difficulties involved in implementing mastery learning programs through staff development.

Program Implementation

Setting

Johnson Elementary, a K–6 school, is located in a quiet, lower middle-class neighborhood of Denver, Colorado, a city of half a million people. Situated midway between downtown and the more affluent suburbs, the neighborhood surrounding Johnson is made up of small, clapboard houses constructed during the 1950s. The school building itself was erected in 1952. Its L-shaped construction facilitated a physical arrangement designating the primary and intermediate grade levels. Grades K–3 meet in the single story wing while grades 4–6 use the double story wing. The library, cafeteria, auditorium, and gym are all accessible from inside the building. Thanks in large part to the efforts of the head custodian, the interior is clean and well-maintained. He told us several times that "providing an orderly and clean environment" was his contribution as part of the Johnson team.

The school had a traditional grade level organization except for a single fifth-sixth grade split. There were 17 regular teachers and seven special education teachers. Johnson had three special education programs. One was a district magnet school program serving 17 autistic children. A second district magnet school program drew 30 blind and visually-handicapped mainstreamed children, the only one in the district. And the third was a pull-out program for students with perceptual or communicative problems.

Stability has marked the past decade at Johnson. Because the neighborhood surrounding the school met desegregation guidelines, it was one of the few schools in the district that did not have to undergo court-ordered busing. There was busing for the special education programs, but most students lived within walking distance of Johnson. Consequently, the school has been spared much of the disruption and turmoil that often accompanies student busing. In addition, the principal, Mr. Gray, with twenty years experience as a principal, has spent the past fourteen years at Johnson, as have seven of his teachers.

The Denver Public Schools had 80 elementary and 27 junior and senior high schools. There were close to 70,000 students and approximately 3500 certified personnel within the district. Based on 1984 figures supplied by the district, the ethnic composition of the elementary school population was American Indian (1.2%), Black (21.1%), Asian (3.4%), Spanish-surnamed (36.8%), and Anglo and others (37.5%). The corresponding figures for Johnson Elementary were American Indian (0.6%), Black (2.9%), Asian (6.8), Spanish-surnamed (32.4%), and Anglo-other (57.3%). Twenty-seven percent of the Johnson students qualified for Aid for Dependent Children.

The purpose of the staff development program was to institutionalize the philosophy and practice of mastery learning in the school.

Implementation History

Johnson Elementary became involved with mastery learning in 1976, the first year of a district-supported staff development program in mastery learning. The program began as an ESEA Title IV-C project with a project director and a small budget (approximately $60,000 each year) and continued for three years. The district provided financial support for the next four years until January 1983, when the program was eliminated in a budget cut.

The purpose of the staff development program was to institutionalize the philosophy and practice of mastery learning in the school. Mastery learning techniques were to be used in all classes and in all instructional programs. As one Johnson teacher put it when asked what it meant that Johnson was a mastery learning school, "That all subjects are taught to mastery."

Two staff development models were developed in the project. The first model was a teacher inservice project in which substitute teachers were provided by the district and teams of teachers from a school attended a week-long mastery learning training session sponsored by what was called the District Staff Academy. The second model trained principals to train their teachers in mastery learning. It was through this second model that Mr. Gray and the teachers at Johnson Elementary were introduced to the theory and practice of mastery learning. Four other schools also participated.

The plan was to have teachers at each of the five schools write a single mastery learning unit each year for three years.

The mastery learning work was time consuming from the start, involving weekly inservice sessions the first year and biweekly sessions the second and third years. The plan was to have teachers at each of the five schools write a single mastery learning unit each year for three years, with the project collecting the units and providing them to other teachers when requested. By developing a learning unit bank and sharing work, teachers would not have to write new units for each new instructional objective. The teachers were to begin in one subject matter and move to a second subject area, the work eventually resulting in mastery learning units representing the complete scope and sequence of curriculum in language arts and mathematics.

Mr. Gray and his staff began writing units in mathematics because they believed it would be easier to identify appropriate objectives in mathematics. Each teacher decided upon a grade level objective and then developed a mastery learning unit to teach that objective. However, pressure from the district forced them to revise this plan and focus on affective education during the second year. But as noted in the second year evaluation report prepared by the project director, teachers were reluctant to write affective units:

> *It was found by project staff during building visitations that teachers are still reluctant to develop lessons to teach these skills. A large portion of teachers still feel these skills are the responsibility of parents, and really do not think of "teaching" personal-social skills during class times. (p. 25)*

The writing of extension activities was emphasized during the third year. In fact, a team of Johnson teachers developed and conducted workshops on extension activities for other district teachers.

The staff development program was based directly on the Bloom "Learning for Mastery" approach as developed by Block (1971, 1974) and Block and Anderson (1975). The mastery teaching and clinical supervision work of Madeline Hunter was also included. The five-page district brochure describing the staff development program, dated March 1984, begins by stating: "Mastery learning is a philosophy about teaching which proposes that under appropriate instructional conditions, virtually all students can and will learn well most of what is taught."

The actual program consisted of an introduction to mastery learning and three components requiring approximately 30 hours of inservice. The three components were Planning for Mastery, Teaching for Mastery, and Classroom Management. Each component had a set of mini-unit workshops, most about one hour in duration. Each workshop had accompanying worksheets, activities, and overhead transparencies.

The workshops were organized and taught according to an eight-step lesson plan format based on Madeline Hunter's work. Each workshop modeled the lesson plan structure advocated in the program. In addition, as teachers completed the workshops they were expected to design a unit of instruction and implement them in their classrooms. Principals were also trained in clinical supervision techniques to assist teachers implementing mastery learning. Teacher observation and conferencing procedures were used.

Factors Influencing Program Implementation

Three features of the staff development program contributed significantly to the instructional practices eventually implemented at Johnson. First, the version of mastery learning outlined in the staff development program was different from the Block and Anderson (1975) version. Second, the lesson structure modeled by each workshop and advocated as the lesson structure of choice focused attention on daily lessons rather than on sequences of learning units. Third, teachers tended to modify features of mastery learning which made it easier to implement in the classroom. Each feature warrants further attention.

The Johnson Version of Mastery Learning

The staff development program outlined a four-step procedure for designing two-to-four week mastery learning units. The four steps were (1) write overall instructional objective for unit; (2) use task analysis to identify component skills ot the instructional objective; (3) develop mini-unit objectives from component skills, develop a unit final examination, and set mastery standard based on mini-unit objectives; and (4) plan the mini-unit instruction following a particular lesson plan format and including diagnostic-progress tests, correctives, and extensions.

There is a subtle difference between this version of mastery learning and the Block and Anderson version. The Block and Anderson version suggests that a course or semester be divided into learning units, that formative tests be administered at the end of each learning unit, and that a final examination be used at the end of the course or semester to grade student learning. The Johnson version suggests that a learning unit be divided into mini-units, that formative tests be administered after each mini-unit, and that a final examination be used at the end of the learning unit to grade student learning. Figure 1 provides a graphic representation of the structural difference between the two models.

The structural units of the Block and Anderson version are course and learning units, covering respectively, months and weeks. On the other hand, the structural units of the Johnson version are the learning unit and mini-unit, covering weeks and days. The shortened time frame of the Johnson version can be most readily observed in the placement of the formative testing component at the end of every couple of lessons rather than at the end of the learning unit. It seems, then, that the Johnson program focused on shorter periods of time, days rather than weeks, and stressed daily lessons rather than sequences of learning units. The Madeline Hunter lesson structure advocated by the staff development program reinforced this emphasis on daily lessons.

The Madeline Hunter Lesson Structure

The lesson plan structure highlighted by the Johnson program included eight features: (1) mental set, (2) rationale, (3) objective, (4) input, (5) model, (6) guided practice, (7) independent practice, and (8) diagnostic-practice test. This lesson model used activities that fit the typical recitation and seatwork lesson structure found in most classrooms. Mastery learning became, as one teacher defined it, steps to follow in a lesson:

> *But I think of it in daily planning as just teaching a given lesson according to the steps of mastery learning. Even if I don't write them down, I have them in the back of my mind so that I do have a goal for each lesson I teach.*

This view of mastery learning as a lesson structure was further supported by the workshop format of the staff development program. Each workshop presentation modeled how the teachers were to design their lessons. In effect, each inservice activity that teachers participated in promoted this interpretation of mastery learning. As Mr. Gray recalled:

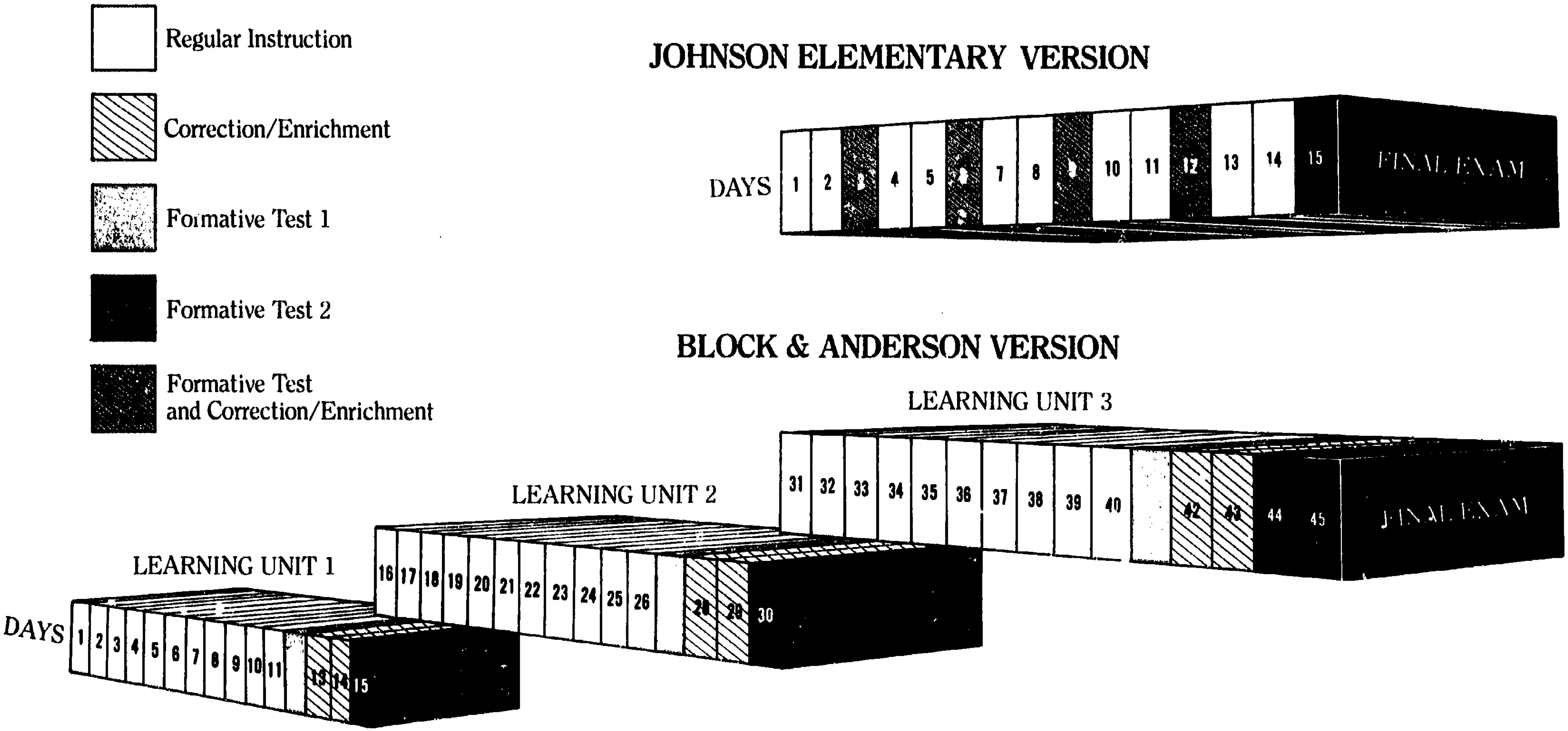


Figure 1
Structure of Two Mastery Learning Models

We used Madeline Hunter's eight steps for lesson planning. All the units that we used—that I used and the project manager used in training me—were done in the same lesson plan format that we expected the teachers to plan their lessons for presenting to their classrooms.

So far we have suggested that the staff development program used at Johnson advocated a slightly different version of mastery learning than the one suggested by Block and Anderson. The staff development program also advocated and modeled a lesson structure based on the work of Madeline Hunter. This modification of mastery learning and the Madeline Hunter lesson structure combined to focus teachers' attention more on daily lessons and less on the learning unit structure of a mastery learning instructional program. A final influence on what mastery learning looked like in practice was the way in which teachers used mastery learning ideas in the classroom.

Teacher Modifications to Mastery Learning

How teachers translated mastery learning ideas into actual practice was an additional factor influencing implementation. At Johnson, teachers appeared to modify mastery learning to fit the realities of their classrooms. The modifications included dropping components of mastery learning, focusing on some components of mastery learning to the exclusion of others, and redefining existing teaching practice in mastery learning terms. In effect, teachers "domesticated" mastery learning. Three modifications, based on teacher descriptions of mastery learning practice, are described here.

Drop Mastery Learning Components. One modification was not to use all components of mastery learning. For example, one teacher described his approach to mastery learning:

I keep [mastery learning ideas] in my head all the time when I teach—like this is what I want to get done today, this is the objective and it should build from one day to the next. But to be a very strict mastery learning person, no, because to do all the pretests, the posttests, and the diagnostic progress tests and all that is time-consuming. I've kind of done away with that; I do the practice part with the class which is basically their seatwork and that sort of thing. From that I determine if they've mastered the objective.

The component teachers commonly dropped was the learning unit itself. New learning units were not written because teachers felt that, having already developed several units, they had internalized the mastery learning ideas. Virtually every teacher mentioned some version of this modification, as the following comments illustrate:

Teacher 1:

> It's hard to say exactly, but I think when you've gone through this three times it becomes part of you.

Teacher 2:

> I just do it all the time without thinking I'm doing mastery learning.

Teacher 3:

> I think it's made me a better teacher, much more aware, given a good guideline . . . though, to be objective about it, it's very time consuming. What I've done is not written a bunch of units like you could do, you could write units but you're talking a lot of work when it comes to that sort thing. What I've done is I use the book that covers all the different objectives that you need for sixth grade. Then what I do is I go through there and I pick out how I want to sequence them and how I want to teach them.

Teacher 5:

> I don't think [writing out mastery learning units] is absolutely necessary. I think when it's new to a person it helps, but when you've used it as long as we have here, it becomes habit and an automatic focus on teaching.

Teacher 6:

> When we first began [mastery

learning] we had to write down everything, see, but once you do it frequently enough, it becomes a part of you and it's just a technique or strategy you use all the time.

Teacher 7:

I think you can transfer the information and get used to using the techniques and the mastery learning units. I feel that once you've done it for a year or two, it just becomes part of the way you teach.

Teacher 9:

I think it's a good way to teach. I think it's the right way to teach, and I think the concepts are excellent. I don't think you have to do a unit or make a unit. I think you just have to remember those steps as you teach.

Focus on a Single Component. A second strategy teachers used was to focus attention primarily on a single component of mastery learning. A component of mastery learning that many teachers embraced was the use of objectives. In effect, some teachers redefined mastery learning as "teaching to objectives," as the following remarks suggest:

Teacher 5:

I think the main thing [about mastery learning] would be always being conscious of teaching to my objective. I try to set the scene, develop a mental set, as I let the kids in on the objective. And I try to always make sure that they have guided practice before they do their work. I found that to be very helpful. I think I neglected that before I had mastery learning training.

Teacher 7:

The main thing that I think a lot of people gained from it was identifying an objective and relating it to the child. That was one of the big things that I felt I gained about it. In previous years we had an objective, but we didn't actually put it on the board. With little children, if you put it on the board and go through "the learner will" everyday, it helps them zero in on the objective was.

Teacher 9:

Kids need to feel a purpose for what they're doing. If they don't have any purpose then they don't feel like doing it. I think that's the most important thing—you state an objective, the kids know what the objective is, and at the end of the day they see what they've done with that objective.

The second-year evaluation report prepared by the project director discussed this same issue. The report stated that the techniques of mastery learning could be implemented without writing new mastery learning units. In addition, it described the fundamental component of mastery learning as objectives:

Subjective data gained by project staff during building visitations reports that once teachers have planned and taught a unit following the specific mastery learning strategy, that process becomes a part of their teaching behaviors. There is not time, nor are teachers expected to develop mastery units for every subject; however, teachers report that once they are familiar with the technique, it can be implemented with ease in the classroom. The components which need to be available and familiar to the teacher are the objectives and tools to evaluate mastery of the objectives. The lesson plans, diagnostic tools, correctives and extension activities can all be developed or accumulated as the unit is being taught. (p. 29)

Thus, the staff development program may have encouraged the tendency of Johnson teachers to perceive mastery learning practice as "teaching to objectives."

Redefine Existing Practice as Mastery Learning. A third modification was to embrace the language system of mastery learning and redefine existing instructional practice in mastery learning terms. By doing so, teachers did not have to change their existing practice. The following description of mastery learning by a mathematics teacher illustrates well how existing practice can be described using mastery learning language:

...and ideally every class period giving them some kind of feedback on how they did that day and letting them know whether or not they've mastered the objective for the day. And usually the criteria we use are things like, on their practice sheets, if they get 80 percent then I figure they've mastered the objective for that day. Then if they get finished—because you always get kids that finish at different times—I let them work on their extension activities which, in a lot of instances, that's their homework.

In this teacher's approach to mastery learning, formative testing was accomplished by using daily worksheets. And extension activities, completed by early finishers, were homework or extra credit worksheets. This teacher expanded on the formative testing later in the interview:

The idea would be to give the diagnostic test after each objective. What I've done is I just go around to every kid and make sure that they know what they're doing.

Summary

The staff development efforts used to implement the mastery learning instructional program tended to focus attention on how mastery learning could be implemented in daily instruction rather than as a series of learning units. This may have made mastery learning more palatable for teachers. Descriptions of mastery learning practice by Johnson Elementary teachers offer some clues about how mastery learning was implemented in the classroom. Teachers appeared to use the language system more than the techniques of mastery learning. In the next section, we will look at three additional influences on the mastery learning program which interacted with and influenced the actual practice of mastery learning at Johnson Elementary.

Influences on Program Maintenance

There were three additional factors that influenced the mastery learning instructional program at Johnson: the lack of a complete scope and sequence of learning units, the negative impact of teacher mobility, and the implementation of a new district-mandated testing program. Each is described below.

An Incomplete Scope and Sequence

The development of mastery learning units by teachers at Johnson and the four other schools involved in the project created a large number of mastery learning units. A 1981 Staff Academy brochure from the district listed 233 mastery learning units available for teachers to check out and use. A perusal of the topics covered by the mastery learning units suggests that, while impressive in their variety and breadth, the topics fall short of representing even a single grade level curriculum, let alone a scope and sequence for an entire subject.

A lack of a complete scope and sequence is only part of the story, however. There is evidence that teachers may not have used the mastery learning units as a sequenced curriculum even if it had been available to them. The second year evaluation report prepared by the project director noted that the mastery learning bank was used more as a resource for ideas than as a curriculum:

However, we found teachers still did not use the duplicated units to a great degree. When asking teachers why, we found that most teachers responded the units did not cover the specific objective they wanted to teach, and it was often easier to develop their own unit. Units were used mainly as resources to teachers, not as a teachers' guide. (p. 27)

Teacher Mobility

Another factor influencing the maintenance of the mastery learning program at Johnson was teacher mobility. When the project was supported by the district, Mr. Gray was able to require new teachers to have training in mastery learning or to attend a week-long Staff Academy workshop on mastery learning. However, after the district dropped the program and a revised teacher union policy made it more difficult to require specific training for new teachers, new staff development in mastery learning became the principal's responsibility. Inservice activities had to be completed on a voluntary basis before and after school. This schedule was difficult to maintain.

As many of the Johnson teachers saw it, the testing program and mastery learning were at odds with each other philosophically.

The severe toll that teacher mobility can have on a program is reflected in the fact that, at the time of our site visit in November 1985, only ten of the 24 current teachers were trained in mastery learning. Of the ten mastery learning teachers, six were grade level teachers, two were special education teachers, one was a music teacher and one was a physical education teacher. As one teacher described the program, "It's not as mastery learning as it was when we first started it because of the difference in staff."

The New Testing Program

A third factor that has interfered with the maintenance of the mastery learning program involved a fundamental conflict between mastery learning and a new district testing program. The new testing program, implemented about the time district support for the mastery learning program was eliminated, consisted of grade level objectives and criterion-referenced tests for grades one through six in reading, language/composition, and mathematics. The tests included pretests, posttests, and interval tests to be administered at specified times during the school year. The tests were computer-scored in the district office, and provided the teacher with student and class profiles of achievement on each of the objectives.

The objectives of the testing program became the objectives for Johnson, as they did for all the elementary schools in the district. But that was not the problem. As many of the Johnson teachers saw it, the testing program and mastery learning were at odds with each other philosophically. Because testing was required at regular intervals during the school year, some teachers felt pressure to have students cover curriculum rather than master it. As one teacher described the effect of the testing program:

> *I have heard [other teachers] saying that they can't always make sure kids have mastered because they have to go on to the next thing to get it done before the [next] test. To me, this defeats the whole purpose of mastery learning. The pressure to cover the curriculum tested on each of the interval tests may have caused some teachers to drop the mastery learning orientation of allowing students enough time to reach mastery. In one teacher's view, "When we brought in [the testing program] then I think mastery learning decreased."*

Summary

The Johnson Elementary faculty spent three years developing a large number of mastery learning units. However, they did not complete an entire scope and sequence of mastery learning units for any subject. In addition, five years following the completion of the staff development program only ten teachers who had been trained in mastery learning remained at the school. And a district-mandated testing program requiring tests to be administered on regular intervals may have interfered with the basic mastery learning principle of allowing students enough time to master the curriculum.

Summary

This case study has described staff development efforts to implement an instructional program in mastery learning and some of the difficulties experienced by the staff at Johnson Elementary. We described six factors that contributed to only a partial implementation of a mastery learning learning program.

The reason mastery learning was not fully implemented was not because of teacher resistance to mastery learning, although there was some teacher resistance in the early years. Many of the teachers at Johnson thought mastery learning was one of the best approaches to teaching and strongly recommended mastery learning practices. As one teacher put it, "We've had many, many programs come and go. I know several times I've heard different people say that of all the things we've done, mastery learning is the best."

Rather, we found it necessary to draw a sharp distinction between the staff development program and its outcomes. The reason is that the orientation of the staff development program appeared to be critical. Is the desired outcome the development of teacher skills or is the desired outcome the implementation of a mastery learning instructional program? While both outcomes are certainly reasonable goals, the latter is much more difficult to implement and maintain.

Teacher mobility poses a constant threat to staff development efforts. Unless the product of staff development work is grounded in organizational or curricular change, the "half-life" of the work produced during staff development is a function of the rate at which teachers leave the school and are not replaced by similarly-trained teachers. At a minimum, learning units should be written and organized into a scope and sequence for the subjects being taught. By doing so, the work may have a chance of surviving the teacher.

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CHAPTER THREE

Flexible Grouping Approaches

This chapter presents three examples of flexible grouping approaches—Conrad Ball Junior High, Explorer Elementary, and Barcelona School. As one might expect with flexible grouping organizational models, each site differs in the mechanics of how students are regrouped for instruction.

At Conrad Ball, the curriculum structure plays an important role in regrouping. The curriculum is organized into a set of sequenced, three-week modules and students are regrouped for instruction in the next module based on their mastery or nonmastery of the previous one. The regrouping process is relatively automatic. At Explorer Elementary, regrouping is less automatic and depends on teacher decisions about individual students. The regrouping at Barcelona is accomplished in a laboratory setting, with the laboratory director deciding which students are to learn what curriculum next. While there are pros and cons to each of these approaches, all share the same goal of attempting to better match students and curriculum.

Conrad Ball Junior High School: A Modular System for Teaching Mathematics

Introduction

Most teachers will tell you that a fundamental goal of teaching is to meet the instructional needs of all students. They will also tell you that one way this goal can be achieved is to teach curriculum at an appropriate level of difficulty and challenge. The problem, of course, is that schools usually organize curriculum into grade level instructional programs and assign students to classes organized by grade level. Because students vary widely in their prerequisite skills to learn the curriculum, some students are well prepared for learning, others less so, and some students have few of the necessary prerequisites for successsful learning. How instruction can be organized to accomodate this student diversity poses a basic problem.

A typical response to this problem, especially in junior high school mathematics, is to make classes more homogeneous by assigning students to classes based on ability. Instructional programs using ability grouping typically form remedial, regular, and accelerated grade level classes. Students are either provided different curriculum or the same curriculum covered at different rates.

Ability grouping presents at least two difficulties. One is that once students are assigned to classes, they remain in those classes for the entire school year. A second difficulty is that the curriculum is rarely differentiated beyond that for the two or three different ability groups. Consequently, the instructional program lacks flexibility both in terms of how it assigns students to groups and how it differentiates curriculum beyond that based on ability.

One way to think about the graded school organization is that it is a grouping strategy, with students being asssigned to classroom groups once a year and provided with grade level curriculum. Merely assigning students to classes on the basis of ability does not fundamentally change this grouping strategy. A program that can effectively accomodate differences in students' learning needs must both design its curriculum so that it closely matches those needs and arrange for students to be frequently reassigned to instructional groups. This requires an organizational arrangement that facilitates the movement of students between instructional groups and a curriculum differentiated enough to make use of the frequent regrouping. Indeed, without a differentiated curriculum, the frequent reassignment of students would be meaningless.

The Math Mod Program at Conrad Ball Junior High School fulfills both requirements. The curriculum of this mathematics program is organized into short, focused modules. And students are reassigned to new modules every three weeks based on the learning outcomes over the previous module. Thus, the program is structured to address the instructional needs of its students more effectively than that found in the typical graded school. This organizational structure has been a key ingredient to the success of the Math Mod Program. As the department chair reported, "I cannot imagine teaching the way I used to with a self-contained classroom and a wide range of ability levels versus this program."

The success of the Math Mod has far exceeded teachers' expectations. "They're blowing the top off the test," reported the department chair. "Our kids coming out of the eighth grade are better prepared for Algebra I than any kids have ever been in this district." Furthermore, "I think we're turning more kids onto mathematics," said the department chair. As evidence, he pointed to the fact that the number of advance math sections at the high school "have almost doubled over a two or three year period." Another teacher added: "This program gives them a lot of success.... When they have success like that they tend to be more interested in it and continue to go on with the program."

The program has also reduced discipline problems. One of the originators explained why: "In self-contained classrooms, if students and teachers developed a personality conflict, they were stuck with that teacher-student combination for the whole year.... This way, discipline problems seem to be reduced. A child always feels like he could get along with a teacher for three weeks, and teachers feel like they could get along with the most troublesome child for three weeks."

Finally, the program has also developed a sense of teacher professionalism and collegiality at Conrad Ball Junior High School. When the Math Mod Program began, the teachers believed they were merely reorganizing the schedule and curricula to better meet the instructional needs of their students. The new organizational structure promotes and even requires professional cooperation and collaboration. The teachers must work together to make the program work. "We're always in constant discussion. It opened up the lines of communication within the department remarkably. It's the best thing that ever happened in my 19 years of teaching," reported the department chair. Another teacher said, "I had never felt such support and togetherness in a group in any school I've ever taught in before. There has never been such cohesiveness."

What kind of school is Conrad Ball Junior High School? How did the program get started? And more importantly, what does this program look like in practice? In the following pages, we take a closer look at this mathematics program. The first section presents the school setting and implementation history. Then we describe the structural features of the program. A summary and analysis of the program concludes the case study.

Program Implementation

Setting

Conrad Ball Junior High School is one of four junior high schools in the school district of a western town of 34,000 residents. Conrad Ball serves 775 seventh, eighth and ninth graders. About 85 percent of their parents hold professional or semiprofessional jobs. As one might expect in a school where the majority of the students come from upper middle-class families, only 15 percent of the student body participate in the free or reduced-price lunch program. Indeed, Conrad Ball lost its Chapter I remedial language program last year because there were not enough economically disadavantaged students in attendance.

The instructional staff includes 46 teachers (41% are male, 59% female) and a full-time librarian. Some of the teachers are itinerant and must travel between Conrad Ball and one or more other schools in the district. A large portion of the staff are veteran teachers with 46 percent having taught for ten years or more. Nearly 18 percent have been teaching between one and three years. Additionally, 46 percent of the staff hold master's degrees.

The teaching staff is divided into standard academic departments. The mathematics department consists of five full-time teachers and two other teachers who teach in the Math Mod Program one or two periods during the day. A typical teaching load is six periods, with about 20 periods of Math Mod being offered each quarter. Each teacher usually has three preparations: Math Mod, and two different ninth grade courses from four offered—general math, survey algebra (the equivalent of one year of algebra taught over two years), algebra I, or geometry. One teacher is designated the department chairman and coordinates the day-to-day activities of the department and the Math Mod Program.

The school building itself is a sprawling 13-year-old brick and cinder block structure divided into two wings with the cafeteria in the middle. Besides its conventional use, the cafeteria serves as an auditorium, study hall, and meeting area. One wing houses the academic classes (science, math, language arts, social studies, foreign language, and special education) and the media-library center. A small computer lab with eight microcomputers is adjacent to the library. The other wing includes the music and art rooms, industrial shops, gymnasium, and home economics classrooms. Three portable buildings have been added to the main building. Language arts and foreign language classes meet in two of the portables, and the remaining one was converted into a weight room for physical education.

The school day officially begins at 7:50 a.m. and ends at 2:51 p.m. There are eight class periods, each lasting 44 minutes. All students take courses in mathematics, social studies, science, language arts, physical education as well as electives. Students also take one period of supervised study hall.

Implementation History

The Math Mod Program began in 1973 at Bill Reed Junior High School. another junior high school in the district. Following five years of successful operation at Reed, the teachers at Conrad Ball implemented the same program in 1978. Today, the Math Mod Program is used in all four of the district's junior high schools. All seventh and eighth grade students participate in the program except for advanced students placed in algebra and some special education students served solely by special education teachers.

Twelve years ago, the math teachers at Bill Reed Junior High School were concerned about the low performance of their students on standardized achievement tests in mathematics. In addition, many of their students could not handle the Algebra I curriculum in the ninth grade and had to be placed in general mathematics instead. They decided to explore other mathematics programs and see what might be done to change the existing program. "We were just fooling around with some ideas to try and make math a more teachable subject," explained one of the teachers.

The teachers at Reed eventually decided on a program that regrouped students every three weeks. While the principal enthusiastically supported the overall concept, "the real barrier was convincing the assistant principal that we could move students without losing them.' The Math Mod Program received the approval of the school board and was implemented at Reed in the fall of 1973. The teachers in the mathematics department at Conrad Ball were asked to participate as a control group for a first year evaluation.

The teachers at Reed eventually decided on a program that regrouped students every three weeks. While the principal enthusiastically supported the overall concept, "the real barrier was convincing the assistant principal that we could move students without losing them."

From the outset, there was great concern about the switching of students every three weeks. Not only were procedures created to ensure that the administration would know where each student was at all times, but the other teachers in the building had to be alerted to the new ways of doing things in the mathematics department. "We spent time explaining it to the staff in the first week of teacher preparation that this was going to be happening," recalled one of the teachers, "and that they could expect to see some mass changes in the halls [during regrouping periods] but that we would try to keep the noise to a minimum."

The Math Mod Program was successful at Reed from the start. "There was this great excitement about the kids doing well and feeling good about math," remembered one of the teachers. "You could sense it within the department almost right away." The teachers' impressions were verified when standardized achievement scores in math improved. One teacher recalled that the "central office was afraid to show us the test scores over the first year because they thought we had cheated."

In 1978, five years after the program was launched at Reed, the mathematics teachers at Conrad Ball chose to adopt it. The department chair cited three reasons behind the staff decision. First, an instructional goal of the school was to increase achievement scores. Second, teachers wanted a program where "the kids with higher abilities could move faster and the kids with lower abilities could take more time." Rather than a completely individualized program, the staff preferred the semi-individualized approach that the Math Mod Program offered. Finally, teachers were having difficulty "picking a textbook that wou' neet the needs of all the students." Since the Math Mod Program did not use a textbook, this problem became moot.

Following a week-long workshop conducted by the Reed teachers, the program was implemented at Conrad Ball in the fall of 1978. Once the program began, the teachers from both schools met frequently to share materials, ideas, and concerns.

Today, all four schools are using the Math Mod Program as standard district policy. Math teachers from each school meet at least four times a year to exchange ideas and materials. This group also approves any recommended changes in the curriculum (which mods are taught) or tests. In all four schools, similar modules are taught at the same time so that students transferring within the district can easily adjust. Thus, if a student transfers from Conrad Ball to another junior high in the district, the student will step into the same module that was being taught before he or she changed schools.

Program Description

The Math Mod Program is for seventh and eighth grade students. All seventh grade students and most eighth grade students were placed in the program. The exceptions were several advanced students taking algebra (three seventh graders and 36 eighth graders) and some students identified as learning handicapped who were unable to handle the mod classes and received instead their mathematics instruction from a special education teacher. However, the Math Mod Program does provide an opportunity for mainstreaming the mildly handicapped. "It's a chance for them to move in and have a group of kids in the classroom that are also having trouble in the same things so that they're not the only student below average or having trouble," said the department chair.

Philosophy

The Math Mod Program began as a way to improve instruction in mathematics. Although there was not an emphasis on a stated philosophy, some attention was given to mastery learning ideas. Workshop materials developed by Reed teachers include a short description of how Benjamin Bloom's work on mastery learning applies to the program. Five mastery learning variables are outlined: aptitude, quality of instruction, ability to understand instruction, perseverence, and time allowed for instruction. The outline states, for example, "if a student fails a topic in a three-week period, he is asked to repeat it. We try to allow one repeat and then give him a new topic. Time is the toughest part of the program."

Curriculum

What Curriculum Is Taught? The Math Mod Program contains 30 three-week modules covering standard seventh and eighth grade mathematics and pre-algebra curriculum. Topics range from basic mathematics operations using

Figure 1

Some Possible Math Module Schedules for Low-, Middle- and High-Ability Classes

		Quarter I			Quarter II			Quarter III			Quarter IV		
		T1	T2	T3	T1	T2	T3	T1	T2	T3	T1	T2	T3
Class 1:	Low	A	C	D	J	K	L	P	Q	V	X	Y	AA
Class 2:	Middle	E	B	N	K	L	I	R	S	V	XY	AA	BB
Class 3:	High	B	O	H	M	I	F	H	U	V	XY	AA	BB
Class 4:	Optional	Flexible Mod Use As Needed											
Class 5:	Optional												

Q1 MODULES:	Q2 MODULES:	Q3 MODULES:	Q4 MODULES:
A. Basic Facts	J. Basic Fractions	P. Decimals I	X. Ratio, Proportion
C. Whole Number (+/−)	K. Fractions I	Q. Decimals II	Y. Percent
D. Whole Number (×/÷)	L. Fractions II		
E. Whole Number Review	M. Fraction Review	R. Decimal Review	W. Calculators
B. Numeration	I. Number Theory	H. Integers	XY. Ratio, Proportion, Percent
N. Measurement	F. Number Properties	S. Rationals	AA. Graphing
O. Geometry	Z. Geometry II	U. Solving Sentences	BB. Computer Literacy
H. Integers	T. Probability	V. Perimeter, Area, Volume	CC. Logic
			DD. Modular Arithmetic

whole numbers, fractions, and decimals to modules in geometry, computer literacy, and pre-algebra. Seventh grade students who complete most or all of the pre-algebra modules are tested at the end of the school year. If they score well, they may be placed, with teacher recommendation and parental approval, in algebra as eighth graders, one year ahead of the normal math sequence.

How Is the Curriculum Structured? The school year is divided into four nine-week quarters. Each quarter is further divided into three three-week time periods during which math modules are offered (T1, T2, and T3 in Figure 1). According to a brochure describing the program, the math modules are "sequenced according to prerequisite needs, with approximately eight – nine mods offered each quarter." Only certain modules are offered each quarter, the general sequence through the school year being whole numbers (first quarter), fractions (second quarter), decimals (third quarter), and ratios and percents (fourth quarter). However, more advanced modules are available each quarter as well. Figure 1 presents the structure of the Math Mod Program.

Each three-week module includes a pretest, posttest, objectives, and accumulated materials for teaching the module. The pretest provides the teacher with information about student strengths and weaknesses while the posttest is used to decide student mastery of the module and whether the student is ready to proceed to the next module.

There is no absolute sequence of modules for students to follow through the year. Instead, sequence depends on previous modular performance, quarterly pretest performance (described later under placement), and teachers available to teach mods. Occasionally, a group of students will be capable of completing an assigned module faster than the allotted three weeks. Teachers have the option to cover the original module objective as well as additional activities which explore the topic in more depth during what they called a "beef mod." And even though all modules are planned for fifteen days of instruction, they have been designed to handle interruptions and loss of instructional days. As one teacher described the mods, "they could probably all be taught in ten days, even though they are designed for fifteen. That gives you time for review, time for quizzes, and time for slowing down."

The teachers make a concerted effort to "spiral back" frequently so that the modules will become more unified and continuous. "I think that probably the weakest area and the hardest part . . . is keeping kids from learning one segment at a time and never tying it together," explained one teacher. "So we work really hard on spiraling back."

How Are Students Placed in the Curriculum? At the beginning of the school year, students are randomly assigned to a mathematics teacher by a computerized scheduling program. After a few days of basic review, students are given two days of pretests to assess their mathematics knowledge and mastery of skills covered in the math modules offered the first quarter of the year. The pretests were designed by the math teachers and consist of about ten questions for each skill area.

The teachers make a concerted effort to "spiral back" frequently so that the modules will become more unified and continuous.

Student pretest performance allows teachers to place students in one of the mods offered first quarter. If a student masters a module on the pretest, the score is entered on a grade card. Once a student is placed at the beginning of the quarter, the next two modules for the quarter are set. This overall assessment procedure is repeated on the last day of the remaining three quarters. Pretesting occurs four times a year.

Instruction

How Are Students Organized for Instruction? Because there are five teachers in the department, up to five different modules may be offered every three weeks. If many students need a particular skill, however, two teachers may teach the same module, thereby reducing the number of different modules. The class size for a module depends on the number of students who place into the module or who have completed the previous mod in the sequence. Most classes have 20 to 27 students; every attempt is made to keep the lower level modules below 15 students.

At meetings held on the last Friday afternoon of the module, teachers decide how students will be organized, which modules will be taught, and who will teach them. Teachers assign students to modules based on their scores from the posttest administered the previous day along with the quarterly pretest assessment.

To regroup students, all that is required from each teacher is the number of students who passed their module and number of students who failed. With this information pooled across all teachers and placed on the blackboard, the number of students needing certain modules is apparent. One teacher described how regrouping occurs:

> *We total all the students that need mod J, all the students that need mod K, all the students that need mod L, all those that need mod I, all those that need mod M, and then—we have five teachers—that's got to be broken down mathematically into five groups. Sometimes it's very frustrating because we have a total of 39 [students] in one column. Thirty-nine is too big for one class so we have to divide that into two teachers. Then we have another class that has 40, that has to be divided into two teachers. That leaves the last class with 36 that has to be a size 36 class. So there are times when the numbers just do not break up evenly.*

Having determined the size of each group and the module to be taught, teachers then decide who will teach each module. The high ability mods and the small class size modes, which many teachers prefer, are rotated among the staff.

Teachers draw up new roster lists and exchange math cards (a type of matn cumulative record for each student). The entire procedure usually takes less than an hour.

One consequence of this regrouping procedure is that the effectiveness of each teacher is made public. Students who have failed the previous module become, in effect, the responsibility of all the teachers. The resulting pressure on teachers to have all their students pass the module does not go unnoticed. As one teacher described it, "You feel terrible when you put your numbers up and out of 25 kids, you've lost 6 of them while your colleague who's taught the other section has 25 kids who have all succeeded."

The revised schedules take effect on the following Monday. On "switch day," students report to the classroom they were in the previous Friday. After taking roll, the teacher announces the new module assignments for the next three weeks. About 15 minutes into the period, all students in the math department switch classrooms to begin the new module.

Students may or may not have the same teacher for two modules in a row. Over the course of the school year, students will most likely come in contact with all of the math teachers. The constant regrouping may pose a problem for some students who find it difficult "adjusting to changing teachers and changing classes all the time." Also, some teachers feel that the regrouping discourages them from developing close relationships with their students. One teacher who initially opposed regrouping for this very reason, conceded that the sense of togetherness is lost but quickly added "not having the continual discipline problem or personality conflict with you, [and] being able to move those kids, is a better tradeoff."

How Are Students Taught? Teachers in the Math Mod Program do not use a standard textbook. Instead, they have designed most of the materials and worksheets themselves. Commercial materials usually consist of extra practice worksheets. Each teacher and the department itself maintain a large file of previously used practice sheets and cross-referenced commercial materials and texts. "We tore [the textbooks] up actually and put the individual sheets in mod folders," explained the department head. Teachers throughout the district also share materials and lesson plans.

The teacher-made worksheets ultimately form the student's "textbook." Each worksheet includes a brief explanation and examples of the skill or procedure, practice problems on the new skill, and review problems on a previously learned skill. Teachers also assign worksheets for homework almost every night to reinforce objectives presented in class.

Although the district curriculum guide defines the objectives to be taught and provides the pretests and posttests to be used, the teachers have discretion as to the pacing, content, formative testing, teaching strategies, and grading procedures for each module. Consequently, while teachers are required to participate in the program, they have flexibility to use different approaches. For example, a new teacher reported: "I have never had anything so well organized to work from. I do not feel like any creativity or anything is taken away. I can do anything, I feel like I can teach it any way that I want."

Teachers in the Math Mod Program do not use a standardized textbook. Instead, they have designed most of the materials and worksheets themselves.

Assessment

How Are Students Advanced in the Program? Following instruction on the first module, a posttest is given to ascertain mastery. Students scoring 70 percent or better on the posttest are assigned to the next module in the sequence. Students not demonstrating mastery are required to repeat the module during the next three weeks or at a later date when that particular module is offered again. However, a mod is only repeated if there are enough students to warrant forming a class. In the case where some students require remediation but there are too few students to form a separate class, their new teacher is alerted and special work is prepared to be completed along with the regular work of the new module.

In rare cases, a student will not attain mastery even after repeating a module several times. This has happened with about ten to 15 students each year. In these situations, the student is placed in a different, but comparable, module with individualized tutoring provided by the teacher during class time or during the student's study hall. Repeated failures by a student are also a signal that a handicapping condition might be present. Such students are often referred to the special education teacher for evaluation.

Rather than being isolated in self-contained classrooms, the teachers at Conrad Ball were required to interact with each other to make the Math Mod Program work.

How Is Student Progress Monitored? Student progress is easily monitored for each student using a "math cumulative card." Space is provided on the card for students' pretest and posttest scores, modules completed, and grades received. This card follows the student throughout the seventh and eighth grades from module teacher to module teacher. It is also sent as part of the records should the student transfer to another junior high in the district.

How Are Students Graded? Report cards are issued every nine weeks. The grades from each of the three modules completed during the quarter are averaged to establish a quarter grade in mathematics. The particular modules completed by a student does not affect a student's grade. Thus, a student who masters three basic modules will receive the same grade as a student mastering three advanced modules. Teachers determine their own grading procedures. Since students have completed different modules, semester tests are not given. As the department chair mentioned, "The kids that have been in the higher mods are going to do much better on those semester exams."

Organizational Arrangements

Scheduling is a primary administrative concern. The regrouping procedure requires that the majority of the mathematics faculty teach at the same time. At Conrad Ball, all five teachers taught their modules during the same class periods, repeating their modules four times a day. An extra section was available one period with the addition of a sixth teacher. A common planning period for teachers could be scheduled during the regular school day. The entire math department stressed the importance of this feature to the success of the program. Figure 2 gives an example of a class schedule.

The number of teachers in the math department is also crucial to the successful implementation of the Math Mod Program. A school with only two or three math teachers would find it difficult to adopt the program as it operates at Conrad Ball Junior High. Not enough different modules could be offered to accommodate the typical skill needs of seventh and eighth grade students. However, Conrad Ball teachers were quick to point out that with modifications, the program could be implemented in a small school Because it provides a thorough and sequential presentation of mathematics skills at the junior high level, the Math Mod Program would be beneficial to even the self-contained classroom teacher.

Rather than being isolated in self-contained classrooms, the teachers at Conrad Ball were required to interact with each other to make the Math Mod Program work. "What you are asking them to do is not necessarily change [their] teaching style, but change [their] relationship with people in the math department" said the department chair. He cautioned, however, "If you had a group of math teachers that didn't get along with each other, then this program just wouldn't cut it." Consequently, it is important that the social climate is such that teachers would be willing to interact on a team basis.

Summary: Increasing Instructional Flexibility

We opened this report with a brief discussion of the problem student heterogeneity poses for teachers when students are organized by age for instruction. A common response to student diversity in graded schools is to group students by ability within grade levels. Ability grouping provides more homogeneous classes, making it easier for teachers to design instruction. We suggested, however, that ability grouping does not adequately match student and curriculum.

The Math Mod Program described in this report was characterized as having two features that could address the difficulties of ability grouping. First, students were regrouped on a more frequent basis, every three weeks rather than every year. Second, the curriculum was organized into three-week modules which students could be assigned to based on their previous learning. These two features provide more flexibility in responding to the instructional needs of students. We need to ask whether the Math Mod Program fulfilled this expectation.

The answer is a qualified yes. There is no doubt that the program greatly increases instructional options for students and provides teachers with the organizational support to carry out these options. Teachers are better able to match curriculum and students. Still the program has limits to the extent to which it can provide for individual differences. These limits should not be overlooked.

The primary limitation is the number of modules that can be offered at one time. With five teachers, there are a maximum of five different modules that can be offered at one time unless teachers double up on their math module preparations. This has been done from time to time but is not general practice. The teachers also have ninth grade classes to teach and have established a rule that they would all have three preparations: a math module and two different ninth grade classes. Teachers have two ninth grade classes because they would "rather have more preps than be stuck with all lower-ability ninth graders."

One consequence of only having five modules is that the modules must cover

Figure 2

An Example of a Class Schedule

	Teacher						
Period	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1	Gen Math-9	Study Hall	Survey-9	Study Hall	Algebra-9	—	—
2	Math Mod-J	Math Mod-J	Math Mod-M	Math Mod-MI	Math Mod-L	—	—
3	Plan	Plan	Plan	Plan	Plan	—	—
4	Math Mod-J	Math Mod-K	Math Mod-M	Math Mod-MI	Math Mod-L	—	—
5	Algebra-9	Algebra-8	Geometry-9	Survey-9	Survey-9	—	—
6	Math Mod-J	Math Mod-K	Study Hall	Math Mod-MI	Math Mod-L	—	Math Mod-K
7	Study Hall	Survey-9	Geometry-9	Algebra-9	Study Hall	—	—
8	Math Mod-J	Algebra-9	Math Mod-M	Math Mod-MI	Math Mod-L	Math Mod-M	Math Mod-K

the range in student readiness for instruction. This is not always possible, as one teacher pointed out:

> *Sometimes there is a small, very, very small group of students that is so low that when they come into even the lowest mod we could offer given the number of teachers we have, they still have a lot of trouble catching up.... And then there is also a small group of students on the top that are not quite making it to algebra but pretty much have learned a lot of the things in the mod math program already.*

Thus, as in all group instructional settings, the students at the extremes in readiness are the ones most difficult to accomodate. At Conrad Ball, the problem would be more severe if there were no algebra and geometry classes to handle exceptional seventh and eighth grade students. Even with the more advanced courses, there are a few students who have learned much of the math mod curriculum being offered during a given quarter but are not quite ready for algebra.

We conclude, therefore, that the Math Mod Program at Conrad Ball Junior High School does indeed increase instructional flexibility. It still has some difficulty handling the small number of student outliers, because there is a limit to the number of modules that can be offered at the same time. However, this limitation should not cloud the fact that the program is quite successful in providing instruction to the majority of students. Moreover, it has increased the ability of teachers to provide instruction at an appropriate level of difficulty and challenge.

Explorer Elementary: Flexible Grouping of Students in Mathematics

Introduction

The graded school organization isolates teachers from their peers. Seldom are there opportunities for teachers to share effective solutions to problems or find support for innovative ideas and teaching practices. Forced to be solitary innovators, teachers must rely on their individual commitment and sense of accomplishment to sustain the high energy level required for innovation. Under these conditions, there is a tendency for teachers to use more routinized forms of instruction when they become mired in the day-to-day exigencies of their classrooms. Ultimately, innovation and experimentation can take a back seat to less fatiguing forms of instruction.

At one elementary school, teachers have created an innovative mathematics program that improves classroom instruction and promotes collegial interaction. Teachers decide cooperatively about what students will learn next based on how well students have completed their current learning. The organizational structure of the program has helped to overcome teacher isolation, or as one teacher described the program, "It eliminates the isolation. Before, you were able to go into your classroom, close the door, and nobody knew what went on there."

The mathematics program at Explorer Elementary is based on a district-developed curriculum of 140 K–8 objectives. This curriculum has a hierarchical, branching structure organized into 24 branches or courses. Students progress through the learning hierarchy as they master the prerequisite objectives. Periodically, teachers regroup students into new classes and provide them with instruction matched to their current learning requirements.

During the first year of implementation, it became evident that the computer technology thought necessary to manage the regrouping of students was not going to be available. The staff at Explorer Elementary and three other schools chose to continue the program despite the lack of computer technology. Efforts to overcome this deficiency produced two positive outcomes; teachers developed a sense of ownership in the math program and strengthened their collegial ties.

Because no computer software was available, teachers had to regroup students themselves. This task required teachers to develop a system that arranged for them to meet and share ideas about students and instruction. Such exchanges occur all too seldom when teachers remain in self-contained classrooms with their own students. One teacher described her colleagues as being like a "little mini-family of sharing all these materials and ideas. If somebody gets bogged down, someone will offer, 'Come on, I'll help you regroup your kids' and that kind of thing."

Teachers enthusiastically praise the program's success. "I think this is so much better for the kids," said one teacher. "They don't get to anything until they're ready for it." Commented another teacher, "I think there's more of an opportunity for the children to have success. And I think I've become a better teacher because I'm focusing more." Still another teacher stated, "I like the grouping, I like the change, I like getting to know all the kids, I like zeroing in on one little thing." Teachers approve of assigning students to groups based on their mastery of prerequisite skills since they are able to focus on a particular skill or set of skills.

Program Implementation

Setting

Explorer Elementary, a K–6 school, is located in a small coastal town in the Pacific Northwest. A recent decline in the forestry industry, the source of most jobs in the area, has resulted in a high rate of both unemployment and transiency. The current growth of high technology industries has somewhat alleviated the unemployment problem and has contributed to an increase in the town's population.

Explorer is one of seven elementary schools in a district that also includes two junior high schools and one high school. Approximately 500 students are enrolled at Explorer, although enrollment fluctuates greatly given the high rental density of the surrounding community. While approximately half of Explorer's student population remains stable, between 500 and 600 students transfer to and from Explorer every year.

The student body is predominately white, comprising 78 percent of the student population. Asians (16%), Blacks (3%), Hispanics (2%), and Native Americans (1%) make up the remaining student population. Six-seven percent of the students participate in the free or reduced-price lunch program, and about 60 percent of the students come from single parent homes. Many of the students live in government subsidized housing located about two miles from the school.

There are approximately 70 students per grade level, with a range from 96 in the first grade to 55 in the sixth grade, according to 1985 enrollments. There is also one self-contained class of 12 special education students. In addition, a preschool of 47 handicapped youngsters from throughout the district is housed in an adjacent building on the Explorer campus. The elementary school principal supervises the teachers and students in this program.

The instructional faculty includes 19 teachers, nearly three-quarters of whom have more than ten years experience. The median number of years of teacher experience is 15.3 years. Explorer also employs a librarian, counselor/psychologist, a learning support center teacher, and two part-time teachers—one in music and another in physical education. Providing support for the teaching staff are 13 aides; seven are instructional aides in the learning support center and the others perform a variety of clerical and teacher-assistance tasks.

The school building itself is a concrete one-story structure built in 1973. Classrooms frame the entire perimeter of the square-shaped building with the library and some offices located in the center. The school was originally designed as an open area building, so the temporary classroom walls could easily accomodate different class sizes and activities. Part of one side of the school is blocked off for classroom use by Explorer Junior High School, which shares the campus.

Implementation History

Planning for the mathematics program began in 1982 as part of the district's routine curriculum review process. The Mathematics Curriculum Review Committee reviewed various curricula, including one designed by Dr. Stephen Rubin of the New Canaan School District, New Canaan, Connecticut. His K–8 curriculum package included objectives organized into an extensive learning hierarchy. Students in the Rubin program progress individually through the hierarchy, learning new objectives based on mastery of the prerequisite objectives. A computerized information management system simplifies student record keeping and program coordination.

Impressed with the Rubin hierarchy, the Mathematics Curriculum Review Committee adopted those materials as well as the Heath textbook series. During the school year, the committee revised extensively the Rubin materials. The seven elementary schools were to choose either Rubin or the Heath series and then develop a building level plan for implementing the following year.

The Explorer staff elected to implement the Rubin curriculum. The teachers spent four months developing a plan to implement the hierarchy, an effort assisted by the fact that three of Explorer's teachers had been members of the district Curriculum Review Committee. The entire staff, according to one Explorer teacher, "spent an entire inservice just reviewing and brainstorming similarities and differences in our opinions of outcome-based education as opposed to mastery learning as opposed to continuous progress. We had to define what it was we as a staff were talking about."

The planning was made more difficult because it was unclear if the computer software to support the Rubin hierarchy would be made available by the district. The staff recommendation to postpone implementation for a year while the software was made functional was turned down by the district committee. Explorer teachers then altered their plans to account for the lack of computer technology. Grouping arrangements, use of a learning support center, and intergrade teaching teams were particularly important concerns. The one-page plan they originally submitted to the district stated that teachers would

1. Maintain original skills grouping until prescription capability is available on system (approximately in November).
2. Student movement by individual consideration, not requiring total regrouping until skills grouping is available.
3. Each teacher is responsible for approximately three skill groups.

Teachers also suggested inter-grade systems such as "grades 1–2, 3 - 4, 5–6 or grades 1–2, 3–4, 4–5, 5–6." They noted that the former arrangement would not allow them a common planning time, but that the latter would.

The modified Rubin program began in the fall of 1983 at Explorer. Several organizational changes assisted implementation. The school psychologist assumed responsibility for assigning students, based on their performance on the placement tests, to their appropriate groups. An instructional aide was added to the faculty to assist in maintaining student records. In addition, all regular teachers, the special education teacher, and several instructional aides provided additional teaching time so that the student ratio in classrooms could be lowered.

However, these changes proved to be inadequate. The staff found managing the program in its initial stages imposed more demands than they expected. The Rubin program called for students to progress through the curriculum at their own learning rates. The record keeping soon became overwhelming, however, and the toll on teachers was tremendous. As the principal recalled, "At our building we had some conflicts in terms of burnout. It became real obvious . . . that in trying to hand-schedule kids and move them, and move them, and move them, virtually all of the energy of the staff was being taken by the math program, not leaving a great deal of time for anything else."

". . . we decided that it was going to be a teacher-paced program, not student-paced . . ."

An equally critical consequence was that instructional decision making suffered. According to the principal, "For a few weeks, we allowed ourselves to get into a situation where, I think, the student learning rates were the only thing running the program, not necessarily our professional judgment in terms of what would be good for that child. . . . That's when we decided that it was going to be a teacher-paced program, not student-paced, because otherwise we would be using all 128 skill levels at the same time, and that's not practical."

To rectify the situation, the Explorer teachers decided in those first several months to slow down and return to their original plan. The staff opted for three teaching teams of grades 1–2, 3–4, and 5–6, each team being responsible for only those students within its designated grade levels. Instruction would be teacher-paced, with up to three within-class instructional groups, some student pacing where workable, and some regrouping of students between teachers.

The revisions improved the program considerably. The program, in its third year at the time of our site visit, is operating smoothly. And the teachers enjoy the program. As one teacher told us, "It is hard work, but even with it being hard work, there isn't anyone in our team who would go back to teaching the old way."

Program Description

All grade level students participate in the program, including 12 special education students. Instruction occurs daily for 45 minutes. The students, for purposes of the math program, are grouped into three grade teams: grades 1–2, grades 3–4, and grades 5–6. Kindergarten students do not typically participate, although occasionally some kindergarten students work in the first grade math groups.

Philosophy

The school district in which Explorer is located has had a long history of innovative educational practices. These practices have, according to the principal of Explorer, been based on clearly articulated goals. The current district philosophy of education, adopted by the School Board in 1979 and amended in 1981, states in part that "Almost all students are capable of achieving excellence in learning the essentials of formal schooling."

The advantages of this curriculum structure are flexibility in organizing instruction and increased options for student progression.

The mathematics program has been the program most fully implemented in accordance with the district philosophy. A brochure describing the program to parents, for example, states that "our goal is for students to learn at their optimal rate through appropriate placement and group instruction . . . . As soon as the teacher is confident that a group of students has learned the content of a unit, they take the end-of-unit test. Those who master the unit move on to another instructional unit. Students who do not attain mastery receive additional instruction and demonstrate mastery prior to moving to the next unit."

Curriculum

What Curriculum is Taught? The final Rubin package, following revision by the Curriculum Review Committee in 1983, consists of 140 K–8 units organized into a large learning hierarchy. Each of the units focuses on single topics covering standard elementary and junior high school mathematics curriculum. The topics range from basic number facts at the kindergarten level to seventh and eighth grade topics in measurement, geometry, and integers.

The principal textbook series is *Heath Mathematics*, although many teachers also use activities from the *Mathematics Their Way* series. Instruction is driven by the hierarchy, however, not by the textbook. Textbooks are used as resources rather than as primary guides to instruction. To assist teachers in using the textbook, a chart was developed linking Heath textbook chapters and materials to each of the 140 units.

How is the Curriculum Structured? The 140 units are organized into the extensive learning hierarchy shown in Figure 1. As the figure indicates, the hierarchy is a complex maze of intertwining units. The Explorer staff affectionately refer to it as "Charlotte's Web," after the first name of the district curriculum coordinator who spearheaded the revision efforts.

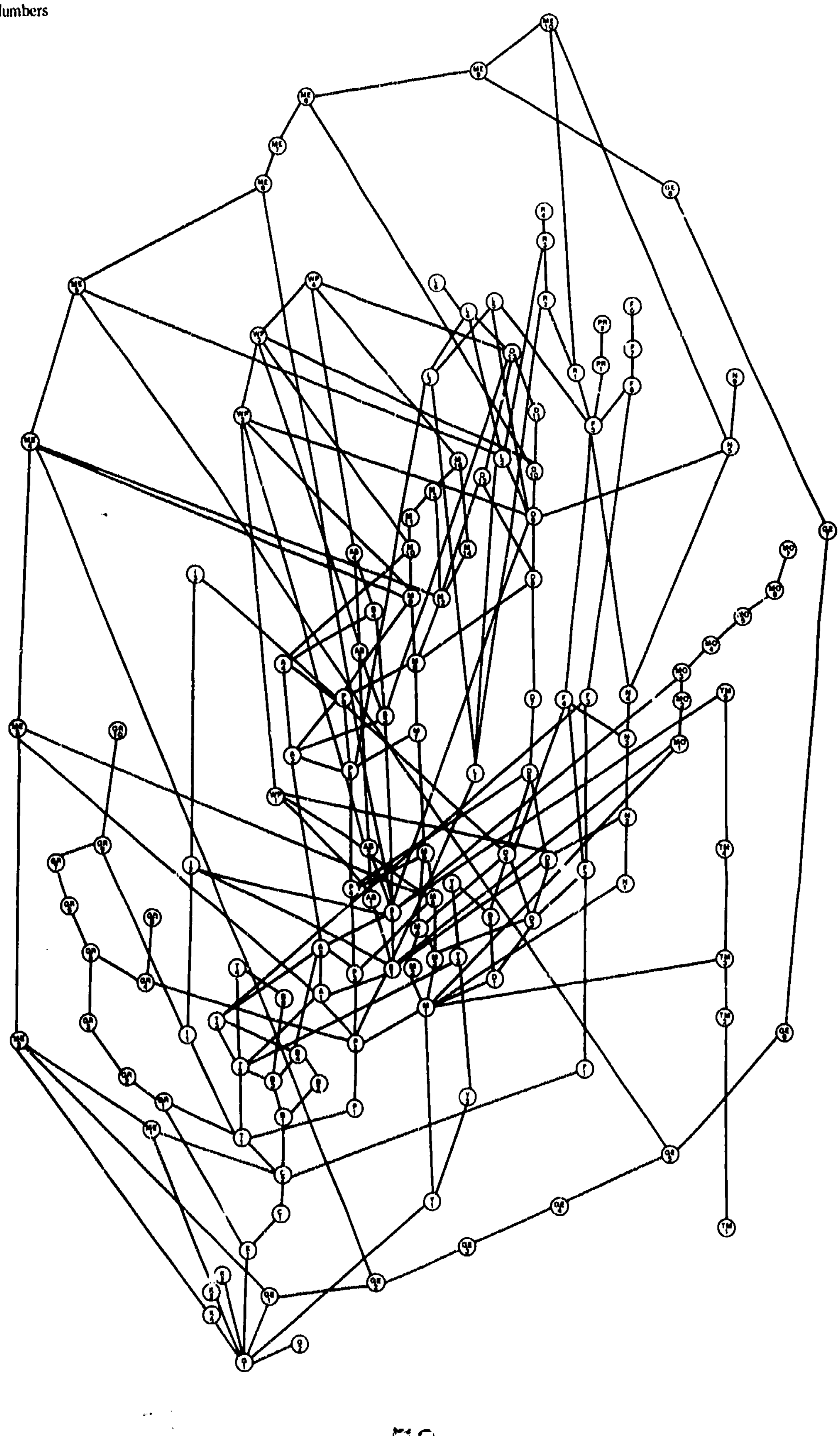
The learning hierarchy provides a curricular road map for teachers. Unlike the linear sequencing of topics common to many mathematics program, the hierarchy offers branching possibilities. Once students have mastered a unit, several new "eligibilities" are open to them. For example, following mastery of Division 5, students are eligible to enter Word Problems 1, Number Theory 2, or Division 6. The advantages of this curriculum structure are flexibility in organizing instruction and increased options for student progression.

The hierarchy is divided into 24 courses, each course consisting of two to

HIERARCHY OF BASIC MATHEMATICAL OBJECTIVES

Strands:

A	Addition of Greater Numbers
AS	Addition and Subtraction of Greater Numbers
B	Adding and Subtracting 0-10
C	Counting
D	Division
F	Fractions
G	Classification
GE	Geometry
GR	Graphing
I	Integers
K	Comparing and Ordering
L	Decimals
M	Multiplication
ME	Measurement
MO	Money
N	Number Theory
P	Place Value
PR	Probability
R	Ratio and Percent
S	Subtraction of Greater Numbers
T	Teen Numbers and Facts
TM	Time
WP	Word Problems—Mixed Operations
Y	Pattern



twelve units. Each unit lists the prerequisite skills required to learn the unit and specific objectives to be covered in the unit. For example, Course A (Addition of Greater Numbers) is divided into four learning units, A1 (Adding 2-Digit Numbers), A2 (Adding 3-Digit Numbers), A3 (Adding Numbers Up To 7 Digits), and A4 (Adding Multidigit Numbers). The A1 Unit is further divided into eight specific objectives (e.g., Student adds two numbers up to 2-digits each, no regrouping, using objects), the A2 Unit into six objectives, A3 into six objectives, and A4 into three objectives.

The courses, units, and objectives are all outlined in a curriculum guide. Examples of the specific objectives for each unit and a list of mathematical symbols and vocabulary for each course are also included. In addition, criterion-referenced tests are available for each unit. One weakness of the hierarchy is a lack of vertical enrichment activities, or "reinforcements," as the Explorer staff referred to them. This has posed a problem for some teachers because some higher ability students, working independently, were moving through the hierarchy too quickly.

The foundation of the mathematics program at Explorer was a commitment to group students according to prerequisite skills.

How Are Students Placed in the Curriculum? A diagnostic test is used to place new students in the curriculum. The test, developed by the Curriculum Review Committee, takes about five 45-minute periods to administer. Because Explorer has a highly transient student population, this diagnostic test is critical to the accurate placement of students. According to the principal, "working with this particular hierarchy has allowed us to plug children in very close to their needs.... This has allowed us to pinpoint skills and lack of skills, that quite often, in a traditional program, would be ignored."

Instruction

How Are Students Organized for Instruction? The foundation of the mathematics program at Explorer was a commitment to group students according to prerequisite skills. Although student-pacing was abandoned early that first year when it became too difficult to manage without computer support, the teachers remained committed to grouping students according to skill. When the staff moved to team teaching, however, each team developed its own approach to skill grouping.

Each grade level team is responsible for organizing their students for instruction. There are six teachers in each of the 1–2 and 3–4 grade level teams and five teachers in the 5–6 grade level team. Teams are primarily concerned with their own students, or, as one teacher put it, "We developed a kind of territoriality... that says we should take care of our own." And each team operates differently.

At the first and second grade levels, there is within-class skill grouping but little cross-class grouping. The team meets regularly to discuss how students are progressing and which units need to be taught, but there is little sharing of students between classrooms. The regrouping that does occur is delayed until the middle of the school year because teachers feel younger students need to first establish a relationship with one teacher.

The 3–4 grade level team does the most cross-class grouping of students at Explorer, regrouping students every three weeks. The team of six teachers is able to offer six different units at any one time for approximately 120 third and fourth grade students. In any one class, therefore, there is a mixture of third and fourth grade students. Teachers meet weekly to coordinate instruction in the six classes.

Every three weeks, the team decides which units are to be taught. Teachers look at what units students have already mastered and the prerequisite skills they have for new units. Teachers then assign students to classes and decide who will teach each unit. The regrouping process, according to one of the teachers, is "very informal, it's what you feel comfortable teaching or really want to teach." Another teacher described the procedure as follows:

> *The first thing that we do is look at these [progress sheets] and the hierarchy. This student has accomplished all of the addition, all of the subtraction, and is into division and multiplication. The next thing on Charlotte's Web says she can go to fractions, and she needs geometry, too. [We go through that] for each child, and as a team we get together and say what skills we are going to teach. . . . Then we look through [the progress records] and find out which students need those skills and we place them into those skills groups.*

At the fifth and sixth grade levels, teachers also meet regularly to determine which units are to be taught and how students are to be grouped. But student regrouping occurs at intervals longer than three weeks. Because regrouping takes place less frequently at this level, there is more student variation within classes. Consequently, we observed more independent work by students than at the earlier grade levels.

The teaching teams do not place students in a group or class with students more than one grade level below them. The reason, according to the principal, is that "we felt that we did not want to put an upper grade student, particularly a fifth or sixth grader, into a situation where they were studying a math skill that a first or second grader might be working with. We felt there would be some rather severe ego implications." Thus, students well below grade level are provided instruction in the learning support center at the school. This center provides academic services to students in Chapter I, handicapped, transitional bilingual, or remedial assistance programs.

How Are Students Taught? While the district curriculum guide defines the objectives to be taught, teachers decide on teaching strategies and materials. More importantly for instruction, however, is the grouping pattern used by the teaching team. Because the grouping arrangements vary from class to class and team to team, the form of instruction also varies. During our site visit, we observed teachers using a variety of instructional forms, from whole-class instruction to a combination of small group and individual, independent work.

In a first grade class, for example, no whole class instruction was observed. The teacher had three groups of students, and she instructed each group for approximately 12 minutes while the other two groups worked on worksheets. Each group had a different worksheet. In other classes, whole-class presentations and undifferentiated work characterized instruction. In one 3–4 math class we observed, students who had mastered the prerequisite skills in Geometry 1 were meeting for the first time in Geometry 2. The teacher had written the first objective for the unit on the chalkboard, and she presented the concept using recitation and guided practice with the whole class for about 15 minutes; independent practice with all students working on the same assignment lasted for approximately 20 minutes; for the last ten minutes, a whole-class recitation reinforced the concept.

Because the grouping arrangements vary from class to class and team to team, the form of instruction also varies.

Instruction apparently becomes more differentiated at the higher grades. In a 5–6 class nearing the end of a course, for example, a mixture of instructional forms was observed: two or three students were working independently on objectives at the eighth grade level; one student was working in the library on a seventh grade objective; and the 20 remaining students were working with the teacher on an enrichment activity associated with the decimal unit on which they had been working. Here, students who are capable of moving quickly through the curriculum are encouraged to do so. The higher ability students, according to the teacher, "are not bored because they have to wait for the rest of the class to catch up."

Assessment

How Are Students Advanced in the Program? When teachers determine that students are ready for a unit test, they give the criterion-referenced test for that unit. The teachers did their own testing rather than use instructional aides, because as one teacher said, "It gives us more information that way... Most of us correct all of our tests." Another teacher said she preferred to do the work herself, "because I can use the results to indicate where reteaching is necessary."

Students who master the test at 80 percent or better are grouped together and taught the next unit, either by the same teacher or a new teacher.

Students who master the test at 80 percent or better are grouped together and taught the next unit, either by the same teacher or a new teacher. Students who do not master the test receive additional instruction by the same teacher or another teacher before moving to the next unit. Some teachers found the latter possibility an attractive strategy, "They don't have to come back to you. They can go to another teacher to be taught, another teacher who has a different technique, a different style. Maybe that is all that it is needed, rather than a kid having to sit in a classroom the whole year long suffering through the same thing."

While the regrouping of students is certainly the cornerstone of the program at Explorer, it is a difficult process which does not always work exactly as planned. For example, students are not always regrouped for corrective instruction, even when test performance indicates that it may be necessary. One teacher described such a situation thus:

> *If I gave the Geometry 1 test and I had four who did not pass, I might just continue on as if they had passed because I will be using the same terms, same figures. I mean the figures aren't going to change while I'm doing Geometry 2 instruction. Then, after a period of days I might decide these kids must have learned it now, and I'll give them the test [for Geometry 2].*

How Is Student Progress Monitored? Every student has a cumulative record which documents criterion-referenced test dates and the test scores for all 140 units. If a student receives a score of less than 80 percent on a unit test, an NM for no mastery is entered on the record. When mastery is finally achieved, the mastery score updates the previously obtained NM score.

This cumulative record of student progress, which follows the student from teacher to teacher, is the primary source of information for grouping decisions. In fact, at least one teacher keeps track of nothing but unit performance, "I don't do as much record keeping because the only thing I have to be accountable for really is whether they passed the test or not. So I don't even keep track of the daily work." Teachers review these records at team meetings to determine which students need which skills. As one teacher commented, "We can see exactly where this little child is. Never in the past in all my years of teaching have I been able to do that for individual kids."

Of course, most teachers also rely on the guided and independent practice segments of each lesson to monitor student progress and to guide their instruction. Daily assignments are used to monitor instruction and adjust teaching accordingly. One teacher remarked that "there aren't many problems with students not doing assignments, because students have been placed in a level which is appropriate for them." As in most classrooms, formative assessment also includes teacher questions, checking progress during independent seatwork, and administering short quizzes.

How Are Students Graded? Report cards are sent home to parents four times per year. The report card is a typical progress report on which all subjects and broad skill areas are listed. The mathematics section is not completed, however. Instead, a computer-printed student mastery report for mathematics only is sent to the parents. This report indicates which units a student has completed and the mastery level achieved. Mastery level is reported as a percentage if 80 percent or higher, or as NM if the unit has been attempted but not yet mastered. The information on the student mastery report is updated regularly as students master the units.

Organizational Arrangements

No administrative changes were needed to implement the program. What was required, however, was that the curriculum be organized into a learning hierarchy with branching possibilities. Teachers had the option to choose from several possible units for their students to attempt next. This provided the flexibility necessary to address differences in student learning rate.

The teaching teams facilitated the periodic regrouping of students. Having small groups of teachers manage the process effectively compensated for the lack of computer assistance. Each group's particular blend of teacher styles resulted in students being regrouped in different ways.

It was important that the teams be allowed to work out their own operating procedures. Allowing the teachers to develop their own regrouping strategies fostered teacher ownership in the program. Indeed, the principal stated emphatically, "Easily the most important element to make this program work would be the type of ownership the staff has in it.... At our building, they feel very strongly that it is theirs. They're going to find a way to make it work even if it isn't working initially.... If it's their program, they'll find a way to make it work because they've invested their own integrity, their own prestige, their hearts into it."

Of course, for this program to work, teachers must be willing to work together, or as one teacher put it, "to be successful with this, you have to like the people you're working with.... There are places I could go where you wouldn't want to get involved in [this program] just because of the people you have to work with."

Summary: The Routinization of Classroom Practice

Certainly a major strength of the mathematics program at Explorer is the emphasis placed on making instructional decisions about what students are to learn next. The lack of computer technology resulted in teachers having to meet in teams to make decisions about which units to teach and where to place students. The teaching teams helped to eliminate feelings of isolation among teachers, and allowed teachers to break out of the routine of "a regular program, a regular classroom, in a regular book, and just going from page to page from day one." Teachers must be willing, however, "to let go of their nice little cozy homeroom bunch."

It is interesting to speculate how the program would have evolved had the computer software been available for regrouping purposes. The computer may be a more efficient way of making regrouping decisions, and it takes the onus for such decisions away from teachers. However, with a computer, the frequent meetings which generate the sharing of ideas and materials and assist teachers in dealing with the frequent regroupings of students would not occur. Furthermore, teacher decisions are likely to be more informed than computer-assisted decisions. It is easy to see how a computer-based program could lead to routinized instructional decisionmaking and a return to classroom isolation.

There are several reasons why the mathematics program at Explorer has been somewhat insulated from routinization. The first reason is that teachers work together to make instructional decisions and share the burden of regrouping students. As one teacher described, "I like being with people because they challenge you. Then you start doing new things and sharing ideas."

A second reason is that teachers are working with different groups of students. As one third grade teacher mentioned, "I get an opportunity to work with different children, different levels, and it's nice. You don't get burned out on it." Another teacher voiced the same opinion, "I like the grouping, I like the change, I like getting to know all the kids." In effect, each teacher is able to start afresh following each regrouping, each new group providing new challenges.

A third reason the program at Explorer may resist routinization of instruction is that the insistence upon mastery for each student "puts additional pressure on the teacher to develop new ways of presenting old material in the second cycle, when the child hasn't learned everything you've been trying to teach and has to be recycled." Teachers are also accountable for their instruction since they share students and the results of their instruction are made public. Several teachers mentioned the peer pressure to provide excellent instruction.

Even so, the press for routinization is powerful. Collegiality, regrouping of students, and public accountability may not sufficiently insulate the program over an extended period of time. As one teacher remarked, "I remember at the beginning, I thought there was a lot of work. It's just become a routine now."

Barcelona School: Using Learning Laboratories to Increase Instructional Options

Introduction

What curriculum students should learn next is a decision teachers continually make during the school year. This decision becomes especially problematic to teachers when the immediate learning of students has been less than adequate. Should teachers progress anyway, hoping that learning will somehow click for those students who initially failed to demonstrate mastery? Or should teachers slow down the pace and reteach the material, giving the slower students a chance to pick it up and be handicapped when reaching the harder material? If teachers do slow down, they must then do something about the faster students who are likely to become bored by the slower pace in material they have already mastered.

For teachers working in self-contained classrooms, the options available to answer these questions are usually limited. Teachers must somehow deal with the learning of slower students while not holding back the faster ones. But teachers faced with the tasks of managing and instructing 20–40 students varying in their readiness to learn are not in a position to be elaborate in their instructional plans. And the immediate options available to them provide no ready solutions, only compromises.

One option is to group students for instruction. By grouping students, teachers can differentiate curriculum and better match the curriculum to the learning needs of each group. In fact, this is the way many teachers handle reading and mathematics instruction. However, grouping leaves the majority of students on their own for large periods of time while the teacher works with each small group. And grouping requires teacher energy. We suspect the reason many elementary teachers group for reading but not for mathematics is that to group for both subjects would be too taxing.

Another option is to allow students to learn at their own pace. Presumably each student can then be provided with the curriculum matched with his or her learning needs. But making each student a group of one extends the burden on teachers from managing three to five small groups to managing as many groups as there are students. The difficulties of instructional management associated with monitoring each student's location in the curriculum also drains teachers' energy.

Thus, it is no wonder why many teachers faced with limited options and a room full of students accept the textbook as the foundation for instruction. The textbook provides a minimal compromise position, since teaching from a text allows teachers to manage the learning of the majority of students. With the majority of students under control, teachers can direct attention to the outliers in the group, both the slower and more advanced students. This may not be a desirable solution, but it is workable for many teachers.

For instruction to be more responsive to the range in student readiness, options must be available to the teacher. Extraordinary effort on the part of teachers can sometimes increase options, but the toll it extracts in terms of energy and motivation can be high. Organizational changes can also increase options by enhancing teachers' ability to group students for instruction and varying time to accomodate the slower learners.

This case study focuses on a unique program for teaching reading and mathematics that was developed at Barcelona School, a large K–8 school. The instructional programs at the school combined flexible grouping with a learning laboratory where students learned individually at their own pace. This organizational arrangement helped teachers decide how students should be grouped for instruction. And although decisions about what to learn next were more limited because the curriculum was highly structured, slower students could spend more time on the same curriculum without impeding other students.

The foundation of these reading and mathematics programs was a well-structured curriculum and a computerized instructional management system which tracked students' progress through the curriculum. One benefit of this program is that student progress was easily monitored by teachers and administrators alike. According to the principal of Barcelona School, "I can't imagine how anybody does this job without this kind of system. I mean, we have the information at our fingertips, literally. If there's a parent waiting out in the office right now, in three minutes I could tell her exactly what her child's doing in math and reading."

Another advantage of the program is the specific information available about what students have learned and what they need to learn to progress at a satisfactory pace. "You feel so much like a professional, like you know what is going on," continued the principal. "You know what is being taught in the school, you know what kids are learning, you know whether the job's getting done or not. So from those two perspectives, I can't imagine how people are still in the dark ages and why they don't change." A sixth grade teacher voiced a similar opinion, "If I look at it selfishly, I think I like traditional methods because I teach one subject. But when you look at it for the real reason why we're here—to benefit the kids—I think the present situation is ideal because you do not penalize the student. You have a diagnostic, prescriptive type program."

We first describe the school setting and how the program came about at Barcelona School. We then take a close look at the structural and operational features of the program. Our case study concludes with a brief analysis of whether this program increased instructional options for teachers.

Program Implementation

Setting

Located in a suburb of a large, sprawling southwestern city, Barcelona School rested on approximately ten acres of land in a largely residential area. Barcelona is one of eight elementary schools in a district serving approximately 6500 students. Despite being 26 years old, the school buildings were in excellent condition. The south end of the campus housed classrooms for grades K–4, the suspension room, a reading lab, a computer room, an auxiliary office and nurse's station, and the school cafeteria. The north end of campus housed classrooms for grades 5–8 and included two reading and two math laboratories, the library, the physical education buildings, and the main school offices. Large play areas surrounded the school. A certificated staff of 56 directed the instructional programs for 1037 predominantly white (85%) and Mexican-American (11%) students.

Implementation History

The reading and mathematics program had their beginnings in 1968, primarily through the efforts of Chuck Adams, a literature teacher at Catalina School, another school in the district. Frustrated by the poor reading skills of his students, Adams decided that a more systematic approach to instruction was needed. Influenced by the individualized instruction climate of the late 1960s, Adams spent the 1968–69 school year outlining and sequencing a set of basic reading skills for grades K–8. Instructional materials, prepared in the form of workbooks and audiotapes, were keyed directly to the skill and designed to be used by students working individually in a laboratory setting.

Adams was able to convince the school board to print the workbook material, produce the audiotapes, and purchase the necessary equipment. In the fall of 1969, the first basic skills laboratory in the district was established at Catalina School for grades seven and eight. During that year, three additional teachers worked with Adams in developing the program. By the end of the second year, the program was operating for all students in grades three through eight.

One of the problems faced early in the development of the program was the isolation of the laboratory staff from the rest of the faculty. Initially all the instruction was done by Adams and a few faculty members. Teachers not associated with the basic skills program did not know how it operated, the program existing as "an island within the school." Many of the faculty felt little ownership in the program and considered the laboratory a "district program"—and a favored one at that, due to the amount of funds allocated by the school board. As we will see later, the autonomy of the laboratory staff may have set the tone for future teacher interactions.

The program was successful and quickly expanded throughout the district. The current program director, one of the teachers initially enlisted by Adams in 1970, recalled how the program expanded: "It just gradually became a district-wide program because the [test] results were starting to show up. . . . The results were such that the [school board] decided that they would go ahead and spread the program across the district." By the 1972–73 school year, the reading program was being used in all the district schools with support from a newly created basic skills department in the central office. Today, all district schools have fully equipped reading laboratories for students in grades three through eight.

As the first basic skills director, Adams started a mathematics program in 1979 based on the same principles as the reading program. By the end of 1982, all schools in the district were operating mathematics laboratories for students in grades five through eight. In addition, two schools had mathematics laboratories for third and fourth grade students. Thus the reading and mathematics programs had been well disseminated throughout the district. As the principal responded when asked how the program operated in other district schools, "You would see the same objectives, the same program, the same worksheet materials."

The basic plan behind the laboratory approach of Adams was a sequential curriculum and a method for monitoring student learning of that curriculum. Students would come to the laboratory for reading and mathematics instruction. Their regular teachers would then be available for small group instruction. Students would spend part of their time in the laboratory and part of their time with a teacher in small group instruction. This plan has evolved into an unique program combining individualized and small group formats.

Program Description

The reading and math curriculum was outlined for all K–8 grade levels. However, the scheduling of students into the reading and mathematics laboratories varied by grade level. Students in grades K–2 remained with their homeroom teacher for their mathematics and reading instruction and did not participate in the laboratory program. Students in grades 3–8 participated in one of three reading laboratories organized into grade level pairs of 3–4, 5–6, and 7–8. And students in grades 5–8 participated in one of two mathematics laboratories in grade level pairs of 5–6 and 7–8.

Philosophy

Current district policy adheres to a continuous progress philosophy. As stated by the Governing Board:

> Continuous progress program recognizes the great variability in the learning rates of children. The fact that one child learns more slowly than another should not preclude the slower student the opportunity to successfully complete the work assignments. Extending this thought over a period of years makes it obvious that the slower student may need an additional year in the elementary grades to be prepared to be a success in high school.
>
> One of the major controlling factors in learning is the amount of time a student spends on the learning tasks. Based upon this knowledge it is unrealistic to expect that a heterogeneous group of children would learn a given amount of content when they have all been given the same amount of time each day and the same number of days in the school year.
>
> Retention at grade level is one of the few options the Board has to provide for the student needing additional time on task. Unfortunately, in the past giving students more time at a grade level, or retaining a student, was equated with failure and with punishing a "bad" student. This Board, however, is committed to the concept that retention at grade level will provide additional time and help from a teaching staff dedicated to helping all children achieve.
>
> Promotion is based upon student mastery of the objectives contained in the Board-adopted curriculum guide. Mastery is defined as the student having learned the skill sufficiently at each grade level to insure success at the next grade level.

The school board's policy to make student promotion contingent upon achievement of basic skills was clearly reflected in the district's instructional programs. Improving test scores in reading and mathematics were major goals for the year set by the Barcelona School Community Council. According to the principal, "Three years ago, the school board said our priority is math and reading. We were aiming to be number one in the state in a five year period. At first, this caused a lot of consternation, but now it's just the way it is." A teacher put it more bluntly, "Reading and math have always been very emphasized in this district, and that's it."

Curriculum

What Curriculum Is Taught? The curriculum for the reading and mathematics basic skills programs was outlined in grade level objectives for grades K–8. In reading, there were 336 objectives, ranging from 32 at the kindergarten level to 27 at the ninth grade level (note that the reading objectives extend to the ninth grade level). In mathematics, there were 283 objectives, ranging from 21 at the kindergarten level to 38 objectives at the eighth grade level.

The reading objectives used at Barcelona were essentially the same ones developed by program originator Adams fifteen years earlier. The reading objectives were organized into five broad areas in the district scope and sequence curriculum guide: perceptual skills, word analysis skills, vocabulary skills, comprehension skills, and study skills. These were further divided into 18 subcategories, ranging from visual and spatial perception skills at the primary grade levels to inferential and evaluative comprehension skills at the upper grade levels. Examples of each objective were given in the curriculum guide.

The mathematics objectives, on the other hand, had been reworked several times during the past six years, mainly as a result of teacher suggestion. Like reading, the mathematics objectives were categorized into three major areas in the district scope and sequence curriculum guide: perceptual skills, concepts and numeration, and concepts and applications. Within these broad areas, 15 different subcategories of typical mathematics topics were identified. Examples include whole numbers, decimals, fractions, money, ratio and proportion, measurement, and probability and statistics.

How Is the Curriculum Structured? The objectives for both reading and mathematics were organized into levels corresponding to the K – 8 grade levels. The one exception was the addition of a level nine in the reading program. Students were expected to master all objectives within each level sequentially. The curriculum was set up so that "an average child is expected to master a level in a year."

Each reading and mathematics level was divided into separate instructional parts. Each part contained approximately seven to 15 sequential lessons with several lessons per objective, each lesson requiring from one to several days to complete. The district developed books that contained the student worksheets and activities.

How Are Students Placed in the Curriculum? Students new to Barcelona took the California Achievement Test (CAT) for placement testing. The CAT scores were the major criterion for grade level placement and also guided teachers in determining the appropriate level of the basic skills mathematics and reading placement tests to administer. The placement tests corresponded to each of the instructional parts of a grade level.

Instruction

How Are Students Organized for Instruction? Students in the laboratory programs divided their time between the laboratory teacher and the small group teachers. The district suggested that the time be evenly split, with students enrolled for two quarters in each setting. In fact, students' schedules varied according to grade level, subject matter, the particular style of the laboratory teachers, how well students were learning the objectives, and, sometimes, student preference for the laboratory or small groups. For example, some students may only spend one quarter in the laboratory. Other students, especially those below grade level, may spend three or four quarters in the laboratory. In addition, students below grade level may be assigned to an additional remedial period during the day in the laboratory. Additional laboratory time, however, was not restricted to remedial purposes. As one laboratory teacher described the instruction, "We have materials here that will take care of the lowest as well as the highest students, so they're all individually programmed."

The laboratory teachers were responsible for seeing that students pass the grade level objectives. Consequently, for reading in grades 3 – 8, and for mathematics in grades 5 – 8, the laboratory teachers decided which students remained in the laboratory and which students were assigned small group instruction with their regularly scheduled teacher. They directed the instruction of the regular teacher, or as one laboratory teacher put it, "I tell them what to teach and who to teach." How to teach is left to the discretion of the small group teacher. In mathematics, for example, one laboratory teacher examined the printout of the test scores every Monday. "I've noticed that these people have not passed their tests, have not passed these particular skills. So, for last week and this week, I sent these students to a particular teacher, a small group teacher, and I told that teacher to concentrate only on these skills."

Students in the laboratory programs divided their time between the laboratory teacher and the small group teachers.

Student assignment to small groups was based primarily on common learning needs, although laboratory teachers often considered the teaching styles and personalities of the regular teachers in making their decisions. These groups, as was true for the laboratory classes, may have consisted of students from the same grade level or from two adjacent grade levels. The latter grouping apparently occurred less frequently, as suggested by this district administrator's statement: "This is probably one of the hardest things for me to get across even to the lab teachers, that the level is not what has to be common, the skill needs have to be common."

Each laboratory accomodated about 35 students in one period. The small group teachers had approximately 15 to 20 per class. These figures varied, however, as the grouping arrangements were flexible and frequently reassessed.

How A Students Taught? Teachers in the laboratory programs must share a commitment to individualized instruction, according to the basic skills director, "because it does mean more time invested than... teaching down the middle or having the high group." The strategies teachers used to individualize instruction varied, depending primarily on whether students were in the laboratory or in the small groups. To a lesser extent, subject matter and grade level also determined the choice of teaching techniques.

Teachers in the laboratory programs must share a commitment to individualized instruction, according to the basic skills director, "because it does mean more time invested than . . . teaching down the middle or having the high group."

Instruction observed in the laboratory settings for both reading and math was almost entirely individualized and student-paced. Students sat in study carrels, worked from basic skills textbooks, and had their work corrected by the instructional aide. During instructional time, the primary responsibility of the laboratory teacher was to monitor student attention and provide tutorial help to students during the course of the 50-minute period. However, if several students required instruction on the same or similar skills, the laboratory teacher could elect to conduct small group lessons rather than delegate that task to the regular teacher.

Instruction in the *small groups* varied more by content area. In the *reading* classes, called literature classes by the teachers, instruction was generally whole-class, teacher-paced discussions or sustained reading. However, small group teachers often supported basic skills rather than directly taught them. This practice started when the program was first getting off the ground and will be discussed in more detail later in the section on "Organizational Arrangements."

In *mathematics*, small group instruction was almost entirely student-paced with the use of student folders. The small groups were essentially satellite laboratories, with little difference in student activities, materials, or instructional methods than what existed in the laboratory. One teacher described provided this description of classroom instruction:

> *This folder tells students what pages in the book to read and to work at They do the problems, and they correct their own work. Then they come to me and say, "Okay, I've done this and I've tested so many." If they miss a lot, I go back and correct their mistakes. If they miss one or two, we hop on with it. . . . When they have completed [the skills] I give them a review sheet. If they have done well on the review sheet and they feel comfortable, then I send them to the lab and the lab does all the testing.*

While direct instruction with the whole class was desired, the classroom management concerns raised by student pacing interfered:

> *I try to have a lesson at least three times a week but sometimes I don't get that in. I know that people would like it everyday, but I get working with students like this and they've got their folders and they need help on one specific thing. I have a number system. They take the numbers, and, sometimes, all the numbers are gone before roll is taken. That's not the day I'm going to do anything because there are so many questions.*

Another teacher remarked that he liked to provide group instruction "at least once a week for at least thirty minutes."

Assessment

When Are Students Advanced in the Program? There were two levels of program advancement: the movement of students through the curriculum and the promotion of students from one grade level to the next.

Program Advancement. Students advanced within the program based on test performance at three levels. First, individual skill mastery was assessed by tests following lessons over the skill. Nonmastery required further work. Second, following instruction over each part of the curriculum (every five to eight skills), another test, broader in scope, assessed student achievement of the five to eight skills. Corrective work was assigned for individual skills not retained. Third, when the student had completed all skills at a grade level, the student was again tested over all grade level skills and corrective work assigned when necessary.

Grade Level Promotion. The promotion policy established by the school board was a key feature of the reading and mathematics programs. Grade level promotion was directly linked to mastery of grade level objectives. According to the principal, the board "put teeth in [the program] when [they] said [students] will not be promoted [unless they pass]. That's when everything changed."

Promotion required that students achieve 100 percent of all grade level objectives in reading and mathematics. Retention was recommended for students who had not achieved at least 80 percent of the objectives by the end of the school year. However, a loophole in the board policy provided principals with some flexibility. A principal could "conditionally retain" or "conditionally promote" students.

A conditional retention could be granted to a student who has passed at least 80 percent of the objectives (but less than 100 percent). This meant that the student would be temporarily assigned to the same grade level in the fall. If the student demonstrated mastery of the remaining objectives by the end of the first quarter, the student would be promoted to the next grade level. However, if the student did not complete the objectives, he or she would be retained at the grade level for the remainder of the school year.

If parents balked at their child's retention, the principal could conditionally promote the student. However, if the student failed to achieve the remaining objectives by the end of the first quarter, the principal reassigned that student to the previous grade.

How Is Student Progress Monitored? Laboratory teachers indicated mastery of objectives on student record cards which were stored in a laboratory notebook. Included on this card were enrollment information, placement test results, dates of assignment to specific skill levels, test scores, and dates of completion of skill levels. A laboratory aide kept track of this information and forwarded it to the office daily, where a computer clerk entered the data on the district office mainframe computer.

An instructional management system in the district office generated reports on which skills had been mastered and which ones remained. The Barcelona School computer clerk used these reports to provide weekly printouts to all the homeroom teachers specifying which skills their students had or had not learned. In addition, any teacher, counselor, psychologist, or administrator could call up data from the computer to get current information regarding the student's academic achievement.

One advantage of the information system was that records were easily transferred from one school to another when students moved within the district. According to the basic skills director, "A lot of our children transfer from school to school. The beauty with this program and the consistency of the record keeping and the testing is, if a child leaves Barcelona School, they send us the records. If that child checks into another school, they call us, often the same day, so that the next day we. . . put these records in the mail to the teacher and that child is working in two days on the same material."

A second advantage was the ability to monitor student progress through the curriculum. One of the laboratory coordinators stated this well: "I like the program because I really know what the kids are doing. Nobody gets away with less.

There's none of this sneaking-by-the-system business. One of the keys is that I know what the child can and can't do. Nobody gets lost."

How Are Students Graded? All Barcelona students receive quarterly report cards. A copy of the grade level objectives in reading and mathematics for the student was attached. Grades were not assigned in these subjects. Rather, progress was reported as objectives achieved and objectives yet to be mastered. In accordance with board policy, parents were notified when their child fell below the expected mastery rate at the end of the second and third quarters. They were also informed that retention would be considered if all objectives are not mastered by the end of the school year.

Board policy also required that the principal request a parental conference for students not mastering all grade level objectives. As the school year drew to a close, there was more pressure on teachers to bring students up to grade level. For teachers, especially those in the mathematics laboratory, seeing that some of their students avoided retention was primary over reviewing curriculum. As one laboratory coordinator argued, "If you are a year ahead or at grade level, there's no pressure on me, there's no pressure on them, and so we have plenty of time to review. . . . For a child who's a year behind, I don't have time to review. He needs to get down the road." The principal reported that some students in the junior high are taken out of all classes except for the reading or mathematics laboratory to allow sufficient time to master objectives for promotion or graduation.

Organizational Arrangements

The major administrative change was the arrangement between the laboratory teachers and the small group teachers. There needs to be good coordination and communication between the two faculty groups. To understand why this is so, it is necessary to examine in more detail the implementation history of the laboratory program.

Early in the development of the reading program, laboratory teachers held full responsibility for teaching the basic skills objectives. Consequently, the small group teachers had developed literature lessons that were not tied to the reading objectives. "They were doing a reading program with the use of library paperbacks and just written book reports," recalled the basic skills director. "So to break that habit we purchased actual literature books, correlated them to the objectives, provided them with worksheets, all this stuff that designated a portion of those objectives as partly their responsibility." However, teachers have not totally dropped that habit, according to the principal:

> *Frankly, what goes on a lot in reading is the literature concept. And that was because it originally started out as that. The literature, the small group reading, was going to be fun. We were going to teach enjoyment and appreciation and that kind of thing. And so the small group teachers are doing that. There are some fascinating things going on there, but they are basically unrelated to the mastery of skills that the lab is working on.*

The problem that arose in the small group reading classes, where teachers did not directly link their instrution to the basic skills instruction taught in the laboratory, also surfaced in the small group mathematics classes. Recalled the basic skills director:

> *When they first started the math labs, they weren't expected to teach specific objectives to groups. If they wanted to do the "fun things" with math, they could do that as long as they were instructing. Well, that too, turned out to be less than appropriate, taken advantage of grossly by some, not at all by some. A specific guideline became, "You will, in fact, teach skills; you are as accountable as the lab teacher."*

The lack of complete communication and coordination between the curriculum and instruction across the two instructional settings stemmed from the assignment of full responsibility for basic skills to the laboratory teachers and perhaps from the hierarchical relationship between the two faculty groups. "As soon as you try to get the small group teacher to help, then you've got two labs, and we've not overcome that problem," the basic skills director said. "One of my biggest pleas in the last three years has been, 'Look folks, you're on the same campus, 90 percent of the time you're within two doors of each other. Will you sit down and talk? Look at that computerized list, and say to the small group teacher, 'What do you teach best?' " Similarly, the principal said, "One of the problems is that the regular classroom teachers can't accept any responsibilities for the teaching of reading or math. It's all the lab's problem now. And that's a mistake. There's not a buy-in by the regular teachers."

Summary: Increased Instructional Options?

We opened this site report by suggesting that the program at Barcelona School was capable of increasing instructional flexibility by providing options to teachers not available in self-contained classrooms. The question we address here is whether instructional flexibility was in fact increased at Barcelona School.

The answer is a qualified yes. The affirmative comes from the fact that the laboratory arrangement provides for flexible skill grouping, additional learning time when needed, close monitoring of student achievement, and the availability of teachers for tutorial instruction when necessary. The qualification comes from the fact that Barcelona may not be taking full advantage of these opportunities for flexibility.

Why do we believe that opportunities have been missed at Barcelona? What impedes teachers from making use of an organizational arrangement designed to provide them with options for instruction? Is it the system or the people using the system? As one district administrator offered, "I don't know if it's from the way our system evolved or if that is just part of the teacher syndrome."

We suggest that a critical feature of a flexible grouping system is communication between teachers. If communication breaks down or is impeded, the information exchange that flexible grouping requires is no longer there. Consequently, the benefits of such a system start to erode. A lack of dialogue can limit both the generation of ideas and the sense of commitment on the part of the teachers.

We found some evidence at Barcelona that communication between the laboratory teachers and the regular teachers was limited. For example, we asked one of the laboratory teachers whether there was a need to meet with his small group teachers on a formal basis. His response was, "What are we going to talk about?" Without the commitment that comes with a sense of ownership, there is always the danger that the system will regress to the least common denominator. In the case of skill-based programs, that may be simply an accountability system which, in the words of the principal, "breaks knowledge into little bitty components that are all meaningless. It never gets back together."

In summary, the laboratory program at Barcelona has increased the instructional options for teachers. At the same time, the teachers may not have taken full advantage of the options. This does not mean that the program is not a good program, but rather that there is room for improvement.

CHAPTER FOUR

Flexible Grouping, Continuous Progress Approaches

This chapter presents a single case of a flexible grouping, continuous progress approach. This approach was developed by Dr. Stephen Rubin of New Canaan, Connecticut. The model developed by Dr. Rubin has been expanded and embellished by the sites that have purchased and implemented the program. Dr. Brent Thorne, Assistant Superintendent of North Sanpete School District, has contributed much to the development of the program.

This approach represents the most sophisticated model of instructional organization presented in this casebook. The model provides for both the regrouping and continuous progress of students through the curriculum. Because students are moving between classes and the testing center frequently, one "sees" this program in action more easily than any of the other programs when one visits a school.

Ironically, while the program is organizationally sophisticated, it is one of the easier programs to implement. This is because the curriculum is purchased and no curriculum development work is necessary. Although most sites have added their own curricular touches, this is not necessary. Adding curriculum to the existing curriculum, however, does require the computer software to be adapted. This requires new programming to be completed.

North Sanpete School District: Combining Continuous Progress and Direct Instruction in Mathematics

Introduction

Students differ in their rate of learning. Because of these differences, it is often hard to provide whole-class instruction at the appropriate level of difficulty. The pace is often too fast for some students while too slow for others. One way to overcome this problem is to allow students to progress at their own rate of learning through the curriculum.

Individualizing the instructional pace for students is certainly not new. A number of administrative plans were developed about the turn of the century providing for different learning rates through the graded school system (see "Some Early Administrative Plans for Student Promotion"). These administrative plans, like the Pueblo Plan, the Cambridge Plan, and the Batavia Plan, accommodated differences in student learning rate either by having more able students do more work in the same amount of time (enrichment) or the same amount of work in less time (acceleration). Unfortunately, while such plans overcome some problems of whole-class instruction, they create other problems of their own.

One problem of student-paced instruction is monitoring and managing the learning of students. Teachers must make assignments, administer and correct tests, and maintain records of student learning. In addition, they must identify poor learning and prescribe corrective instruction when necessary. Attempting to do this for each student rather than a single class is time comsuming and draining for a teacher. In fact, instructional management problems were a major reason for the loss of interest in individualized instruction in the early 1970s.

A second problem with student-paced instruction is providing direct instruction. Teachers must make judgments about where instruction should be targeted when students are spread out in the curriculum. This problem is often intractable. Even if teachers can identify small groups of students who might profit from direct instruction, they must still attend to the rest of the students in the class. It is difficult to provide anything other than instructional packets or folder instruction for students.

What is needed is an instructional program that provides student-paced instruction, can be reasonably managed, and can also accommodate direct instruction.

In short, whole-class instruction does not adequately deal with differences in students' learning rates. Yet simply allowing students to learn at their own rate is not always a feasible alternative. What is needed is an instructional program that provides student-paced instruction, can be reasonably managed, and can also accomodate direct instruction. Such a program would retain the benefits of teacher-directed learning while allowing students to progress at a pace commensurate with their own abilities, skills, and interests.

Some Early Administrative Plans for Student Promotion

By 1870, the graded school organization, with courses of study and defined time allotments for curricular areas, was well entrenched in American education. Not long thereafter, educators began to devise ways to overcome some of the shortcomings of the graded school.

The primary problem, as perceived at the turn of the century, was the large number of "retarded" students not promoted at the end of the school year and who were required to repeat a grade. Child labor legislation and compulsory attendance laws, passed early in this century, exacerbated the problem. But promotion was not the only difficulty. Students were being dropped from the educational system because of social and motivational problems associated with being grade level repeaters.

One of the first large surveys of the promotion problem was reported in 1909 by Leonard Ayres in *Laggards in Our Schools*. Based on his survey of a number of large city school districts, Ayres estimated that 33 percent of all students were retarded in grade level, and that only one-half of all students finished the eighth grade, and only one in ten finished high school. Ayres ended his book with the following conclusion: "We have seen that a large part of all the children in our public schools fail to make normal progress. They fail repeatedly. They are thoroughly trained in failure. The effect of such training should be carefully considered, for the problem it presents is a grave one." (p. 220)

In response to this promotion problem, a large number of administrative plans were developed and implemented about the turn of the century. The plans varied widely. The first comprehensive plan to introduce flexibility into the graded school was developed by W. T. Harris, Superintendent of the St. Louis schools from 1867 to 1880. The so-called St. Louis Plan was a quarterly promotion plan in which courses of study were divided into four ten-week units with promotions possible every ten weeks. However, individuals were promoted, not classes. Thus, classes were heterogeneous, the plan simply making it possible for abler students to progress at a rate faster than others.

Preston Search is generally acknowledged as the first to advocate continuous progress for students. As superintendent of the Pueblo, Colorado, schools from 1888 to 1894, he developed his "Pueblo Plan" which allowed students to follow individualized programs at their own pace. This program is described in his book *An Ideal School* published in 1901.

Another administrative plan was the nine-year elementary course of Cambridge, Massachusetts, also known as the Double-Track Plan. The first three grades were completed by all students; several months into the fourth year, however, students were divided into one of two tracks for the final six years. One track could be finished in six years, students being classified by typical grade levels. The second track could be finished by abler students in four years, and students were classified into four grades, A, B, C, and D. Students could also be moved between the two tracks to complete the course of study in five years, either from regular to fast (i.e., grades 4, 5, 6, C, D in five years) or from fast to regular (i.e., grades A, B, 7, 8, 9 in five years).

The Batavia Plan was developed by John Kennedy, Superintendent of Public Schools in Batavia, New York. The plan was developed largely by accident. An additional teacher was hired due to an increase in students. However, all the classrooms were occupied. Because many of the classrooms were constructed to hold 60 to 70 students, Kennedy proposed placing the extra teacher in one of the larger classrooms and filling the classroom with students. One teacher could provide direct instruction while a second teacher could provide individual assistance to students who could not keep up with the rest of the class. This "class-individual" system was viewed as an appropriate compromise between class instruction and individual instruction.

The Santa Barbara Concentric Plan was developed during Frederic Burk's one year as Superintendent of the Santa Barbara City Schools. Burk's wife Caroline, also an educator, described the plan tested during the 1898–1899 school year in an article entitled "Promotion of Bright and Slow Children." The plan divided each grade into three "concentric" sections, A, B, and C, with abler students progressing from C section to B section to A section. Fast students could be promoted to the C section of the next grade level. A pupil doing the minimum amount of work stayed in the C sections of each grade each year. The work in each grade level section was similar in content, but B and A sections were more difficult and provided more depth.

The Platoon Plan, or work-study-play schools as they were known at the time, was developed by W. A. Wirt, first in Bluffton, Indiana, and then later in the schools of Gary, Indiana. Platoon schools divided students into two platoons which alternated between work on fundamental subjects in homerooms for half the school day and activity subjects in special classes for the other half-day.

An instructional program in mathematics that appears to do this is the one developed by Dr. Stephen Rubin at the Center School in New Canaan School District, New Canaan, Connecticut. Major features of the program include (1) student self-pacing with frequent reassignments of students to new instructional groups, (2) a centralized computer management system that assigns students to new groups and maintains records of student learning, and (3) direct instruction from the teacher responsible for the particular objectives being taught in the group.

The mathematics program at Center School (no longer in existence) produced very positive results in the academic achievement of its students. For example, data collected over a six-year period indicated that no more than one or two students per year in the entire school failed to reach grade level on standardized mathematics tests. In addition to dramatic learning gains, the Rubin math program, as it is now known, was credited with three other beneficial outcomes. Rubin and Dr. William Spady outlined these points in an article pubished in *Educational Leadership* (see Rubin and Spady, 1984).

First, teachers have greater freedom to teach. "Because the task needs of students in their class at any one time are quite narrow, teachers are relieved of the multiple pressures of task diversity, time and classroom management, and individualization that characterize most classrooms." Teachers are able to concentrate on collecting and using the best materials and techniques available for the set of objectives they are responsible for teaching.

A second outcome is shared accountability. The flexible grouping arrangement and frequent student reassignments mean that teachers will work with most of the students in the school at one time or another. Consequently, no one teacher is held exclusively accountable for a student's achievement. "Because everyone contributes to the success of the student body," reported Rubin and Spady, "everyone shares in its successes."

The third outcome attributed to the program is increased staff morale and cohesion. "Because the vast majority of students learn so well under this system, their success reinforces the teachers' sense of success and efficacy. The result is a positive team feeling and renewed staff vitality."

The Rubin math model has now been implemented in five school districts besides New Canaan (see "Schools and Districts Using the Rubin Math Model"). North Sanpete School District, located in rural central Utah, has perhaps done the most to revise and develop the program.

Educators in North Sanpete first learned of the Rubin math model in March 1984 during a conference on Outcome-Based Education sponsored by the Utah State Office of Education. After making site visits to other districts following outcome-based principles, the Board of Education decided to adopt the Rubin math model. Using funds made available by the state legislature, North Sanpete purchased the objectives, the criterion-referenced tests, the computer software, and the training. Dr. Rubin and his staff trained 35 administrators and trainers in the operation of the program.

Because the computer software was inadequate for its needs, North Sanpete began to examine other management systems. A mathematics program developed by Gary Guyman at Whitehorse High School in Utah was adapted for use in North Sanpete with Brent Barlow doing the computer programming for the Rubin hierarchy.

The program in North Sanpete was piloted in 1984–85 in two elementary schools and one middle school. North Sanpete educators made various modifications in the program, including the addition of new curricular topics and the development of a new computer software management system. In 1986-87, the remaining three elementary schools in the district implemented the program after receiving training from their colleagues (see "Some Key Implementation Events at North Sanpete").

The five elementary schools and one middle school in North Sanpete School District are relatively small. The smallest elementary school has 120 students and five teachers while the largest elementary school enrolls 580 students with 18 teachers. The middle school has 470 students and 24 teachers.

Program Description

All second through eighth grade students in the district's six elementary schools participate in the Rubin math program, including special education and academically talented students. Except for the first grade students at one school, the kindergarten and first grade students do not participate in the program.

Philosophy

The philosophy for the Rubin math program is based directly on mastery learning theory and practice. As the district describes the philosophy, "Under appropriate instructional conditions, virtually all students can and will learn well what schools want them to learn when given sufficient time for mastery."

Curriculum

What Curriculum Is Taught? The curriculum for the mathematics program is organized around 281 K–8 objectives, or terminals, as they are called in the Rubin program. The terminals are organized into 34 content clusters, beginning with clusters like counting and addition with sums to ten, progressing to content clusters like factoring, quadratic equations, and simultaneous equations. Teachers maintain curriculum files for each terminal which are used for planning and delivering instruction. Textbooks are used only as adjuncts to instruction.

How Is the Curriculum Structured? An important characteristic of the curriculum is that all 281 terminals are organized into a large learning hierarchy, with terminals linked to each other according to the prerequisite skills necessary to learn each terminal. The learning hierarchy, or the "spider web" as it is called, specifies explicitly the order in which the terminals are to be learned. Figure 1 provides a graphic representation of the learning hierarchy as well as a list of the 34 content clusters in the hierarchy.

By articulating the sequence of terminals to be learned across the nine grade levels from kindergarten to eighth grade, two important results are achieved. First, grade level barriers between terminals are broken down, setting the stage for continuous progress in a nongraded organization. Second, and more importantly, students are grouped for instruction based on their mastery of prerequisite terminals or skills. Thus, students are learning new terminals at a difficulty level presumably better matched to their current skill level. As a consequence, the likelihood for successful learning is greatly enhanced.

It is important to note that the sequence of terminals is not linear, with a fixed order of terminals to be learned. Rather, the hierarchy is more tree-like, usually with multiple links between

Schools and Districts Using the Rubin Math Model

Santa Barbara Unified High School District
Sonya Yates, Assistant Superintendent of Elementary Schools
723 East Cota Street
Santa Barbara, CA 93103

School District Number 9
Daniel Ginther, Director of Instruction
P.O. Box 548
Eagle Point, Oregon 97524

Davis School District
Forest B[illegible]ker, Principal
Adams Elementary School
2500 North 2200 East
Layton, Utah 84041

North Sanpete School District
Brent Thorne, Assistant Superintendent of Schools
41 West Main Street
Mt. Pleasant, Utah 84647

New Canaan Public Schools
Steve Rubin, Assistant Superintendent of Schools
156 South Avenue
New Canaan, Connecticut 00840

Ouachita Parish School District
Jim White, Assistant Director of Special Programs
701 St. John St.
Monroe, Louisiana 71201

terminals. This permits a student to learn one of several new terminals following the mastery of any given terminal. Students are not confined to just the next one in the sequence. This feature allows flexibility in assigning students to the next terminal since there are usually options available. Without this flexibility, a "logjam" of students could form at particular terminals.

Instruction

How Are Students Organized For Instruction? Student grouping is a unique feature of the program. Mathematics is taught at the same time each day, allowing the entire faculty to participate in the program. In the elementary schools, this works well since all teachers would normally teach mathematics. Because of the subject matter specialization of some teachers at the middle school, however, not all teachers participate in the program. Consequently, it was necessary to teach mathematics for two consecutive periods each day. This required some difficult, but not insurmountable, scheduling decisions.

Each teacher works with an instructional group on a set of closely related terminals. One teacher might have responsibility for only three terminals while another teacher might have responsibility for teaching 11 or 12 terminals. The number of terminals assigned to a particular teacher is determined by need, teacher preference, and practical knowledge that has been acquired about "what works."

The number of instructional groups at a school and the terminals offered at any given time depend on the number of teachers and instructional aides available to form groups. In North Sanpete schools, these range from seven to 18 instructional groups, with about 60–80 terminals being taught at any given time. Between 120–130 terminals are taught each year.

The fundamental feature of the Rubin math program is the flexible grouping of students. Students are assigned to a particular instructional group because they need to learn the terminal being taught in that group and have the prerequisite skills for that terminal. Approximately 20–30 percent of the students are tested each day, meaning that students are reassigned

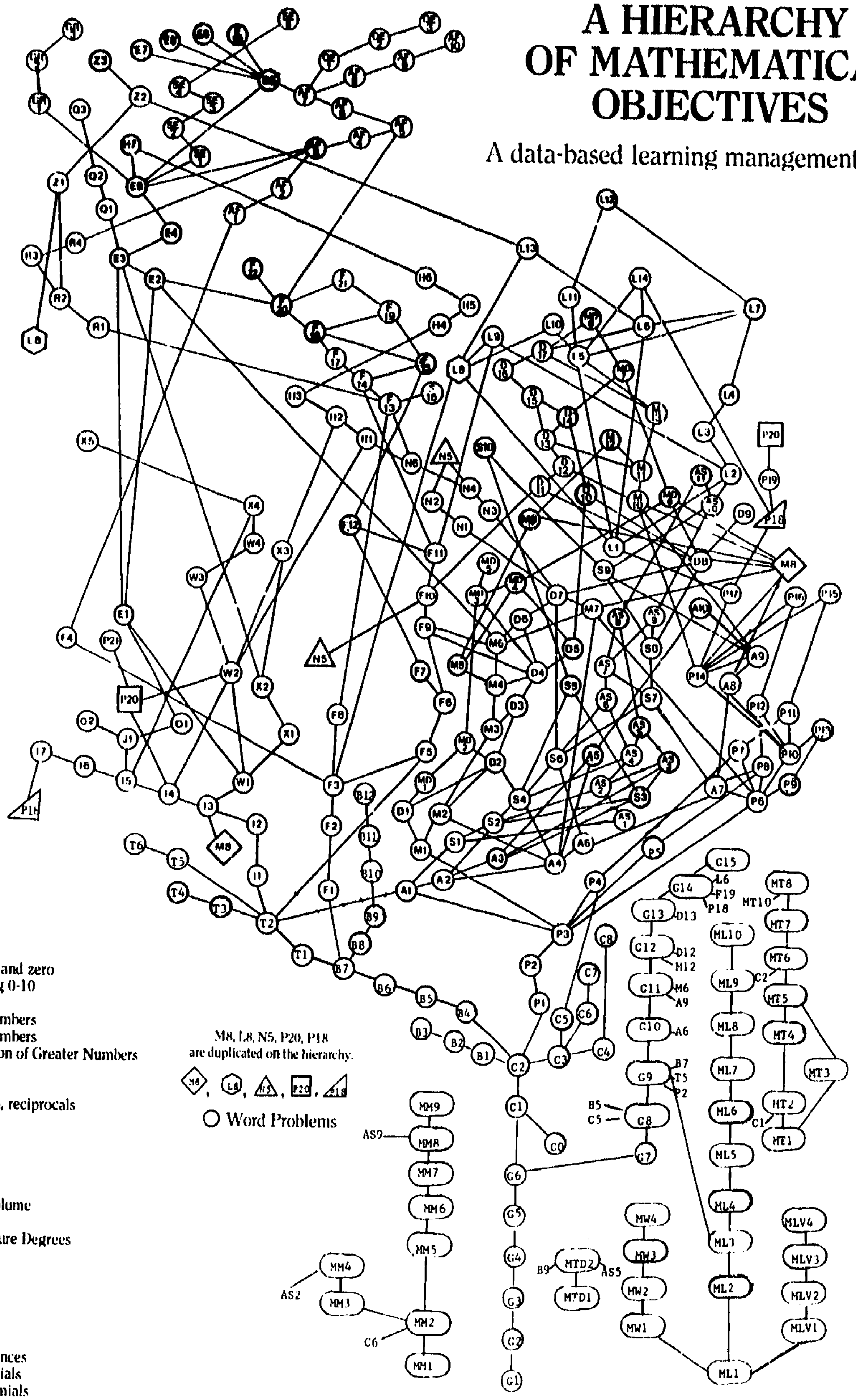
Some Key Implementation Events at North Sanpete

March 1984	Initial exposure to Outcome-Based Education in conference
April 1984	Site visits to Johnson City Central School District, New York; Mukliteo School District, Washington; and New Canaan School District, Connecticut
August 1984	Trained 35 staff in Rubin math model and prepared pilot materials
August 1984	Begin pilot testing of Rubin math in 3 schools
December 1984	4 district trainers certified in Carol Barber mastery learning model
February 1985	All instructional staff begin training in Carol Barber mastery learning model
June-August 1985	Revise Rubin math program
July 1985	Establish learning support center (LSC) at Middle School; Late buses initiated for LSC students three days a week
August 1985	Continue pilot testing of Rubin math in 3 schools
September 1985	Establish comprehensive staff library for correctives and extensions
March-April 1986	Provide training in Rubin math for 3 additional schools
April 1986	All staff complete training in mastery learning
June 1986	District coordinator meets with representatives of districts from Oregon, Utah, and California to coordinate revision efforts in Rubin model
June-July 1986	Provide 4-week summer school for corrective instruction; trained 25 staff in John Champlin's Outcomes-Driven Developmental Model; make additional revisions in Rubin materials
August 1986	Begin third year of Rubin math in 3 schools; implement first year of Rubin math in 3 other elementary schools

Figure 1

A HIERARCHY OF MATHEMATICAL OBJECTIVES

A data-based learning management system



TERMINALS

G	Geometry
C	Counting Numbers 1-9 and zero
B	Adding and Subtracting 0-10
T	Teen Facts
A	Addition of Greater Numbers
S	Subtracting Greater Numbers
AS	Addition and Subtraction of Greater Numbers
M	Multiplication
D	Division
MD	Multiplication/Division, reciprocals
N	Number Theory
P	Place Value
L	Decimals
F	Fractions
MM	Measurement Money
MLV	Measurement Liquid Volume
MT	Measurement Time
MTD	Measurement Temperature Degrees
ML	Measurement Length
MW	Measurement Weight
R	Ratio and Properties
Z	Percent
I	Integers
J	Order of Operations
O	Open Phrases and Sentences
W	Operations with Monomials
X	Operations with Polynomials
E	Equations and Problem Solving
Q	Inequalities
H	Factoring
AF	Algebraic Fractions
SE	Simultaneous Equations
GR	Graphing Equations
QE	Quadratic Equations

System Design and Program Development by: Dr. Stephen E. Rubin Copyright 1982, 1964, 1967, 1982 revised New Canaan, Connecticut edited by: Babs Myers, Mary Grace Carpenter, Jim Fenwick and Gabe Jeantheau, Elaine Dormer, Suzanne Fenwick, Barbara Haigh. Graphic Design: Eric Sizensky. 1985 revised North Sanpete School District.

to new teachers as often as once a week or sooner.

When students demonstrate to the teacher that they have learned a particular terminal, they are sent to a central testing center to take a criterion-referenced test (CRT) over that terminal. A CRT is a test that has test items measuring one specific objective or skill; they are used to assess whether a student has or has not learned the terminal.

Students who attain at least 80 percent on the CRT progress to a new terminal and are reassigned to the approriate class working on that terminal. This may be with the same teacher the student just had or with another teacher. If the CRT is not passed at 80 percent, the student returns to the class for further instruction. Students can also be assigned to the learning support center for special assistance at the discretion of a teacher.

The central testing center is a critical component of the Rubin math program. In North Sanpete, the testing center is located apart from the regular classrooms. For example, in one school it is located in the cafeteria. In another, it is set up on the stage of the auditorium. In the testing center, the CRT is completed by students, given to a faculty member operating the instructional management computer program, and scored immediately electronically. If the student passes the CRT, the score is automatically recorded in the student's file, and a class enrollment menu appears on the computer screen. This menu allows the faculty member to enroll the student immediately in a new instructional group. If the student does not pass the CRT, a list of the items missed by the student is generated and returned with the student to the student's teacher for corrective instruction.

The computer program provides information on what terminals the student has already mastered, what new terminals the student is eligible to take, what instructional groups are teaching the new terminals, and the current enrollment in those classes. Other information is also provided about the terminals, such as whether the terminal is assessed on the standardized achievement test used in the district.

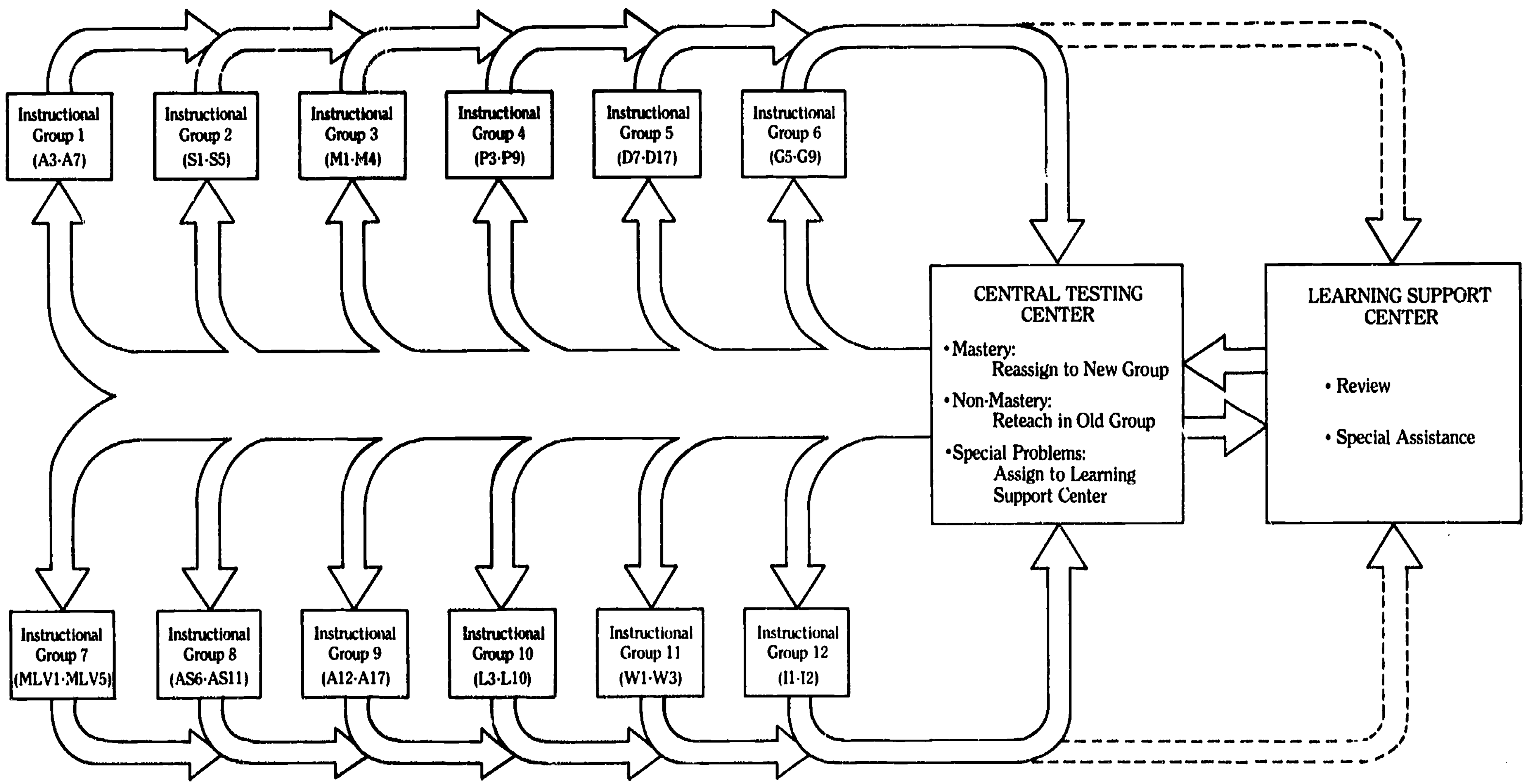
The faculty member operating the computer program and making the student assignments following testing works closely with the teachers. Because there are usually multiple options for new terminal enrollments following mastery, the assignment policy can be modified to adjust class size, teacher preference, and student need. For example, suppose a teacher felt it was more appropriate to teach a set of five terminals with small class sizes. It may be possible to accommodate this preference if another teacher was available who could accommodate larger class sizes.

Because of the frequent regrouping of students, teachers get to see many if not all the students. How many different teachers a given student would see depends, of course, on how the teachers decide to split up the curriculum. Some may tend to be generalists, opting to teach many of the objectives over the year. Others may opt to be specialists, setting up their rooms to focus on only certain topics all year long.

Because there are usually multiple options for new terminal enrollments following mastery, the assignment policy can be modified to adjust class size, teacher preference, and student need.

Figure 2 provides a representation of how the Rubin math program is structured. In this figure, 12 instructional groups covering 67 terminals are shown. The central testing center and learning support center are also indicated. Students move from the instructional groups to the testing center, where mastery or nonmastery of a terminal is determined. Based on the assessment, students are either enrolled in a group for instruction over a new terminal for which they are eligible or returned to the students' former instructional group for corrective instruction. Since the terminals are sequenced and articulated across grade level, students can progress at their own pace.

Figure 2
Flexible Grouping in the Rubin Mathematics Program



How Are Students Taught? Each teacher has responsibility for a small number of terminals. For example, the teacher who has instructional group five in Figure 2 is responsible for 11 terminals, D7 – D17:

D7: Single-digit divisor into 2-digit dividend with remainder
D8: Single-digit divisor into 3- and 4-digit dividend with remainder
D9: Single-digit divisor into 5-digit dividend
D10: One-step word problems with single-digit divisor into 3- and 4-digit dividend with remainder
D11: Two-digit divisor into dividend with multi zeros and no remainders
D12: Two-digit divisor with zero into 3- and 4-digit dividend with remainder; also checking
D13: Two-digit divisor into 3- and 4-digit dividend with remainder
D14: One-step word problems with 2-digit divisor and 3- or 4-digit dividend using money
D15: Three-digit divisor (last two digits are zero) into 3-, 4-, and 5-digit dividend with many zeros and no remainders.
D16: Three-digit divisors with zeros into multi-digit dividends with remainders.
D17: Three-digit divisors into multi-digit dividends with remainders.

At any given time, the teacher might have new students coming into the class for instruction in one of the eleven terminals with others finishing instruction on one or more of the terminals. The teacher decides how students will be grouped within the class and what materials will be used to teach the terminals.

The teacher must also decide how to integrate the new students who enter the class after instruction has begun. Even though the students in a group might be more homogeneous in their prerequisite skills, they do not all enter the instructional group at the same time. Thus, at any given time, students are spread out among the set of objectives the teachers is responsible for teaching. This poses an interesting problem to teachers, who must find creative ways for handling the movement of students in and out of their instructional groups. Learning centers, for example, might be set up in different corners of the classroom with students progressing through the different centers.

Although students might be learning different terminals in the same instructional group, direct instruction is still emphasized. This is possible because, even though the students are spread out among the terminals, the terminals' topics are still very close. The idea is that direct instruction is a preview for some students, on-target for others, and a review for those students who have already mastered the terminal being taught. This might also help to broaden students' understanding of mathematics beyond simply viewing it as one isolated skill after another.

Pretests for each terminal are also available to teachers. These pretests are administered when a student is enrolled for a new terminal. The pretest allows the teacher to determine whether the prerequisites for the terminal have been retained by the student. In addition, cumulative review tests are administered periodically to assure students are not just learning isolated skills. If students do not demonstrate mastery of the prerequisite for the terminal or perform poorly on the cumulative review test, teachers have the option of sending students to a learning support center for direct assistance in the prerequisite skills or review of previously learned skills. The learning support center is also available for students needing special assistance. Since late buses are scheduled three days a week, this work might very well occur after school.

The learning support center is used for another purpose. If an instructional group reaches a point at which only five or six students remain in the group and no new students are enrolled, the group is assigned to the learning support center. The students complete their work in the center and are then reassigned to new classes when ready. This frees a teacher to open a new instructional group.

Assessment

How Are Students Placed in the Curriculum? Placement tests have been developed for locating new students in the curriculum. These tests are used to place new students at the appropriate location in the learning hierarchy, regardless of grade level designation.

How Is Student Progress Monitored? The computerized instructional management program maintains student files. These files constantly update a record of student terminal performance, student location in the curriculum, and the current teacher. The computer-managed system developed by North Sanpete also makes available instructional group rosters, the length of time students have been working on a current terminal, the number of students who have mastered the prerequisite skills and are eligible for a given terminal, and progress reports. The software system requires an Apple IIe computer for operation and a hard disk is highly recomended.

How Are Students Graded? At the elementary schools, students do not receive grades in mathematics. Instead, a computer-generated record of all the terminals mastered by the student is sent home to the parent. This report also includes the number of terminals passed during the current reporting period and an estimate of the number of terminals to be completed by the end of the school year. At the middle school, parents also receive the report of terminals mastered. In addition, students receive grades of either A, B, or Incomplete.

Organizational Arrangements

There are at least two sets of fundamental administrative requirements for the Rubin math model. First, there are a set of technical requirements—the objectives, the criterion-referenced tests, and the computer program which manages the entire system. Although these only provide the skeleton of the program and must be enhanced with curriculum materials, without them the program is inoperable. Second, there are a set of administrative requirements. Mathematics must be scheduled to be taught at the same time each day and teachers must be willing to participate in the program. Some teachers do not like giving up "their" homeroom children, preferring to maintain a tighter control over what and how their class is learning. This has also posed a minor problem when parents ask teachers about their child's work in mathematics. Since students receive instruction from many teachers, homeroom teachers sometimes find it more difficult to answer parent questions in mathematics. Of course, there is a wealth of information on what each student has learned. Teachers need to examine the progress reports before meeting with parents.

Summary: Combining Continuous Progress and Direct Instruction

The Rubin math program combines student self-pacing with direct instruction. In so doing, the program takes advantage of one of the positive features of student self-pacing—allowing each student to learn at his or her own rate, irrespective of other students in the class. It also takes advantage of one of the positive features of whole-class instruction that is often lost with student self-pacing—direct instruction by the teacher.

Self-pacing allow students to progress at their own pace without being held back by slower students or pressured to progress by faster ones. This can and does have a positive effect on student motivation, but must be carefully monitored. One of the best motivators for children and adults alike is perceived progress. In the Rubin program, students perceive they are making a great deal of progress, since they progress through the curriculum in small, successful steps which act to spur future work. For some students, however, there is a tendency to develop a "horse race" attitude, where passing tests becomes more important than understanding mathematics. Alternatively, there may be some students who may tend to procrastinate and progress through the curriculum at a rate perhaps even slower than under whole-class instruction. Consequently, one important teacher role is to monitor student progress carefully and learn from these new learning rate cues.

It is because the curriculum is organized around a set of objectives that students can pace themselves through the curriculum. This raises the possibility that the curriculum has been oversimplified and that too much emphasis is placed on student test performance. Learning a set of isolated skills well does not mean that the student will develop a good understanding of mathematics. It is important, therefore, that teachers emphasize the concepts and principles that underlie mathematics.

It appears that the Rubin math model has the positive features of both self-pacing and whole-class instruction: continuous progress and direct instruction. However, there is a price for this opportunity—direct instruction is more difficult, and there is a danger in the program taking on characteristics of a horse-race, with students and teachers alike focusing on speed as the sole criterion for learning. With proper monitoring, this danger can be held in check.

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CHAPTER FIVE

Continuous Progress Approaches

Chapter Five presents a single case of a continuous progress program at George Dilworth Middle School. This program was developed by a teacher for use in his mathematics classes. Insofar as the program is only used in his mathematics classes, this program represents the "smallest" one in the casebook. This does not mean that the program can only be used at the classroom level, however.

This student-paced, mastery learning program, as the case study explains, has solved many of the classroom management problems that the so-called individualized instruction movement ran into during the 1960s and 1970s. It has taken a computer-rich environment to do so. The microcomputer-based program works because the computer is able to monitor and track student progress through the curriculum. Without the computers, the program would likely be too difficult to manage for any length of time.

This program provides a nice contrast to the whole-class mastery approaches presented in Chapter Two. At the classroom level, the major difference between this program and those in Chapter Two is whether the teacher paces instruction and the whole class moves as a group or whether students move at their own pace. The case study points out some of the important implications surrounding this difference in instructional pacing.

George Dilworth Junior High School: A Continuous Progress Program That Works

Introduction

Grade level instruction to students grouped only by age is often not an effective match of curriculum and students. Student diversity is often too great to target instruction well. As one teacher stated, "The first day of teaching you realize that group explanations don't always explain everything to everybody."

The problem is certainly not new. Classroom teachers have experienced the difficulties of group instruction ever since graded schools became widespread in American education around the mid-19th century. Emerson White (1874), for example, Superintendent of the Columbus, Ohio, schools delivered a paper to the National Educational Association in 1874 titled, "Several Problems in Graded-School Management." White concluded that if the class as a whole is to attain a high level of learning, then "it is necessary that the lowest members of it reach a good standard, and this results in the holding back of the bright and industrious pupils until by iteration and reiteration the dull and indolent may be brought to the required standard. The amount of time and talent thus wasted in some graded schools is very great."

Preston Search (1895), in a similar paper presented twenty years later before the same National Educational Association, wrote, "The public schools are places where pebbles are polished but diamonds are dimmed." Search was the Superintendent of the Pueblo, Colorado, schools from 1888 to 1894, and has been generally credited with developing the first continuous progress program. Search's solution to the problem of individual differences was to allow students to pace themselves through the curriculum.

Other similar programs were also developed during the first two decades of this century (see "Some Early Attempts at Individualized Instruction"). Unfortunately, these self-paced programs lost their appeal during the 1930s. It was not until the 1960s that self-pacing was rediscovered as a solution to the problem of instructing groups of heterogeneous students. The so-called individualized instruction movement generated a large number of packaged, "teacher-proof" programs. But these programs, despite their attractive packaging and use of the latest in criterion-referenced assessment technology, still had not solved the instructional management problems associated with students spread throughout the curriculum. Memories of some of the disasters of the the 1960s and 1970s are still with educators today.

Our study of the computer-based mathematics program at George Dilworth Junior High School, Sparks, Nevada, shows this need not be the case. Not only has the program overcome some of the difficulties associated with student pacing and instructional management, but the program has improved student learning as well. The program effectively organizes mathematics instruction at the junior high school level. According to the principal of the school, Mr. JWood Raw, "It's been a lot of hard struggle, but after I see what we have, where we're going, and what we're doing, I'd do it again."

The program itself does not teach students; it manages student progress

Some Early Attempts at Individualized Instruction

During the early part of this century, a number of experiments in "individual education" were attempted with much success. Three of the most publicized programs were developed by Frederic Burk (1913), Helen Parkhurst (1922), and Carleton Washburne (1920).

Frederic Burk. Frederic Burk became the first President of the recently founded San Francisco State Normal School in 1899 (the Normal School became San Francisco State Teachers College in 1921). He remained President there until his death in 1924. Normal schools were teacher training institutions where high school graduates were trained for two years to become elementary teachers. Students typically took academic courses in education and pedagogy and completed student teaching assignments with regular teachers in training schools, much like today.

It was Mary Ward, an arithmetic supervisor, who apparently should be credited with putting together the first working instructional program of individual instruction (Washburne and Marland, 1963). She carried out the initial mini-experiments on student-pacing from 1909 to 1912 and constructed the first set of self-instructional exercise materials. She found student pacing to be quite workable, reporting a drastic decrease in discipline problems and increase in student interest and effort. It is interesting to note in passing that it is probably no accident that individual education began in mathematics, perhaps the most drill oriented of all subjects.

Dr. Burk, upon hearing of the new procedures Ward developed for arithmetic, requested all subject supervisors to begin working on "self-instruction bulletins." A large number of these bulletins were developed and eventually published for distribution by the state printing office between 1913 and 1917. According to Burk (1924), the faculty at the Normal School wrote and published over 100,000 copies of instructional booklets in 26 different topics. Beginning in 1913, individual education operated in reading, arithmetic, language, geography, writing, spelling, language, and composition.

Between 1913 and 1915, Burk published two small pamphlets which received considerable attention in the educational community. The first pamphlet, called "Monograph A: Lock-Step Schooling and a Remedy," attacked the graded school and the "fundamental evils and handicaps of class instruction," attributing the high rate of grade level retardation (retention) and drop-out to the inappropriateness of the "lock-step." It also outlined the individual education program begun at the Normal School and which allowed varying rates of progress by students.

Burk described the principles on which the exercise books were developed, three of which sound quite familar: no abstract explanations, one new "difficulty" at a time, and automatic reviews. The fourth principle, lesson elasticity, meant that duplicate exercises were available for each lesson and could be assigned for students needing more work, thus adjusting lessen length as needed. The grade standard in the training school was established as the rate at which the slowest, diligent student progressed through the exercise books.

In 1915, Burk published "Monograph C," using the unusually long title: "In Re Everychild, a Minor vs. Lock-step Schooling: A Suit in Equity. Data of Results, Methods and Costs of Operating Schools by Individual Instruction." This monograph reported the results of variability in student learning rates, instructional time expenditures and savings, and school costs of the first two years from 1913 to 1915.

The period from 1913 up to 1917 was the most active time for the development of the program at the Normal School. In 1917, however, the California Attorney General ruled that the Normal School could not use the California State Printing Office to produce the booklets. There was some speculation that the textbook publisher for the State of California may have been involved in bringing the Normal School to the attention of the attorney general. In any case, the attorney general's ruling, coupled with the faculty turnover due to World War I and the difficulty of retraining faculty, sharply interfered with continued experimentation, development, and dissemination of the work at the Normal School.

Carleton Washburne. Recommended by his mentor, Frederic Burk, Carleton Washburne became Superintendent of the Winnetka Public Schools in May 1919. The small school district of Winnetka consisted of three elementary schools and one junior high school. Although small, the Winnetka Public Schools embarked on a reform initiative that continued well into the 1960s (see Washburne and Marland, 1963; Washburne, Vogel, and Gray, 1926).

Washburne had been on the faculty of Burk's Normal School for five years prior to 1919, first as an assistant to Mary Ward and then as the science supervisor and instructor in educational psychology. When he moved to Winnetka, he brought much of the Normal School program with him. There were modifications, however.

The program at Winnetka was implemented slowly (Washburne, 1920). The foundation of the program was a philosophy that "each child has the right to the fullest possible development, both as an individual and as an integral part of mankind" (Washburne, 1924, p. 11). He continued, "The child must be given a mastery of those skills and knowledges which are commonly used; he must be given an opportunity to express his own individuality—to do creative work; and he must be made to realize that he is a part of the social organism."

The curriculum in the Winnetka schools was divided into two parts: the "common essentials" and the "group and creative activities." The common essentials were the basic subjects—arithmetic, reading, language, writing, history and geography—used by everyone and which everyone must master. The group and creative activities, on the other hand, were not viewed as having common knowledge and skills which should be mastered by everyone. These subjects—art, music and literature appreciation, playground activities, and "color material and background" to history and geography— were viewed as areas where student learning could be expected to differ legitimately.

The common essentials were taught using the individual instruction of Ward and Burk. Students were allowed to progress at their own rate. "Instead of quality varying, time varies: a child may take as much time as he needs to master a unit of work, but master it he must" (Washburne, 1925, p. 79). Instruction was carried out for the most part, by self-correcting practice books which led students gradually through a series of lessons, each step being mastered before the student progresses to the next. However, the teacher, with no recitations to hear, was available to help and encourage students at most any time.

Student progress was monitored with the use of goal cards. The goal card had each unit of achievement written on it, and, as each student mastered a unit, the date of completion was indicated next to the unit. Every six weeks, students connected the completion dates for all units completed. Students could work at two different grade levels in different subjects, but if work in the most advanced subject was more than a grade level above the least advanced, the student was required to drop the advanced subject and spend more time on the less advanced one.

The group and creative activities, which occupy about half of every morning and afternoon, were handled differently. In the words of Washburne, Vogel, and Gray (1926, p. 20) "here time is the relatively constant factor, while achievement varies from child to child." There were no tests, and much of the work emanated from student interest and their work in history and geography. Activities included discussions, self-government of the school, drama, projects, assemblies, handwork, art and music, and physical education.

Helen Parkhurst. Helen Parkhurst developed an instruction plan different from that of Burk and Washburne. Her plan for reorganizing the school was based on three principles: student freedom, student interaction, and student time management. The student focus of these three principles illustrate her emphasis on the student relative to the teacher. As she stated in her book: "I contend that the real problem of education is not a teacher's but a pupil's problem. All the difficulties that harass the teacher are created by the unsolved difficulties of the pupils" (Parkhurst, 1922, p. 23).

Parkhurst spent several years developing her ideas about reorganizing schooling around a "laboratory method." In 1918, she was asked to make suggestions for improvement of the Berkshire Cripple School by the chair of the school's education committee, Mrs. W. Murray Crane. Taken with her ideas about education, Mrs. Crane was instrumental in getting the laboratory plan implemented at the school in 1919.

The success of the program at the Berkshire Cripple School prompted Mrs. Crane to support the implementation of the laboratory plan in the high school of her home town of Dalton, Massachusetts, in 1920. In Dalton, Parkhurst was visited by Miss Belle Rennie of London, who soon after wrote a short description of the Dalton Laboratory Plan for the Education Supplement of the *London Times*. The plan generated a great deal of attention in England, and soon after developed a worldwide following.

The Dalton Plan can be used to reorganize any school from the fourth grade up. Younger students, according to Parkhurst, did not yet have the "tool subjects" to work independently. The foundation of the plan was the division of the curriculum into jobs and units (see Parkhurst, 1922, 1924). Each subject was divided into work of about 20 school days or one month. The work of all subjects for a month formed a job. A job was quantified into units of work, each unit roughly equivalent to a daily recitation. With six subjects, for example, there would be six times 20, or 120 units of work per job. Teachers were encouraged to make the topics in each subject of a job interrelate, mutually supporting each other. The jobs were written out in the form of assignment contracts which explained the tasks to be accomplished. Students were then responsible for budgeting their time so as to complete all the tasks of a job.

Classes were arranged so that each subject had its own ungraded laboratory with a specialist teacher available. Students went from laboratory to laboratory as they saw fit in order to complete their assignments. Since there were no bells, students could work in a given laboratory for as long as necessary before moving to the next one. Students took on the next job as soon as they completed the previous one. The only requirement was that all units of work in a given job had to be completed before progressing. Thus, students could not ignore subjects with which they had difficulty.

Materials that students could use to complete their assignments were collected in each subject laboratory. It was their responsibility to search out resources that would allow them to complete their assignments. Although students worked at their own pace, they were also encouraged to work cooperatively in small groups if there were other students working on similar assignments. Three types of progress charts were maintained by the teacher and students to monitor individual and group progress and provide incentive.

The actual schedule of a Dalton school could be modified as necessary. Parkhurst described a typical morning as being organized into three periods. The first was an organization period (15–30 minutes), where a teacher advisor monitored progress, heard students' daily plans, and helped reconcile any unit shortages that might exist. The second was the laboratory period (2–3 hours) where students completed their jobs. The third was a conference period (30–40 minutes) where students could complete group work, alternating among the different subjects according to a fixed schedule.

through the curriculum. Microcomputers are used to correct student assignments and administer quizzes. By allowing students to advance through the curriculum at their own pace, the program gives students major responsibility for learning. In describing how students changed during the mathematics program, the program's originator stated, "They kept waiting all the time to be told what to do, and that feeling is pretty well worn out now. They are just on their own. The structure is all gone."

The lack of structure is, in fact, the primary reason students like the program "You do your own work without the teacher telling you what to do," commented one student. Another student suggested, "It's fun to be able to work out problems on your own or with the help of a friend." Still another student, "You can go at your own pace and don't have to wait or have people wait for you." "I can do the work on my own and the teacher doesn't get up in front of the class to lecture," commented a fourth one.

Program Implementation

Setting

George Dilworth Junior High School of Washoe County School District in Sparks, Nevada, serves about 680 students enrolled in the seventh and eighth grades. The community surrounding the school is mostly low middle to middle class. There are 29 classroom teachers, a special education teacher, two counselors, and a librarian.

"You can go at your own pace and don't have to wait or have people wait for you."

The unique scheduling of classes at Dilworth deserves attention. There are two short homeroom periods, one in the morning and one following lunch. Seven instructional periods range from 34 to 45 minutes in length. The first class each day does not change its schedule. The other six classes, however, rotate through a six day cycle of modules, each class meeting one period earlier each day. If social studies met third period today, for example, it would meet second period tomorrow. Thus, excluding first period, each class meets at a different time each day and no one class is stuck with the less desirable time periods during the day. Bells are not used to indicate period changes. Yet, students and teachers have no problem keeping track of the schedule.

Implementation History

Dilworth's principal, Mr. Raw, has been the key figure in getting computers into the school. "I think computers are this generation's way of life," explained Raw. "In another five years, 85 percent of the work force will somehow be tied in with computers. So it isn't a fad. It's here and it's going to stay, and it's something kids ought to know about at the middle school level. I think I'd be lacking if I didn't provide it for them."

Providing computers for his school is something Principal Raw has been steadily working on over the past six years. At first it was not easy. "The district was dragging its feet," Raw recalled. "They thought computers should be in the high school, not the middle school." But starting with two computers purchased out of the school budget in 1980, Dilworth now boasts a spacious computer laboratory housing, at present count, 109 microcomputers.

Helped by an incentive grant from the district, Raw was able to get 24 more computers in 1981. Once a critical mass of computers had been assembled, Raw began working on the development of formal courses. He worked with a teacher to develop two computer literacy courses. One, all seventh graders are required to take. The other is an elective course focused on programming. He also set his sights on having a mathematics program that could take advantage of the computer's information management capacity. The goal, he said, was to offer "a math program for all students, not just a higher-level program or a remedial program. We wanted a program that would upgrade and support our math and still be within the bounds of the district mandated, criterion-referenced testing."

Another reason Mr. Raw wanted a computer-based mathematics program was dissatisfaction with an out-of-state testing service Dilworth mathematics teachers had been using since 1980. This service provided a beginning-of-the-year assessment of mathematics skills in the form of individual student reports indicating which skills had been mastered, which needed review, and which needed instruction. One problem with the program was the time lag between the testing and the student reports. The turnaround time was two to three weeks. This, according to the principal, "put the teachers in a bad spot. You can only review so much." Another problem was the expense of the testing service, which had risen considerably over the four years.

In 1982, a local mathematics teacher, having heard about the computer program at Dilworth, arranged for a visit. Mr. Mark Myrehn had been working for several years on a computer-based program for organizing mathematics instruction. Mr. Raw saw the opportunity to bring in a new mathematics program and drop the expensive testing service. As Raw recalled, "the two just happened to fall together, and Myrehn transferred in 1983." The mathematics program has been in operation since the 1983–84 school year.

Program Description

The literacy and mathematics classes are held in the computer laboratory. The laboratory was made by constructing large doorways in adjoining walls of the center classroom of three adjacent rooms. The literacy classes and the mathematics classes are held in the side classrooms. The center room is used as needed.

The computer mathematics program at Dilworth is used by a single teacher for all his eighth grade mathematics students, including those in the remedial mathematics class. "I haven't found anybody that can't do the work if they want to," according to Mr. Myrehn.[1] In addition, an academically talented seventh grade class also uses the eighth grade program. "They are flying through the program. Those types of kids need very little outside help from me. It's almost a self-run class."

The computer math program centers on the completion of textbook assignments. The student completes the assignment either at home or in class and then enters the answers into one of the classroom microcomputers. If the assignment is scored at 80 percent or better (calculated by the resident computer program), the student is allowed to save the grade in his computer file and take the five-item quiz over the assignment. If the student does not pass the assignment, then the student must redo the assignment until mastery is reached. If the quiz is not passed at 80 percent, the student must redo a different, computer generated quiz before the next assignment can be attempted. Students must follow the prescribed sequence of lessons.

Curriculum

What Curriculum Is Taught? The curriculum is standard eighth grade mathematics, derived, for the most part, from Addison-Wesley's *Mathematics in Our World* textbook. Topics include addition, subtraction, multiplication, and division of whole numbers, decimals, and fractions; percents; measurement; and positive and negative numbers. Two geometry units are also included.

How Is the Curriculum Structured? The curriculum is organized into three cycles, each cycle moving students through the textbook and successively presenting them with more difficult problems. "Cycle 1 is review, Cycle 2 is computation, and Cycle 3 is using all the different concepts." Each cycle is divided

1. Unless otherwise indicated, all remaining quotes are from the teacher and originator of the program, Mr. Mark Myrehn.

into a number of learning units. A learning unit contains text assignments, five-item computer generated quizzes over each assignment, and a unit test. At the end of each cycle there is also a cumulative test. Table 1 outlines the three cycles and 18 units of the curriculum.

How Are Students Placed in the Curriculum? Students typically start the school year at the beginning with Cycle 1. New students are assessed using an end-of-year seventh grade textbook test and placed in the curriculum sequence according to teacher judgment. Typically, new students entering in mid year start at the beginning of Cycle 2. In addition, the teacher has the option to place students back in the curriculum if he feels the student needs more work on a particular topic or set of topics.

Table 1
Curriculum Structure of the Computer Math Program

Cycle	Unit Number	Number of Assignments	Curriculum Topic
1	1	14	Whole Numbers
	2	8	Decimals
	3	13	Fractional Numbers
	4	6	Percents
	5	6	Measurement
	SPECIAL UNITS		Geometry: Construction and Measurement
2	6	15	Whole Numbers
	7	15	Decimals
	8	13	Fractional Numbers
	9	11	Percents
	10	7	Measurement
	11	5	Metrics
	12	10	Positive and Negative Numbers
	SPECIAL UNITS		Geometry: Congruent and Similar Triangles
3	13	9	Whole Numbers
	14	6	Decimals
	15	8	Fractional Numbers
	16	9	Percents
	17	8	Measurement and Metric Concepts
	18	19	Positive and Negative Numbers

Instruction

How Are Students Organized for Instruction? Instruction occurs in the computer laboratory. Students are responsible for completing the textbook assignments, correcting the work, and taking the assignment quizzes. When students enter the classroom, they are expected to take out their work and begin without teacher intervention. If students are ready to check an assignment or take a quiz, they go to a microcomputer. If not, they are expected to work quietly on the current assignment.

At the beginning of the school year, students are eased into the system. Although it only takes a few minutes to learn how to use the system, students need several weeks to develop the routine of being responsible for their own work: "We're starting now where they just come in, and they're on their own. So I think it takes about two weeks really. I gradually allow them more and more freedom from a normal class and ease them into what we're doing now." For the students "not used to not having structure," the responsibility of learning on their own is "kind of a learning experience for them."

Once students complete an assignment, they move on to the next one in the sequence. This stops students from complaining "there's never nothing to do," when they have finished an assignment and less academic time is lost due to transitions from one activity to another. Also, the teaching adjustments in group instruction caused by student absences are eliminated. Myrehn does not have to re-explain concepts or hold back the other students; instead, students returning to the classroom simply resume work on whatever assignment they need to complete.

How Are Students Taught? Instruction is almost entirely done by the textbook. The activity format used in the classroom is seatwork, with students working at tables or at one of the computers in the laboratory or adjacent classroom. Students progress through the assignments, alternating between working on the assignment and entering problem answers and taking quizzes on one of the microcomputers in the laboratory. The teacher provides virtually no whole-class instruction; as he put it, "I gave up chalk five years ago." However, practically all classroom time is available to the teacher for tutoring when necessary.

It was advantageous to break out of the standard whole-class approach to teaching mathematics because "In the whole-class structure, you take roll part of the period and then you spend, I'd say, half of the period correcting yesterday's assignment and getting it turned in or whatever. Then about another fourth of the period is spent on explaining the new day's concept, and then the last ten minutes or so they would work on it. . . . And, in here, I'd say it's totally reversed. All that is done by the machine so most my time is just teaching the kids that need help."

"I think self-pacing is important for the fast students because it allows them to progress. And it is important for the slower students because it allows them time to learn. Or, if they get stuck on a certain concept, instead of just one assignment that night to do, they can work on it for a few days—master it before they go on."

Myrehn attributes an increase in student self-esteem to the computer math program. Students work on their own and have successful learning experiences: "What's good about this is, instead of trying to compete with a class, they get to compete with themselves or one or two other kids that are working with them. . . . And so they start competing with themselves and working together. They don't care if the high kids are 40 pages ahead. They're working with someone at their own equal level."

The self-pacing has also had a positive impact on classroom management. Discipline problems have decreased, "A lot of that is gone, plus they don't have to sit here for 45 minutes and listen to me talk while they sit still. I think the getting up and getting down and constantly going from the computer back to the book eliminates a lot of the problems. Plus I can monitor everybody. Just basically, I know pretty well what everybody's doing at any one time."

Assessment

How Are Students Advanced in the Program? Students advance through the curriculum based on quiz and learning unit test performance. Students must attain 80 percent on the five-item quizzes before moving to the next assignment. They must also pass the unit tests at 70 percent for advancement. If the unit tests are not passed, then students must redo the assignments they did not pass. Advancement is tied directly to test performance, or, as Myrehn stated, "The computer doesn't accept remedial work, it only accepts 80 percent and that's it."

Very little cheating takes place. Even if a student copied another student's assignment answers, the student would still have to pass the computer-generated five-item quiz. Students have found that "it's easier to learn it than to just try to fake it through because they keep getting retested and retested."

How is Student Progress Monitored? The teacher maintains biweekly records of student progress on the computer. "The machines basically monitor what they do instead of myself." He may obtain a computer printout of prior work for any student at any time. The teacher described the advantage of being able to closely monitor student learning:

> *The students turn in papers and by the time they get them back they've already turned in some more that are wrong. So they get all these papers back with all these marks on them, and they've forgotten the whole concept in the first place. So in this system, when the paper gets turned in, it's been corrected and the quiz has been done. They have to do it right before going on. . . . I think that's the most important thing. It's neat to be able to see what you get wrong immediately and do it again. I think you learn more that way.*

How Are Students Graded? Students are graded on the number of assignments completed for each two-week period. A posted grading scale is used which compensates for varying number of days within the two week period (e.g., there are sliding grading scales depending on whether the block was a five-day block, six-day block, etc.). Since students do not receive credit for completing more than 35 assignments in a two-week period, they are discouraged from racing through the program too quickly. However, "they start seeing the fact that the more work they do, the more they get out of it."

Organizational Arrangements

There are no organizational arrangements required to implement the computer math program. However, the software program written by the teacher is required, as is a classroom with enough computers that students do not have to wait. The program could work well with a ratio of one computer for every three students, but there might be times where students would have to wait to use the computers.

Another requirement is that the curriculum be well-specified and outlined in detail. Without a fixed curriculum, it is too difficult to manage and monitor student learning.

Mr. Myrehn summarized the benefit of the program by comparing it to group instruction: "The first couple of days when you have to go back to use the board, it's just unbelievable how much time you waste. Their attention span is zero, and the attention span in here is basically 100 percent. . . . So all I get to do in class, now is teach. All the rest of it, the 90 percent of wasted time in class, is all gone now. They get a lot more done."

Table 2
Reactions from Whole-Class and Individualized Instruction Teachers

Teacher Task	Whole-Class Instruction	Individualized Instruction
1. Prepare students for new work.	The pain [with individualization] is that it's 28 people in one class all at different places. At least half of them have questions at the same time. And you can't instruct them together. So there's a lot of frustration on my part and on theirs because they're ready to do some work and they don't know how.	In group teaching you explain a concept and then those that know how to do it go on and those who don't kind of try to ask for help. And when there's fifteen of them asking, basically fifteen of the same types of questions, you end up explaining the same thing fifteen different times to the whole class. And the way it works out in here is you are really working with just one individual at a time.
2. Assign work and monitor completion.	I dislike individualization. It's very difficult for one person to keep track of 30 people at 30 places and make sure they understand what they're doing and give them the time they need. As I tell all my classes, I cannot answer all your questions individually because there isn't time, there're 30 of you and 45 minutes. So that's why I ask students to ask me questions up here because it saves time for everyone.	Well, I've done [self-pacing] just for a week unit, where you give out some assignments and they work at their own pace. It works well for a couple of days, but the paperwork and the tracking and the review of the students is just unbelievable. And so what the machines do is like having 30 aides there—it's what they're designed to do, aid. No teaching is done, just aiding.
3. Check work performance.	[In self-pacing] there's a problem getting it graded, and getting it back to them so that they know what they did. I mean even one person, each period, grading papers would not complete—all the papers wouldn't be graded. [Letting the class grade the papers] takes away a lot of time, I think, from the class. It isn't that productive, but I can't grade and I'm not going to grade all those papers.	It's almost impossible to immediately test after each page, which our computers can do, and review after each page—with 150 different review tasks in one day—it's almost impossible for some person to make up. To do it right as far as actually keeping track and correcting each of the student's papers, I think it would be impossible [without computers].

Summary: Trade-Offs Between Whole-Class and Individual Instruction

The central issue this site report raises is the trade-off between whole-class or large-group instruction and individualized instruction. Groups of students usually vary in readiness and motivation for learning, and the instructional pace can often be too fast for some students and too slow for others. Nevertheless, many teachers use whole-class instruction because it's easier for classroom management. Moreover, allowing students to learn at their own rate usually requires a fixed curriculum for students to complete and can engender instructional management problems. The advantage, however, is that students are not held back or forced to move faster than their interest or capability will allow. Table 2 provides teacher comments about the advantages and disadvantages of the two approaches to instruction.

Individualized instruction has received relatively little attention in recent years. Student self-pacing suffered a major blow when several major studies, in comparing self-paced instruction to "traditional" instruction at both the elementary level (Schoen, 1975; Miller, 1976) and the secondary level (Bangert, Kulik, and Kulik, 1983; Hirsch, 1976; Miller, 1976), concluded that self-paced programs did not significantly improve student learning. These findings, which indicated that student learning did not benefit from this instructional strategy, were used to support the position of teachers and administrators who were reluctant to tolerate or overcome the management problems typically associated with self-paced instruction.

The computer math program at Dilworth suggests that the problem is not with self-pacing per se, but with instructional management (Slavin, 1984). In fact, we suggest here that the program at Dilworth was successful because it has been able to solve three instructional management problems associated with self-pacing. This has allowed the positive effects of self-pacing to emerge (see "A Study of Program Effectiveness," next page).

The three management problems solved by the Dilworth program are (1) how to prepare students for new work when all students are at a different point in the curriculum, (2) how to monitor daily assignment completion, and (3) how to check student work once the assignments are completed. The computer program at Dilworth made work assignments for each student, monitored assignment completion by not allowing students to advance until they had demonstrated mastery, and corrected and maintained a daily record of student work. This freed the teacher to provide instruction in the one truly individualized activity format: working one-on-one with individual students. As Gibbs (1970) has pointed out, this has always been the fundamental goal of individualized instruction.

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A Study of Program Effectiveness

The Study. During the 1984–85 school year, Far West Laboratory for Educational Research and Development conducted a yearlong study of the computer math program. Student scores in the five eighth grade math classes using the computer math program were compared to student scores in four classes of another eighth grade mathematics teacher at the same school who used the same textbook but followed the more usual whole-class approach to teaching mathematics.

The Design. Students were pre- and posttested using two cognitive tests. The first cognitive test was a 50-item computation test. This test measured skills common to the eighth grade curriculum: addition, subtraction, multiplication, and division of whole numbers, decimals, and fractions; percents; area; positive and negative numbers; and algebraic equations. The second cognitive test was a 25-item word problem test measuring the same skills as the computation test but in word problem form. The pretests were administered in September and the posttests in May.

The number of problems for each formal assignment made during the school year was also counted, each problem being classified as either a computation problem or a word problem. Computation problems were defined as problems where the mathematical operation was obvious from the directions to the problem set or from the problems themselves. Word problems were defined as problems where the mathematical operation or operations necessary to solve the problem had to be inferred from reading the problem statement.

In this type of research design, the major comparisons of interest are the ones between mean scores on the posttests for the two programs. To make sensible comparisons between the two math programs, however, it is important to determine if students in the two programs scored about the same on the pretests.

If the two groups scored about the same on the pretest, then we would have evidence that any difference observed on the posttest could be attributed to the instructional program. However, if the students in each of the two programs did not score about the same on the pretest, then it would be more difficult to attribute any observed differences on the posttest to the instructional programs. A competing and

Table 3

Pretest and Posttest Mean Scores

Instrument	Program		Level of Significance
	Regular Math	Computer Math	
Pretest			
Computation	22.86	23.51	NS
Word Problems	5.67	5.62	NS
Posttest			
Computation	26.56	34.61	.001
Word Problems	7.27	7.95	NS

Note: NS = Not Statistically Significant

Table 4

Number of Mathematics Problems Completed During the School Year

Problem Type	Regular Math		Computer Math
	Normal	Remedial	Combined
Computation	1034	1272	2046
Word Problems	124	69	117

Note: No distinction was made between normal and remedial classes in computer math.

equally plausible explanation is that the students in the two programs were different at the beginning of the school year, and these initial differences produced the differences on the posttest. Thus, it is important to examine the comparability of the two groups on the pretest scores.

Even this is not enough, however, because there are two differences between the groups—the program and the teachers. If there are differences between the groups on the posttest, we still do not know whether they are a result of the programs, the teachers, or both. The best we can do is look at the scores and find evidence, not proof, of program effectiveness.

The Results. Table 3 presents the pretest and posttest scores for the two cognitive measures. There were no statistically significant differences on the two pretests. On the posttests, there was a statistically significant difference on the computation test in favor of the computer math program but no difference on the word problem test. The mean score difference on the computation test is a a sizable and important positive effect for the computer math program.

Another way to quantify differences between the two groups is to examine the number of problems that students had an opportunity to complete. Table 4 presents the number of problems completed by students in regular math and computer math. The average completion point for students in computer math was the end of Cycle 2. Using this point for computer math students, the average number of computation problems worked was estimated to be 2046 and the average number of word problems was 117. For the three normal classes of regular math, the number of computation problems assigned was 1034 and the number of word problems was 124. For the remedial class of regular math, the number of computation problems was 1272 and the number of word problems was 69. Thus, the differences between the two groups was primarily in computation problems, not word problems.

The Conclusions. The results of this study suggest that the students doing the computer math program achieved more in the area of computation skills but did not achieve more in the area of word problem performance. It appears likely that the difference in computation skills in favor of the computer math program could be attributed to some students in the self paced program receiving additional practice and review. It also appears that the lack of difference between the two programs in word problem performance at the end of the school year was because students in both programs completed about the same number of word problems during the school year.

CHAPTER SIX

Instructional Management Approaches

Chapter Six presents the final case study of this casebook, the instructional management program of Beaverton School District as described through its use at Cooper Mountain Elementary.

This case study is not a model of instructional organization and therefore does not fit any of our four models. Cooper Mountain has been included in this casebook as an example of a district-wide, computer-based assessment system. Instructional management programs like the one in Beaverton School District support curriculum articulation across grade levels and between schools, create a common vocabulary and focus for teachers, and outline teaching and testing requirements.

Instructional management systems are often used to provide assessment information about a set of objectives that students are expected to learn. Contrary to what is often claimed, however, there is no guarantee that teachers will use the information provided by an assessment system for instructional purposes. While Cooper Mountain's program provides teachers with assessment information about the specific objectives that students have or have not mastered, it stops short of moving into the instructional domain. Teachers may or may not make use of the information provided. While these programs, in principle, can be more closely linked to instructional decisionmaking, making this final step is difficult, as this case study points out.

Cooper Mountain Elementary: An Instructional Management Approach to Accountability or Adaptive Instruction?

Introduction

Adaptive instruction is a basic feature of outcome-based education. A program that uses adaptive instruction outlines its curriculum goals and objectives, targets instruction to those goals and objectives, and periodically uses criterion-referenced assessment instruments to determine how well students have learned the goals and objectives. When assessment data identifies specific learning deficiencies in individual students or groups of students, corrective action is then indicated. For adaptive instruction to be successful, the objectives, instruction, and assessment must be directly linked to each other.

Adaptive instruction has three essential components. First, a criterion-referenced assessment system is needed. Tests are constructed to provide specific information about well-defined objectives. The objectives may or may not be the same as the objectives used by a school or district. Still, teachers and administrators can use the results to find out how well students have learned the objectives. On its own, however, this information has limited instructional use.

Second, the assessment system is aligned to the curricular goals and objectives developed by the school or district. This means that not only do the tests measure specific objectives, but there is a direct tie between the instruction teachers give to students and the assessment measures they use to determine student learning. Without that connection, the tests would be ineffective tools for providing teachers feedback on how well they are teaching students. Curriculum alignment yields an accountability program.

Finally, adaptive instruction requires a close connection between instruction and assessment. Assessment must occur soon after instruction so that future instruction can be targeted to whatever learning deficiencies have been identified. Teachers depend on immediate access to assessment data if they are to use that information for instructional decisions. They cannot wait several weeks for test scores if they are to make prescriptions for future instruction based on current learning.

For adaptive instruction to be successful, the objectives, instruction, and assessment must be directly linked to each other.

Instructional management systems are receiving considerable attention as a viable means of providing adaptive instruction. Most management systems feature computer software capable of storing large numbers of objectives and their tests; scoring student performance on those tests through optical scanners; and generating and storing a variety of performance profiles on students, classes, and schools. Peripheral software is usually available to inventory instructional resources and materials, which are keyed to the objectives, and to maintain student attendance records and other student information. The advantage of such a system is that it can easily handle the heavy amount of information flow required by adaptive instruction.

One of the best developed instructional management systems we have seen is the one in the Beaverton School District. Since 1976, the district has invested substantial time, energy, and money in its elementary math and reading programs. Initially piloted in a single school, the two programs, Managing Reading By Objectives (MRBO) and Managing Arithmetic By Objectives (MABO), are now used in all 26 elementary schools. [MRBO and MABO consist of objectives, tests, and procedures for administering, scoring, and using the test information.] Both programs generate and manage substantial quantities of assessment data regarding student performance on objectives. This information is managed centrally on a mainframe computer by district personnel. Coordination is handled at the building level.

Beaverton School District is located 30 miles from a major metropolitan area in the Pacific Northwest. While its overall setting is rural, the surrounding area is growing rapidly, taking on many typically suburban characteristics. New housing tracts and shopping malls are under construction, and the school is expanding classroom facilities in anticipation of continued enrollment growth.

The school district itself has 26 elementary schools, six intermediate schools, and three high schools. Total student enrollment in the district was about 20,000 students. The district employed over 1200 teachers, many attracted by Beaverton's reputation. According to one teacher, the "reputation of the Beaverton School District is statewide, you know, one of the best in the state. They pay you the best wage, have the best materials, and provide the best services."

Cooper Mountain Elementary, the school we selected to visit, enrolled approximately 400 students in grades kindergarten through six. The instructional staff was comprised of 14 teachers and a certified support staff consisting of a learning disabilities teacher, a half-time Chapter I teacher, a part-time school psychologist, and a speech/language teacher.

We initially visited Cooper Mountain Elementary[1] in the fall of 1985 to study their reading and mathematics programs. The intention of MRBO and MABO was to provide some organization and consistency to the reading and mathematics curriculum. Teachers were expected to use the assessment data to organize their instruction in these areas. Our field records raised several questions about how and to what extent teachers use MRBO and MABO data.

We made a return visit to Cooper Mountain in the spring of 1986 to ascertain what role the MRBO and MABO data actually played in teachers' instructional decisions. We learned that although MRBO and MABO are well developed accountability programs, teachers in general do not use the data to make the types of decisions required for adaptive instruction. As one principal stated, "It's not an instructional program. It's pure management."

The emphasis on the managerial use of the system started during its early development. According to Dr. Steven Lynch, Director of Elementary Schools, the teacher union had prevented the district from linking the system to the instructional model used for inservice at that time. Consequently, teachers found it difficult to use the information provided by the system for adaptive instruction.

Teachers used MRBO and MABO primarily for two purposes. First, MRBO and MABO provided teachers with a general starting point for instruction at the beginning of the school year. Second, teachers used MRBO and MABO information to determine which objectives had not yet mastered. Students were then pulled from instruction for special work on these objectives in order to complete, as best as possible, the student skills profile.

However, teachers did not generally use MRBO and MABO to make decisions about corrective instructional action at the time students were having learning difficulties. At Cooper Mountain, as in most schools, instructional decisions about what students were to learn next were based primarily on the textbook. Why instructional decisions were only loosely connected to the MRBO–MABO assessment information is one of the questions addressed in this case study.

1. As part of an evaluation of the MRBO and MABO programs completed by the Northwest Regional Educational Laboratory (Savard, 1984), a faculty rating of the programs was obtained at each of the 26 schools in the district. The programs' most positive rating came from the Cooper Mountain Elementary faculty.

Program Description

Purpose of the Program

The primary purpose of MRBO, according to a district brochure, is as a "management system designed to help the teacher keep track of each child's progress in learning to read. By enabling the teacher to accurately track each student's progress, it ensures that your child will be making the most efficient use of his or her learning time, without unnecessary overlaps or omissions of information."

Another district document, titled "Benefits of a District Instructional Management System," lists five benefits for teachers:

- Can determine when a student has mastered a skill
- Can pinpoint where students need instruction and identify the kind and variety of different materials needed
- Can talk to students and/or parents about what needs to be learned and progress made
- Can ensure students have mastered the basics before they move into more challenging materials
- Can focus on teaching toward an instructional objective

Curriculum Features of MRBO and MABO

MRBO consists of 196 first through sixth grade reading objectives divided into four areas of instruction: (1) vocabulary; (2) comprehension; (3) structural analysis; and, (4) study skills. Phonics skills are also part of the program, but are separated from the above four areas.

The objectives are organized into 12 levels: Pre-Primer (PP), Primer (P), 1, 2.1, 2.2, 2.0, 3.1, 3.2, 3.0, 4, 5, and 6. The objectives are also categorized, within levels, into basic and standard strands. The basic strand includes below grade level objectives which are generally completed before students move into grade level or standard strand objectives. An additional challenge strand is available for students working above grade level.

Figure 1, a district document, provides a graphic representation of the curriculum structure for MRBO. This document also suggests the general outline of testing recommended to teachers.

MABO operated much like MRBO, with two exceptions: there is no challenge strand in MABO, and there is no differentiation between basic and standard strands. There are 175 objectives organized into six grade levels, one through six. The objectives are divided into eight general topics: (1) number concepts; (2) communicating ideas; (3) estimation and approximation; (4) computation; (5) problem solving; (6) geometry; (7) measurement; and (8) charts and graphs.

Assessment Features of MRBO and MABO

Three types of assessment instruments are used in MRBO and MABO: placement tests, survey tests, and individual objective tests.

Placement Tests. The MRBO and MABO placement tests are designed to identify at what grade level to begin testing new students in the MRBO and MABO systems. These tests are not linked to specific MRBO or MABO objectives. MRBO has eight placement tests, and MABO has six placement tests.

Survey Tests. The survey tests are designed to assess more than one MRBO or MABO objective. These tests are usually given early in the year to find skill deficiencies. Survey tests have three to five test items per objective, and the criterion for mastery is set at 100 percent. Computer printouts designate objectives as either "pass" (all items correct for the objective) or "instruct" (not all items correct for the objective). Those objectives designated as "instruct" require the teacher to move to the next assessment phase—the individual objective tests. The survey tests are used for placing students into

Figure 1
Testing Plan—Year At A Glance

BS—Basic Strand
SS—Standard Strand
CS—Challenge Strand

GRADES		PP	P	1	2.1	2.2	2.0	3.1	3.2	3.0	4	5	6
1	BS	1	4	11									
	SS	1	3	2									
	CS												
2	BS				8	11	10						
	SS				7	5							
	CS												
3	BS							8	7	18			
	SS							0	4	1			
	CS												
4	BS										23		
	SS										7		
	CS												
5	BS											22	
	SS											11	
	CS												
6	BS												22
	SS												10
	CS												

General progress of instructional groups at, above, and below level through the year

Skills Groups:	September	January	April
Below Level (Individual Tests)	Below grade level — use Basic Strand	Instruct using Basic Strand objectives	Instruct using Basic Strand objectives
At Level (Individual Tests)	Standard Strand at previous level completed	Complete Basic Strand at grade level	Complete Standard Strand
Above Level (Survey Tests & Individual Tests)	Complete Standard Strand for current grade level	Completed Standard Strand Start Challenge Strand and Basic Strand above level	Complete selected objectives in Challenge Strand Instruct using Basic Strand objectives at level above (except Gr. 6)

instructional groups, making a skill profile, or projecting a long-term instructional plan.

Individual Objective Tests. Individual objective tests are designed to determine mastery of single objectives. Objective tests are usually five to ten items in length, with the mastery criterion set at 80 percent.

MRBO and MABO Reports

All teachers for grades three through six used answer sheets which were computer-scored at the district office and returned to the school, usually within three days. First and second grade tests were consumable, which meant that teachers had to complete the answer sheets for students. This was not, understandably, the most positive feature of the program for primary teachers. One first-grade teacher commented, "When I get all this [test] information, then I have to sit down and do all the computer sheets and all that stuff. And it's just not my favorite thing."

A variety of computer reports were available to teachers and administrators:

Survey and Individual Objective Test Reports. The survey and individual objective test results can be reported for each student either as simple pass/fail summaries or in more detail, giving the actual percentage of items correct for each objective.

Group Status Reports. There are four group status reports available. At the request of a teacher, these reports can provide the cumulative or current year testing history for a group of students. The four reports are (1) detail report, which indicates whether an objective was passed and what year the test was attempted for all objectives, (2) tests taken/passed report, which provides the number of tests possible and number passed for each content area within each level (e.g., in MRBO, comprehension, vocabulary, structural analysis, and study skills objectives within each of the 12 levels), (3) percentage report, which lists the number of tests possible, number passed, and percentage passed within each level, and (4) completion range, which gives a listing of students organized into ranges of percentage of objectives completed for a given level (e.g., two students completed 0–24 percent of level 4 objectives, ten students completed 25–49 percent of level 4 objectives, etc.).

Individual Skills Profile Reports. This profile is a one-page summary which lists all objectives and indicates when each objective was passed by a student. The skills profiles, one each for MRBO and MABO, accompany the report card sent to parents. According to the principal, a teacher can order the skills profile "to show only the ones he has passed, so it's totally positive, or you can order the printout on a kid that shows the ones he's passed and the ones he has attempted and not passed."

All teachers for grades three through six used answer sheets which were computer-scored at the district office and returned to the school, usually within three days.

Objective Summary Reports. This report gives the number of students tested, number of students passing and failing, and percentage of students failing for each objective. According to district information, "The summary for a grade level [at the school level] can provide information useful in selection of instructional materials and teacher inservice needs."

The district also supplies a hand-completed form to teachers called the "class matrix." According to district information, the matrix is designed "to help teachers identify instructional groups in their classes." The matrix is a series of single pages with the objectives listed across the top and space for student names down the side. For each student, a teacher enters a plus or minus in the objective column, depending on whether the student passes the objective or not. These matrix sheets also have individual objective and survey test numbers on them, as well as shading that indicates whether an objective is a basic or standard strand objective. The matrix, the most popular record keeping device for many teachers, records the same information as the individual skills profiles. Many of the more detailed reports are not used nor were they intended to be used by the teachers.

MRBO and MABO Operating Procedures

The description to this point has focused on the structural features of the two programs. This section discusses how the program is expected to work.

A learning disabilities (LD) teacher at each school is assigned responsibility for site level coordination of the MRBO and MABO programs. Tasks include coordinating staff development/training, ordering test materials, specifying procedures and timelines, and answering teacher questions. A half-time instructional aide asists the LD teacher.

At the beginning of the school year, teachers have the individual skills profile and standardized achievement test results from the previous year for returning students. These scores, as well as any informal work samples the teacher may have collected, are used to form reading groups. New students are given MRBO-MABO placement and survey tests. Teachers are also expected to test skills that have not been passed at last year's grade level.

While MRBO and MABO objectives provide the foundation for the overall curricular plan at each school site, teachers are encouraged and expected to expand the total scope of the reading and math programs according to their own interests, talents and available resources. According to the LD teacher, "[we use MRBO and MABO for] just double checking ourselves to make sure we're teaching everything. . . . It is the bare bones that we're checking on, and then they go from there."

At Cooper Mountain, the principal put together a calendar that assists teachers in planning and scheduling for assessment. This timeline has four cutoff dates for testing. These dates correspond to the nine-week report card period so that students' testing histories can be brought up-to-date. The dates also serve as check points for the number of objectives a student has been tested on to date. In addition, the timeline outlines what needs to be completed each month and helps teachers pace their testing. A lack of diligence in testing can produce negative consequences, as explained by the principal:

> *What happens is you get around in May, if you haven't been watching it, and you'll find a couple of those [teachers] who haven't been doing any testing yet. Then all of a sudden, they're testing their kids four or five days a week, the kids are complaining, their mothers are complaining, and the teacher is complaining because they can't teach any reading because they have to do these tests. So you have to monitor it.*

The Use of MRBO and MABO by Teachers

At Cooper Mountain Elementary, as in all Beaverton School District schools, MRBO-MABO was a fact of life in the district, a "condition of employment." Our concern was not whether teachers used MRBO-MABO, but how they used it. As one central office administrator said, "It's one thing to say that all the teachers are using the instructional management system in the building, but it's another thing to say how well they're using it." Likewise, another district administrator said, "People have thought of lots of good ways to send good information out there, and now we just have to make sure that they use all that information."

To understand how teachers use MRBO and MABO, we must distinguish which tests are being used and at what time during the school year. Depending on the time of year teachers administered tests, they used the assessment information for different purposes. Consequently, we have organized the following discussion around three time periods during the school year.

Testing at the Beginning of the School Year

At the beginning of the school year, teachers used the survey tests to provide a general assessment of student competence, or as one teacher put it, "to just get a feel for where they are." The individual tests were administered after instruction had begun. Two teachers described the typical procedure for using survey tests:

So I would give the survey tests at the beginning of the year and find out, more like a pretest, find out where they need extra instructional aid versus the regular program. And then retest with the individual testing later.

The way I've used it is that at the beginning of the year, I give the survey tests to the kids, to kind of find out where their strengths and weaknesses were. And then I've gone from there, taking those results and trying to zero in my teaching to where the kids need the most emphasis.

The survey tests, however, were not used with students below grade level. As one teacher explained, "I have the low math. So in that, there is no survey given because it would be absolutely frustrating for them, and it would be a waste of my time and paper because there's no way that these children are going to be able to take a survey test and pass it."

Teachers also used the survey tests as a device to locate the "holes" in the student's learning history. These holes then become the focus for the instruction, as described by one fourth grade teacher:

I have 28 in the top reading group, which is wonderful. I mean that's marvelous! So I had 28 kids whom I put into a survey skill test for MRBO, to see where the holes were. And then I used those holes as my objectives for the children. Because they were the top readers, I can give the survey test. If they're not my top readers, you can't give the survey test.

Several teachers noted that they did not use the survey tests very much because they required 100 percent correct to pass while individual tests only required 80 percent.

Testing During the School Year

Once the school year was under way, teachers administered the individual objective tests to measure skills taught during instruction. Teachers used these tests in an interesting way. They waited from one to three weeks after instruction before administering the tests. Virtually every teacher mentioned this strategy:

I wait a couple of weeks before I test [a] skill, because it isn't just a teach-test immediately type thing. You see if it sticks.

I'm not sure what the rule is, but, I think, usually one to two weeks and then you go back and retest.

I would wait a week or so. . . . But there is a wait time that I really like to have. I do not test the next day; it shows nothing when you do that.

You have to wait awhile. Wait a couple weeks just to make sure—two to three weeks is what I wait—with a short review in between there.

I give them the unit test out of the book. And then a couple of weeks later, I'll come back with the MRBO or the MABO tests and test to see if they have retained that lesson or that skill.

Consequently, teachers did not make use of the assessment information for immediate instructional decisions. Although most teachers expressed their intent to reteach objectives not passed by students, and in fact many did so, it was reteaching well after the original instruction. Due to the delay between the end of instruction and assessment, reteaching was accomplished primarily by teachers pulling students periodically from instruction to "replug the holes":

Then you go back, and I look and I

see where the holes are for these particular children. And then I pull groups of children who need a particular skill.

I would pull small groups of kids that needed specific skills and give them specific instruction in skill areas they were weak in.

I'll be very frank with you. Right now, the way I'm getting a lot of it done is that I have an intern. She is teaching right now and I'm pulling kids. See, you have three or four absent or this or that and so you're constantly going back and pulling these kids.

So that's how I plan on picking up the skills that the kids don't have, pulling in small groups of kids and doing specific skills with them.

Thus, while the assessment information was used by many teachers to reteach students who did not pass tests the first time, the assessment information had little direct bearing on the next unit of instruction for students. This strategy may have been affected by the emphasis district training procedures placed on MRBO-MABO as a "test-teach-test" model rather than the teach-test-reteach model of adaptive instruction. For example, one set of teacher directions for testing suggested that once skill deficits have been determined, "continue with the test-teach-test strategy using individual skill tests."

Thus, assessment information was used not so much to correct learning as it was to document what learning had or had not occurred. One teacher commented, "I tested them because I knew I would be required to have that information turned in at some point." Others noted that the testing simply confirmed for them that students had indeed learned the material taught during instruction. For example, one teacher said, "It's just a check to see which kids are retaining the things that we are doing."

In addition to the two to three week rule, some teachers used other strategies which delayed receiving assessment information even more. One teacher, for example, described how the size of the answer sheet influenced the testing strategy:

You have this answer sheet with six spaces on it, right? Now after I give one test am I going to send those answer sheets to the computer and have them check that one little box and then get that back in three days and cycle back? No. No. I'm going to fill out the answer sheet, and when they're all filled, they go into the computer and then maybe in another month or so, we'll cycle back and hit it again if we need to.

Because each answer sheet contained enough space to test six objectives, this teacher waited until students had been tested on six objectives before submitting them for scoring.

Testing at the End of the School Year

At the end of the school year, teachers were concerned about completing their testing and filling out the skill profiles of their students. Testing depended on how diligently teachers had tested during the school year. One teacher described the process as follows:

At the very end of the year... I've got my matrix and I've got skills up here—pass, pass, pass, oh, here's somebody who didn't, pass, pass, pass, here's somebody else who didn't—I'll pull however many kids didn't pass that test and I order those forms, those tests again.... I will give that test twice and that's it.

Another teacher explained why she delayed testing until the end of the school year:

I've worked with the program seven or eight years at least, and it seems that if I retest right away, chances are, they still haven't had that much more experience with the concept yet. But if I wait until the end of the year, more than likely they'll pass it.

Excessive testing was discouraged by district administrators because "if a teacher gets real hung up with nitpicking and going back and wanting to fill in all the blanks with plusses, then it can really be a nemesis for a high student."

Summary: Accountability or Adaptive Instruction?

We began this case study by outlining three requirements for adaptive instruction: a criterion-referenced assessment system, curriculum alignment, and a close connection betweeen instruction and assessment. One way to provide adaptive instruction that is receiving considerable attention is by implementing a computerized instructional management system.

We examined one well-developed instructional mangement system that appeared to have the necessary features for adaptive instruction in place. However, our conclusion is that the program, known as MRBO and MABO, did not go beyond providing accountability information. Assessment was too "distant" from the actual instruction; in fact, most teachers we spoke to considered MRBO and MABO to be an assessment program independent of instruction. One teacher remarked, "I would rather spend my time instructing than testing."

What factors impeded teachers from using the assessment information to directly affect inst uction? We found several reasons why Cooper Mountain teachers perceived MRBO and MABO as almost interruptive of their instruction and used them perfunctorily.

First, some teachers questioned the validity of the individual student profile reports because there was inconsistency in how these reports were used across grade levels. Said one teacher:

> *To me, MRBO is not a good indicator, and I'll tell you why. Because not every person uses them the same way. You may have two different teachers in the grade level in front of you. One teacher feels that it's very important for every kid to pass the tests. No matter what, every kid is going to pass the tests. Another one may not have that philosophy.*

Second, the textbook series is the foundation of the instructional program, not the MRBO or MABO objectives. Teachers found it more convenient to use the assessment instruments readily available from the textbook or their own curriculum files. They also found the tests derived from the textbooks and other teacher-designed assessments more meaningful sources of information because they closely reflect the classroom instruction. As one teacher said, "I don't look at MRBO that much. I don't use it for planning my instruction. I know what I need to cover for my first grade students." Another teacher commented, "I use the initial assessments that go with that program. I don't use MRBO-MABO." Thus, mainly as a result of the misalignment between assessment, curriculum, and objectives, teachers view MRBO and MABO as more of an administrative template placed on top of the existing instructional program.

Third, teachers did not receive the assessment information on a timely basis. This lack of timeliness was not because the district was tardy in delivering test results to the teachers. On the contrary, according to several teachers, the district usually returned test scores within three days. Rather, the delay was caused by teachers postponing the MRBO and MABO testing for several weeks following instruction. By following such a schedule, assessment information could be used to determine the retesting of students, but not necessarily the immediate remediation of students.

In conclusion, the MRBO-MABO program was, for most teachers, a mandated framework overlaid on existing instructional practice. While the results of the assessment information were undoubtedly used and were in general helpful, they were not likely to affect teacher planning of instruction in any major way other than pointing out holes to be filled by pull-out instruction. The assessment information was too distant from the actual instruction for it to be used by teachers on a timely basis.

Our analysis confirms that made by a Northwest Regional Educational Laboratory evaluation of MRBO-MABO made in 1984 by Savard (1984). One of the conclusions of that report was:

Many teachers are not using the MRBO-MABO system in the way it was intended. The major problem is that testing is not taking place on a regular basis nor is it proceeding apace with instruction. Therefore it is reasonable to conclude that it is not being used to manage instruction as fully as it could. (p. 102)

Given the propensity of MRBO-MABO to be linked more closely to accountability than to instruction, it is not surprising that MRBO-MABO played a significant role in reporting student progress to parents. As the principal stated, "Public relations-wise, it's been a marvelous thing because for the first time, in my experience, the teacher can sit down with the parent and show them the specific skills that the child has mastered since the last time the teacher and parents talked. Parents like that." MRBO-MABO provided the common language for such dialog to take place.

In addition, for many teachers and administrators it was the first time they were actually able to specify with confidence the skills they had been teaching. As the principal of Cooper Mountain stated, "It's the first time in some 26 years... that I've felt like, as an administrator, I had some idea of what was happening in the reading program in grades 4, 5, and 6, particularly 5 and 6 .... you never knew whether they really needed to be teaching what they were teaching or not, and they didn't either."

Perhaps this has been the real benefit of MRBO-MABO to Beaverton School District. It has provided a means of talking about instruction in a way that everyone could understand. And it provided something concrete which everyone could direct attention to during instruction. An interesting perspective on MRBO-MABO was provided by a ten-year veteran working his first year at Cooper Mountain and Beaverton School District. Having been exposed to MRBO-MABO for about two months, he offered this comment on MRBO-MABO:

Personally, I think this is the way to go because I think that it gives a teacher the chance to really zero in on where kids have their weaknesses.... I like the idea that I can test right now and find out where these kids are at so that I can put my energies into areas where they need more help rather than going through a basal reader and just doing the skills as we go along hoping that at the end of the year, when we take their achievement tests, they've picked up everything.

CHAPTER SEVEN

Implementing Models of Instructional Organization

Introduction

This casebook has presented case studies of ten programs defined as mastery learning or outcome-based education. The programs have been organized in the casebook according to four models of instructional organization. The four models are whole-class mastery, flexible grouping, flexible grouping/continuous progress, and continuous progress. We have also included a case study of an instructional management program.

None of the programs in this casebook, in our view, comply fully with the mastery learning or outcome-based programs described in educational literature. This should come as no surprise. The translation of outcome-based ideas within a time-based school organizational structure is bound to yield imprecise results and compromises. This fact was underscored by the reform experiences of educators in our ten case studies. One should not conclude, however, that the ideas are not worth pursuing or that no reform occurred. Schools and school systems are difficult organizations to change and reform, especially for long-term programs like mastery learning and outcome-based education. Many of the efforts in this casebook represent extensive reform even though the programs may have been less than fully implemented.

In this chapter, we take a broad view of the ten sites and outline some program implementation and maintenance issues. In the first section, we discuss seven obstacles to implementation and program maintenance. In the second and final section, we present a general design for implementing any of the instructional organization models. We suggest a mastery-oriented *belief system* is critical for the implementation of any of the instructional models and that this belief system is best developed and fostered in schools with established norms of cooperation and collegiality among teachers and between teachers and administrators. We also suggest a general building-level model for program implementation. This model outlines important building and district-support components for all four instructional organization models.

Program Implementation and Maintenance Issues

A fundamental concern about any innovation or program revision is the *fidelity* with which the innovation or revision is implemented. Discrepancies between the program as described on paper and program as implemented call into question the quality of the innovation or revision. But program implementation is only half the battle. Once an innovation or revision has been implemented partially or fully, it is necessary to maintain the new program. The issue becomes the *extent of time* that program practices are being used.

Most OBE programs are implemented gradually. Consequently, it is difficult to distinguish when a program is implemented and when it becomes institutionalized. At any given time, some components are in place and need to be maintained while other components are just being implemented. Thus, implementation and maintenance concerns often occur simultaneously. Even so, the issues each raise are different. In this section, we first present obstacles to program implementation and then we discuss threats to program maintenance. Although these issues apply to most educational programs, they are discussed here in the context of mastery and outcome-based programs.

Obstacles to Program Implementation

Four obstacles to program implementation are (1) lack of reform preconditions, (2) poor understanding of program features, (3) teacher resistance, and (4) teacher domestication.

Lack of Reform Preconditions. Educational reform is difficult even under the best of circumstances. Yet it becomes even more arduous if certain preconditions are not present. Five prerequisites have shown up singly or in some combination in the sites studied.

First, implementing mastery learning or outcome-based education requires an extensive amount of *work* by administrators and teachers alike. Implementation is accomplished over years rather than months, weeks, or inservice sessions. Second, *user commitment* is critical to implementation success. Without the commitment, energy for organization change is low or nonexistent. Third, it is critical that implementation efforts be *well-planned* and organized. Without adequate planning, implementation can be disjointed and the pieces never fully assembled into a program. Fourth, a clear *goal* of the direction of the implementation efforts is required. Without a consensual destination in mind, it is difficult to keep the reform efforts on track and leading in the right direction.

The final precondition is *leadership* and *organizational support*. Decisions made by whomever administers the reform efforts must maintain and support the implementation rather than sidetrack or impede it. Without leadership and organizational support, all the rest—the goal setting, planning, commitment, and work—will be jeopardized. It is also true that school board support will likely make such leadership easier to exercise.

Poor Understanding of Program Features. How accurately a program as described on paper is translated into practice hinges on the interpreter's understanding of the program. This may not be a problem with small or less extensive reforms. However, given the complexity of reform that mastery and outcome-based models entail, poor understanding can be a problem. Some districts and schools do not receive adequate consultation or receive training that is not consistent with the intent of mastery or outcome- based practice. Other districts or schools receive adequate initial consultation and training but are then left on their own devices to complete implementation. In either case, inadequate implementation is almost certain.

Teacher Resistance. Initial efforts to implement mastery learning and outcome-based programs often meet resistance from teachers and administrators. We found many reasons for this opposition.

First, mastery learning and outcome-based programs require extensive time commitments from teachers. The staff development efforts to train teachers in mastery learning theory and practice typically require hours of inservice and often extensive curriculum revision. Many teachers face time constraints already, and to revamp everything on top of existing job requirements is too much work. Furthermore, embracing major change is an implicit admission that the teachers' current classroom practices are in need of an overhaul.

Not only are the time commitments demanding, but the philosophy of mastery learning challenges prevailing teacher beliefs about students. Teachers have first-hand experience with the extent of student differences and how those differences influence motivation and learning. To suggest that all students can and will learn if only taught properly raises a red flag for some teachers. Many teachers have heard similar claims in the past, but dispute these claims based on their own experiences.

A third reason many teachers resist mastery learning and outcome-based education is that they do not initially understand the concepts. This might be because the trainer does not present the concepts correctly or clearly or because they are not learned correctly. For whatever reason, teachers' knowledge and opinions about mastery and outcome-based practices are sometimes based on an incorrect understanding.

A complaint that is often voiced about mastery learning, for example, is that it is mechanistic and fosters uniformity. One teacher just beginning mastery learning inservice activities (not at one of the schools in the case studies) told us, "I have a real dislike for the concept of mastery learning because everybody has to say the same thing and everybody does the same thing at the same time." Another teacher at the school said, "everything is spelled out" and mastery learning "takes away all your innovative ideas." These perceptions are not well founded, and it is a good bet that these teachers adopted few mastery practices.

These and other reasons can lead teachers to resist mastery and outcome-based inservice activities. Resistance can take many forms, from disgruntlement during training sessions ("It won't work with my kids") to noncompliance ("You do what you want behind closed doors"). A common strategy for teachers is to not pay too much heed to the inservice activities, based on their assumption that the program will likely follow past scenarios of "here today, gone tomorrow." One teacher, for example, told us, "It's this program's turn now but it will fade away soon and another will come."

Not only are the time commitments demanding, but the philosophy of mastery learning challenges prevailing teacher beliefs about students.

In the face of resistance, it is tempting to make mastery learning and outcome-based education more palatable to teachers. This can be done in a variety of ways. One way is to water down the full implications of mastery learning ("It's only a philosophy"). Another way is to tell teachers that they are already doing mastery learning and that only minor modifications in their teaching are needed ("It's just good teaching," or "Most teachers are doing it already"). Still a third way is to suggest that an initial outlay of effort is all that is needed ("You just do it once and it becomes part of you"). Trainers, in an effort to present mastery learning in an acceptable form, sometimes do so at the case of diluting the mastery and outcome-based concepts and thereby decreasing the fidelity of program implementation.

Teacher Domestication. Even under favorable conditions, where adequate preconditions for change are present and there is little teacher resistance, implementation fidelity can still be jeopardized by teacher modifications to a program. Teachers often alter a program to fit more closely the constraints of classroom instruction. In so doing, the original intent of the program can be diluted or lost altogether. This is what is meant by teacher domestication.

There are numerous ways in which domestication can occur. Teachers may selectively focus, for example, on one component of mastery learning practice to the exclusion of others. Thus, some teachers emphasize the teaching to objectives component of mastery learning rather than the feedback/correction component because, we suspect, it is easier to implement objectives-based instruction than to implement correction/feedback instruction.

Threats to Program Maintenance

Three threats to program maintenance are (1) staff mobility, (2) press toward routinization, and (3) new curriculum or testing programs.

It takes a considerable amount of time to learn mastery practices and even longer to become proficient.

Staff Mobility. Staff mobility refers to the extent of teacher and administrator turnover in a district or school. We have found mobility to be an extremely formidable threat and one that has no direct remedies. While working conditions influence the desirability of maintaining employment in a particular school or district, there are many factors outside the control of the educational system that affect work force stability.

Staff mobility is a critical threat to program maintenance primarily because much of mastery and outcome-based practice resides in specialized teacher knowledge and skill. This knowledge and skill is not typically part of a teacher's repertoire unless the teacher has completed specialized training in mastery and outcome-based techniques. Mobility would not normally be a problem except that it takes a considerable amount of time to learn mastery practices and even longer to become proficient. Consequently, when skilled teachers leave a school or district, part of the program leaves with them.

It is useful to think of a district or school as possessing a "collective knowledge," the collective knowledge being the expertise of individual teachers and administrators. Staff development efforts attempt to contribute to the collective knowledge of a school or district. Staff mobility can erode the collective knowledge. In the case of mastery and outcome-based practices, the consequences can be severe. Other things being equal, the half-life of a district or school program is a direct function of the turnover rate of the faculty. The collective knowledge potentially threatened for the life of the program and staff development resources must be allocated simply to maintain the program at its original implementation level.

Press Toward Routinization. Mastery and outcome-based programs increase the instructional burdens on teachers. At the classroom level, these programs require that instructional decisions be based on the learning outcomes of students. This means that teachers must first collect information about learning outcomes, and second, that they use that information to provide immediate instruction appropriate to the learning needs of students. This fundamental requirement of outcome-based education greatly increases the instructional and managerial burden on teachers in an environment where a strong press to routinize classroom activity already exists. This press toward routinization will exist throughout the life of the program and represents a major ongoing threat to mastery and outcome-based programs.

New Curricular or Testing Programs. New curricular or testing programs pose a potential threat to mastery and outcome-based programs. Curricular materials in mastery and outcome-based programs are based on and organized around learning outcomes. Such outcomes are specified prior to instruction, and criterion-referenced and mastery tests are administered to indicate the extent to which students have reached these outcomes. Teachers use this information to organize students for instruction matched to their current level of learning and to provide corrective instruction to students not yet demonstrating mastery. Thus, any large-scale change in either the curriculum or the tests threatens the existing program. Revisions in curriculum and assessment can occur, but provision must be built into the system for maintaining congruence between the curriculum and testing programs.

General Designs for an Implementation Plan

How can these obstacles and threats to implementation fidelity and use be overcome? How can educators increase their chances for better congruence between the theory of mastery learning and outcome-based education and the actual practice of instructional programs based on these ideas? We suggest two fundamental activities. First, devote considerable effort to establishing a mastery-oriented belief system. Second, develop a comprehensive, building-level plan for program implementation and support. Each of these activities are discussed below.

Mastery-Oriented Belief Systems

We have been most impressed with the positive and self-reinforcing effect of a mastery-oriented belief system on teachers and students alike. Believing that all students can learn contributes in many positive ways to how teachers approach teaching. Most importantly, teachers hold high expectations for success. Students come to expect success as the outcome of instruction and some even begin to insist upon it.

The importance of the belief system cannot be underestimated. Apart from its affective consequences for teachers and students, a mastery belief system can help establish and sustain the motivation for change, can help reform efforts stay on track by providing an overarching goal to guide actions, and can help remind teachers what fully implemented mastery or outcome-based practices look like. By playing such a role, the belief system can maintain fidelity of implementation.

Belief systems are best established in schools and districts that foster teacher cooperation and collegiality. The programs that we saw experiencing success were programs where teacher cooperation occurred, either because the program required it or because the teachers learned that it made their teaching easier. Teacher cooperation also contributed to instructional flexibility, since teachers could work out procedures by which students, based on their instructional need, might be shared among teachers.

Establishing a belief system is not an easy task. Belief systems and collegiality cannot be mandated; they need to be created and fostered through a variety of activities supported and rewarded by district administration. Dissemination of knowledge, leadership teams, staff development activities, recognition of accomplishments, and teaming arrangements can all contribute. The bottom line, however, is commitment.

Building-Level Plans

The full implementation of mastery and outcome-based programs becomes a complex, long-term process involving local school boards, district administration, principals and teachers in an examination and redesign of the instructional system and the district policies that support that instructional system. Certain changes in school and district policies can help insulate the program from threats to program maintenance. We have organized these school and district policies into a five-component model of district-supported mastery and outcome-based education. This model uses many of the same components of mastery learning and outcome-based education identified in Chapter One but organizes them in a manner consistent with existing practice.

The model of district-supported mastery and outcome-based education is presented in Figure 1. The five components are instructional organization, aligned curriculum, instructional delivery, information management, and administration. Each component has district- and building-level factors. Each of the five components are briefly discussed below, with primary emphasis given to the building-level factors.

Instructional Organization. This casebook has described four ways in which students are organized for instruction in a program or a school. What model of instructional organization a district

	[illegible]	INFORMATION MANAGEMENT	ALIGNED CURRICULUM	INSTRUCTIONAL ORGANIZATION MODELS	INSTRUCTIONAL DELIVERY
DISTRICT-SUPPORT FACTORS	[illegible]	Computer Support	Curriculum Planning	District-Building Coordination	Staff Development
	[illegible]		Testing Program	Building Plans	Categorical Funding Support
	[illegible]		Exit Outcomes	Promotion/Graduation Policy	
	[illegible]				
BUILDING-LEVEL FACTORS	[illegible]	Resource Storage	Course of Study Rationales	Student Placement	Teaching Skills
	[illegible]	Item Banking	Course of Study Outcomes	Student Advancement	Within-Class Grouping Skills
	[illegible]	Test Creation	Learning Units		
	[illegible]	Report Production	Materials		
			Mastery Assessment Methods/Standards		

Figure 1
A Model of District Support and Building Level Factors for Mastery Learning and Outcome-Based Education

or school chooses to implement has direct implications for how students will be placed and advanced in the program.

Coordination between the district office and the building staff is a critical factor in how smoothly that instructional system is managed. Obviously one would always strive for good coordination, irrespective of whether it was done within an outcome-based framework. However, there is added significance in a outcome-based district, when conceivably, schools could be using up to four different models of instructional organization, each with its own support requirements from the central office. Consequently, coordination becomes even more important with different building plans.

Aligned Curriculum. In an aligned curriculum, where what is tested is what is taught, there is close coordination between the testing program of the district and the curriculum of the school. This does not mean, however, that tests should determine the curriculum taught or that the curriculum should only cover topics tested. Teachers and curriculum experts should determine the curriculum, and tests should be developed or selected that match that curriculum.

Figure 1 identifies two levels of specificity for defining learning outcomes. At a general level, an aligned curriculum starts with exit outcomes, the learning outcomes a district (or state) desires for all its students. Exit outcomes express the broad educational goals toward which the schools can design their course of study outcomes. Exit outcomes can be organized to correspond to the district's school organizations—for example, elementary, middle, and secondary.

Course of study outcomes are the learning outcomes for a particular subject. Each subject—mathematics, reading, language arts, science, or social studies, for example—has its own set of outcomes. Collectively, these outcomes are written such that their attainment provide the basis for students to obtain the broader exit outcomes. Course of study outcomes are written at a level between instructional objectives, useful for daily lesson design but too numerous for program organization, and exit outcomes, typically too broad for adequate description. Guiding the establishment of course of study outcomes are rationale statements, descriptions of purpose and justification of the outcomes in the curriculum.

Because the course of study outcomes cannot be taught at the same time, they need to be organized into manageable blocks of curriculum. The learning unit, two to four weeks worth of instruction covering one or two course of study outcomes, is a useful division of curriculum. It is not so small as to fragmentize the curriculum nor so large as to interfere with mastery testing and correction/feedback procedures.

Instructional Delivery. Once students are organized for instruction over some segment of curriculum, they need to be taught. Instructional delivery refers to actual teaching techniques and how the curriculum is presented to students. Two fundamental aspects of teaching involve specific teaching skills and within-class grouping arrangements.

New staff development efforts need to supplement and reinforce existing practice, not replace it.

There has never been a shortage of new staff development programs for classroom teaching and grouping techniques. Each year brings a new batch of programs for teachers and administrators, promoters using the latest jargon to explain why it is better or more comprehensive than its predecessors. Many of these programs offer useful information to teachers and administrators, and should be part of a comprehensive plan for school improvement. What is necessary, however, is to build upon the knowledge that has been gained from past staff development efforts. New staff development efforts need to supplement and reinforce existing practice, not replace it. A comprehensive plan acts as a framework to slot new work into the existing framework. Without it, it is certainly understandable why many teachers adopt the standard "here today, gone tomorrow" attitude that particularly underlies their resistance to new programs.

Information Management. Information management is exactly what the name implies—managing the information generated by the mastery or outcome-based program. The amount of information management required depends on the instructional organization model and the size of the program and the number of such programs in a district. For programs generating sizable amounts of information, computer-managed assistance is usually required. Storage of resource information (e.g., course of study outcomes), item banks for mastery and criterion-referenced tests, computer-generated tests for specific outcomes, and report production are potential areas in need of management.

Administration. A building-level plan for mastery and outcome-based program implementation requires administrative support, both at the building level as well as the district level. Figure 1 outlines a number of policy areas which will require attention. However, some of these areas do not require immediate attention. In fact, it is likely a mistake to attempt too many changes at once. The specific pattern of administrative support will depend on the particular instruction organization model chosen from implementation. The prudent administrator will plan policy change so that it unfolds over time and matches the required mechanics of the instructional model implemented.

Conclusion

The four models of instructional organization outlined in this casebook are difficult programs to implement. The practices of the ten schools described in the case studies are indeed commendable. Yet we do not offer these ten case studies as "exemplary schools" deserving emulation. Rather they describe educators who have attempted to go beyond current curricular, instructional, or organizational arrangements found in the majority of schools today. They have accepted the challenge of translating a difficult set of ideas into actual practice. And while they may not have always been completely successful, their experiences have provided us with ideas about how to begin moving closer to the ideal of successful learning for all students.

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Appendix A: Case Study Methodology

Background to the Case Studies

The ten case studies were written over a period of roughly six months. The organization of the case studies was the product of many hours of discussion during the previous year with various project members. Moreover, the substance of each case study reflects thinking that occurred as a result of work on all ten case studies as a group.

Because the ten case studies in this casebook come from different projects, the site selection procedures and case study methodology vary somewhat from site to site. A brief history of the three projects will help organize the description of site selection procedures and methodology used to produce these case studies.

The Computer Math Project

The first project was a year long case study of a student-paced, mastery learning mathematics program developed by Mark Myrehn, an eighth grade mathematics teacher at George Dilworth Junior High School in Sparks, Nevada. This project was part of the work conducted under the Secondary Science and Mathematics Improvement Program at Far West Laboratory during 1984 and 1985. The purpose of the study was to examine differences in the amount of work completed in student-paced and teacher-paced classroom environments. Martha Harrington visited the school every few weeks, collecting daily assignment and work data and interviewing the principal and the two mathematics teachers involved. Over 20 site visits were made during the school year.

The Excellence Project

The second project, Excellence in Instructional Delivery Systems, was funded by a one-year grant to Dr. Robert Burns and Dr. Brian Rowan from the U.S. Secretary of Education's Discretionary Grant Program. This project, which extended longer than the original 1985 duration due to funding changes, completed two activities: (1) a national phone survey of OBE programs and (2) site visits to five of the ten case study sites in this casebook: Johnson Elementary, Barcelona School, Cooper Mountain Elementary, Conrad Ball Junior High, and Explorer Elementary.

The national survey that identified these five sites used a snowball sampling technique. The procedure involved asking a group of informants knowledgeable about OBE to nominate schools with OBE programs and other individuals knowledeable about OBE. This procedure is useful in studies that examine relatively rare events and leads to a process of chain referral that allows one to sample widely throughout the country.

Over 130 people in 34 states were interviewed by telephone during March and April, 1985. These individuals identified 89 schools; we screened this list to 29. Structured phone interviews were conducted with the principals of 25 of the 29 schools during May and June, 1985. The average interview length was 45 minutes. All interviews were tape recorded and transcribed (see Jones, Rowan, and Burns, 1986, for the results of this survey).

The five sites of the Excellence Project selected for visitation represented different organizational arrangements for the delivery of instruction. Data were collected according to procedures outlined in the next section and initial site reports were written. These initial site reports, considered the raw data of the project and typically between 30 and 50 pages in length, included relatively detailed documentation. The initial site reports provided the basis for the final case studies.

Penny Jones carried out the phone survey work and was site visitor for Explorer Elementary. Brenda LeTendre (Conrad Ball), Larry Robertson (Cooper Mountain), and Bob Polkinghorn (Barcelona) were site visitors and also wrote the initial draft of one of the case studies. Until April 1986, Dr. Brian Rowan was involved in all phases of the work including conceptualizing the project and methodology, reviewing initial drafts of the case studies, and completing the analysis of the phone survey of outcome-based education programs.

The Support Project

The third project, Support for Outcome-Based Education, was funded by the Department of Education's Office for

Educational Research and Improvement under contract to Far West Laboratory. One of the activities of the project for 1986, under the direction of Dr. Nikola Filby and Dr. Robert Burns, was the writing of four additional cases studies—Mariner High School, Johnson City Central Schools, Red Bank Public Schools, and North Sanpete School District—and the revision of a fifth case study—George Dilworth Junior High—a product of the first computer math project.

The first three of these sites were identified from the phone survey of the Excellence Project (Mariner, Johnson City, and Red Bank). The Mariner and Johnson City site visits were carried out using the same methodology that was described above for the five Excellence Project sites. An initial case study draft of Mariner was prepared by Penny Jones. Bob Polkinghorn completed initial phone interview work with Johnson City. Bob Polkinghorn also made a second site visit to one of the Excellence schools (Cooper Mountain) to obtain additional information for the writing of the final case study. For the third site, Dr. David Squires, Supervisor of Curriculum and Staff Development at Red Bank Public Schools, under contract to Far West Laboratory, wrote the initial draft of the Red Bank case study and worked closely with Dr. Robert Burns on several successive versions of the case study.

The remaining two sites were identified through project activities other than the phone survey. The fourth site, North Sanpete School District, was visited for only a single day in April 1986, although visits to similar programs at two other sites were made. The final case study, that of Dilworth Junior High, was revised extensively from work completed during the first computer math project.

Case Study Methods

Data collection and report writing involved three steps: (1) principal phone interviews prior to the site visit, (2) a site visit where answers to a set of questions were obtained using the methods of principal tours, cruises, teacher and student interviews, and classroom observation, and (3) the writing of an initial site visit report. Descriptions of each of these steps, abbreviated from the manual used to train site visitors, are presented below.

Pre–Site Visit Phone Interviews

Data collection began by conducting a series of phone interviews with the principal prior to the site visit. The interviews helped us be proactive, informed visitors who knew a great deal beforehand about the type of programs being visited.

The purpose of the first phone conversation was to establish rapport and a good working relationship with the principal, and to describe the kinds of activities we wanted to observe during our site visit. The second phone contact confirmed with the principal the logistics of the site visit. We also conducted a program description interview, which extended our understanding of the site and program characteristics (see Appendix B). The purpose of the third phone conversation was to verify final arrangements of the site visit and to interview the principal about the history of the program (see Appendix B).

Site Visit Procedures

The primary task of site visitors was to obtain answers to a set of questions covering the school and the instructional program. These questions are outlined in Appendix B. We also used a set of specific methods to collect information on these questions. The exact order of activities to follow was left to each researcher's judgment and discretion. The four methods were school tour, school cruises, structured interviews with teachers and students, and classroom observations. These methods were influenced by, and in some cases, borrowed from the work of the Instructional Management Program at the Far West Laboratory for Educational Research and Development (see Dwyer, Lee, Barnett, Filby, and Rowan, 1985). The methods are described below.

School Tour. During the first day at the school, we arranged an initial meeting with the principal to discuss and schedule activities, identify a work space, and to request several documents including a staff roster of all personnel at the school (including grade level for teachers), a map of the school, and a time schedule of the school day. We also arranged a school tour. The tour, conducted by the principal or a key informer designated by the principal, acquainted us with the environment in which the instructional program was embedded. Visiting the classrooms, lunchrooms, libraries, and play yards and observing what went on in different parts of the school provided us with a broader context for describing and analyzing the particular program or programs of interest.

School Cruises. Our understanding of the school context was expanded further by periodically walking the school grounds on our own. These school cruises, conducted with permission of the principal, encompassed the entire school. We visited classrooms, the front office before school started, teacher lounges, and observed recess or breaks between classes during these cruises. Field notes from the cruise activity usually noted specific comments and topics of conversation, lesson formats in classrooms, interesting activities, and the nature of interactions between students, teachers, and between the teachers and students.

Interviews. There were two structured interviews, one for students and one for teachers (see Appendix B). Other staff members might also be interviewed. All these interviews were tape-recorded, with permission from the interviewee.

Classroom Observations. Classroom observation of lessons was a critical part of our site visits. In order to have some basis for describing typical teacher and student experiences over time, our aim was to watch complete lessons of the same teacher for three consecutive days.

We were most interested in anything related to mastery learning and the grouping management strategy. Particular attention was paid to distinguishing between the *lesson* grouping arrangement a teacher might use for a given lesson and the *program* grouping arrangement dictated directly by the grouping management strategy of the program. We also noted when and how staff members used any mastery learning words (e.g., correctives, formative evaluation, learning units, mastery testing, mastery criterion). Below are examples of specific activities we looked for:

- Orienting: Does the teacher orient students to what is going to be learned during the lesson? Does the teacher relate the new work of the lesson to previous work? Does the teacher make an explicit statement of the lesson purpose?
- Assignments: What assignments are the students working on (get a copy of any handouts from the teacher after the lesson)? What textbook are the students working from? Are all students working on the same assignment or different assignments?
- Procedural and management concerns: Are there logistic issues that result from any unusual movement of students (e.g., long transitions between lesson activities, down time while students leave or arrive from other places, classroom management problems with students)?
- Task orientation: What is the task orientation in the classroom? Are students getting down to work? Are there problems because students do not know what to do? Do teachers control the learning of the students or is there some sense of student responsibility for learning? Are students held accountable for their work?
- Diagnosis/feedback/correction: Does the teacher use specific diagnosis or feedback/correction activities? Is there evidence that the daily work of students is checked and monitored on a relatively careful basis?
- Mastery testing/grading: Is there any mastery testing occurring? Are students given any nontraditonal forms of grades?
- Special grouping for nonmasters: Is there evidence of special groups within the classroom based on their nonmastery of earlier work? Are there special activities for nonmasters? Are students acting as tutors for other students?

Appendix B: Instruments

Program Description Interview

First Part of Interview

Begin by describing briefly the major dimensions of the program as you understand them. Ask the principal to confirm your description or make corrections when necessary. Think in terms of the major dimensions that have been identified: (1) general program characteristics, (2) philosophy, (3) curriculum, (4) instruction, (5) assessment, (6) grouping management, and (7) information management. Be sure to find out basic descriptive information (can be approximate now):

- Number of teachers in program by grade level
- Number of students in program by grade level
- Number of support staff necessary to run program

Second Part of Interview

The key dimension to focus on after confirming your general understanding of the program is *grouping management*. Grouping management refers to how students are organized for instruction in the program. There are three general forms of grouping: whole-class, flexible grouping, and continuous progress. This dimension is probably the most difficult to explain succinctly, so it is important to probe the principal if necessary.

1. How are students assigned to class at the beginning of the school year? How are students organized for instruction in the program?

2. Is the grouping arrangement the same at each grade level?

3. Is instruction teacher-paced or student-paced?

4. Who coordinates the program? What does the coordinator do? Who keeps track of where each student is in the curriculum?

5. Do students stay in their classrooms or do they move to other classrooms, laboratory, testing center, etc.?

6. Is there grouping of students across grade level?

7. What is the grade level promotion policy?

8. How is grade level to grade level articulation done? How is information shared from one grade level to the next (about the curriculum and about students)?

9. What happens to students who do not pass the formative tests?

10. Are special education students included in the program? Are special arrangements made for these students?

Program History Interview

Introduction

1. How long has the program been in operation? What was the first year? Who have been the key persons in the program since conception?

Phases of Program History:

SAY "We want to find out about the various phases of the program history. We have found it useful to consider three phases: planning, implementation, and maintenance. So, we would like to talk about each of these phases. Let's start with the planning phase."

a) **Planning Phase:**

2. Why was the program originally started? What did you want to accomplish?

3. What were the initial goals of the program?

4. What decisions had to be made first? What conflicts had to be resolved? How were they resolved?

5. What advice about planning a program would you give someone just starting to think about a program like yours?

b) Implementation Phase:

6. What kinds of administrative support was required to implement the program?
   i. school board
   ii. district superintendent
   iii. district curriculum specialists
   iv. principals

7. Were parents involved? If so, how?

8. We want to find out about other types of support required to implement your program. What about:
   i. financial support
   ii. staffing support
   iii. consulting support
   iv. materials and equipment support
   v. inservice training support (For whom? By whom? When? What? How frequently? How long?)

NOTE: For each type, find out what was needed and how it was obtained. Inservice training support requires additional elaboration.

9. What were the major problems of implementation? How were they solved?

10. What was the most important type of support for getting the program started?

11. What advice would you give someone implementing a program like yours?

c) Program Maintenance:

12. Has the program been altered from the originally envisioned program? If so, how? Why?

13. What resources are required for the ongoing operation of the program? How are these obtained?

14. How is the program monitored (e.g., test scores, teacher satisfaction)? What is the purpose of the monitoring?

15. What advice would you give about program maintenance?

General Impressions

16. What are the strengths of the program? What are the weaknesses of the program?

17. What unintended consequences of the program have you noticed?

18. If you had to implement the program again, would you proceed in the same way? Why or why not?

Site Visit Topics and Questions

General School

1. What does the neighborhood of the school look like? (Drive around the neighborhood for a few minutes.)

2. What does the school look like? What is the overall condition of the building and the grounds?

3. Has there been any significant changes in the school in the past five years (e.g., additional teachers, change in demographics, major increase or decline in enrollment)?

4. What other instructional programs are there at the school (e.g., special education, accelerated programs)?

5. How are students grouped for instruction (age graded, cross-age graded)? How are students assigned to classes at the beginning of the school year (ability grouped, heterogeneous)?

6. What kind of teacher and principal evaluation system is in place? Are there legal or administrative constraints (e.g., state requirements, collective bargaining regulations and laws, district contractual obligations)? What is the purpose of the evaluation (e.g., improvement, promotion, termination)? What type of evaluation is used? How frequent is the evaluation? What is evaluated?

General Program

1. What additional costs does the program incur beyond normal operating costs? Have there been any trade-offs in budget amounts so that this program can continue to exist?

2. What additional materials, equipment, and personnel are required by the program?

3. What special committees were or are required for planning the overall program each year?

4. What are the major role changes for principals, teachers, and specialists at the school as a result of this program? Are there any job descriptions available for principals, teachers, specialists?

5. How is coordination of the program obtained? Who is the primary coordinator? How difficult is coordination? What are the major problems in coordination?

6. How important is the principal as a leader in program development and maintenance? How much commitment is required by the school staff?

7. Are there any students excluded from the program? If so, why? What is provided instead?

8. What happens during the first two weeks of the school year?

9. How do students know what to do each day?

Philosophy

1. Are there written district, school, or program philosophy statements? (Get copies.)

2. What persons or theories are the primary sources of the belief system that underlies the program? What outside experts have spent the most time or have been the most influential at the school?

Curriculum

1. What objectives are available by grade level? What kind of objectives are they (minimum competency, target/grade level, enrichment)? Are the objectives just basic skills or do they include higher level objectives as well?

2. Are mastery learning or OBE objectives different from other objectives? Is there anything special or different about the program objectives? Are there objectives for the other instructional programs (e.g., science, social studies)?

3. How are the objectives organized? Are there units or modules of instruction? Are the objectives in a linear sequence or can branching occur? If branching occurs, how?

4. How were the objectives derived? Are they the same or different from district objectives? How do they match up with district objectives?

5. What textbook series are used? What are the other primary sources of the curriculum?

Instruction

1. Is there a clear model of instruction for all program teachers to follow or can they teach any way they want? What is the model? How do most teachers teach?

2. Two major features of mastery learning are learning units and formal procedures for providing "feedback and correction" to students not mastering the material in the learning unit. Describe these two components, if they exist. Is there a formal teach-test-reteach sequence? How much emphasis is placed on correction and feedback? What type of correction and feedback activities exist?

3. How do you know when a student has mastered a skill or unit of instruction? What happens to the student who does not master the skill or unit? What are the other students doing while the nonmasters are correcting their learning?

4. Who paces instruction, the teacher or the student? What happens to the students who are capable of moving very fast through the curriculum?

5. How is student progress monitored? How is information on the location of the student in the curriculum maintained?

6. What are the teacher's instructional roles? Is there more emphasis placed on teaching than record keeping?

7. How are decisions made about daily instruction? For example, who decides how much time will be devoted to the teaching of a particular unit? How are resources allocated to the teaching of a particular unit? How are decisions made as to what materials, activities, and teaching techniques will be used to teach a particular unit? When does the planning occur? Who does the planning? How often does it occur during the school year?

8. What cumulative record information, if any, is used in the planning of the units and grouping of the students?

9. How are student absences handled? How are students handled who move in at midyear?

Student Assessment

1. Does pretesting occur in the program? If so, how are the test scores used (e.g., diagnosis, placement)? What kind of test is used (e.g., diagnostic or placement test)? Where did the test come from? How frequently are the tests used?

2. Does formative testing occur in the program? If so, how are the test scores used (e.g., nongraded feedback)? What kind of test is used (e.g., criterion-referenced test)? Where did the test come from? How frequently are the tests used?

3. Does summative testing occur? If so, how are the test scores used (e.g., grading)? What kind of test is used (e.g., norm-referenced test)? Where did the test come from? How frequently are the tests used?

4. How is mastery defined? What test evidence will be accepted that mastery has occurred for the learning unit? For the semester or course? For the school year?

5. How well are the objectives, instructional materials, and

assessment instruments aligned? Are objectives linked directly to assessment instruments? Describe breadth of linkage.

Grouping Management

1. How are students organized for instruction in the program? Describe the formal procedures for how grouping occurs. For example, how are skill groups formed and how are students advised? Who does the coordination?

2. Does cross-grade grouping of students occur? If yes, describe how this occurs? Are special provisions made for higher-grade students being placed with lower-grade students?

3. Is a student's progress in the program restricted by grade level? Can a student progress beyond grade level in a given year? If yes, how far ahead can the student get? What about other subjects?

4. Is grade promotion tied to some type of criterion? If yes, what is the criterion? What provision is made for students not meeting criterion? Do they repeat the same grade? What percentage of students are not promoted at each grade level?

Information Management

1. What kind of report card is used? Get a report card for necessary grade levels.

2. What kind of student record-keeping system is used? How often are the records updated? What information is recorded? Who keeps the information? What is the information used for? Is the system centralized? Is it linked formally to the objectives of the program?

3. What information about the student is carried from one year to the next? What grade level articulation occurs? Do teachers talk to each other across grade level? Are formal mechanisms in place? How are skills and deficits of a particular student communicated to next year's teacher?

Typical Experiences

1. STUDENT: Can you describe the typical experience of a "generalized" student in the program? Use the necessary unit of analysis—day, week, learning unit—for your particular program. The appropriate unit is the one that contains all the program features and which simply gets repeated in the next unit. If I was a student, what would I be doing the first day of the unit? As the unit progresses? At the end of the unit? How is the learning pace of the student taking into account?

   a. If I am a student and the formative test shows that I do not understand the material, then what happens?

   b. If I am a student and I am having trouble with a particular exercise, what do I do to get help?

   c. If I am a student who has trouble with pencil and paper tests, how do I do my formative evaluations?

   d. How much homework do I do?

   e. What happens to the students who finish early?

   f. What happens to the student who does not meet criterion on the summative test?

   g. How are grades assigned?

2. TEACHER: Can you describe the typical experience of a "generalized" teacher in the program? What specific roles are required? Are there any additional skills required of teachers to perform adequately in the program?

3. PRINCIPAL: How involved is the principal in the program? Is the principal required to do any additional work because of the program? Are there any additional skills required of the principal for the program?

Inservice Program

1. Is there inservice available at the school or district specific to the program itself? If yes, describe the inservice program. What is the content? Who participates? Who does the training? When does it occur? Where does it occur? Who gets to participate? Are the teachers compensated?

Program History

1. Do you know the key actors in the history of the program? Can you write a relatively complete description of program implementation and maintenance?

2. Do you know what the main problem areas were in the program? Do you know how the problems were resolved?

3. What advice about program implementation and operation is available? Could you write down four or five major tips for implementing and operating this kind of program?

4. Is there a prior history of significant change projects in this district or school? Are there district or school level incentives for innovative behavior on the part of the principal or teachers?

5. Has there been any significant faculty turnover, factions, or tensions?

Student and Teacher Interviews

Student Interview

Ask all students the following four questions:

1. Why are you doing this assignment?
2. What are you supposed to be learning by doing this assignment?
3. What will you do with the assignment when you finish?
4. What happens then?

Other questions to ask as you see fit:

5. How do you know if your work is correct?
6. What do you do if you need help?
7. Is the work in this class easy, hard, or just right?
8. Does all your work count in this class?
9. Do you have to wait for other students before moving to the next topic?
10. Does the program move too fast or too slow for you, or does it move just about right?
11. Do you like math? Reading? Language arts? Why or why not?

Teacher Interview

1. What is your personal philosophy about teaching? What do you want the students to retain most from having been taught by you?
2. What special skills are needed to teach in this program? How are these skills acquired?
3. How much autonomy do you have in choosing the teaching materials and strategies in this program?
4. Tell me a little about the inservice program in the school. Topics? Who decides the topics? How frequently? When does it occur? Are teachers compensated?
5. What are the most rewarding aspects of working in this program? What are the least attractive aspects about working in this program?
6. Do you plan the program with the other teachers in this school very much?
7. Who makes the decisions about curriculum and instruction? Who makes the decisions about the program policy? What role did you play?
8. What is different about teaching in this program (compared with teaching in a regular program)? Is it easier or harder? Why?
9. How much extra work is involved with teaching in this program? What kind of extra work?
10. What are the strengths of the program?
11. What in the program needs improvement?
12. If you left this school for another district, would you want this program to go with you? Why or why not?
13. If you were to give advice to someone who was contemplating going to teach in a school with a similar program, what advice would you give?

Site Visit Report Outline

I. Introduction: Development of the Theme (1–3 pages)

II. Program Setting (4–7 pages)

- A. Brief description of community and school neighborhood (1–2 paragraphs)
- B. Description of district context and physical plant of school (3–6 pages, also include Table 1 of descriptive data)
- C. Brief description of the program (grade level, subject matter, structural features) (1–2 paragraphs)

III. Description of Program History (8–12 pages)

- A. Initial motivation for program (1–2 pages)
- B. Initial conditions (2–3 pages)
- C. Program planning (2–3 pages)
- D. Program implementation (3–4 pages)

IV. Structural Features of the Program (9–15 pages)

- A. Description of Program Features (6–10 pages)
  1. Philosophy
  2. Objectives
  3. Instructional Practices
  4. Assessment Procedures
  5. Grouping Management
  6. Information Management

B. General Program (3–5 pages)

1. Staffing
2. Cost
3. Materials/Equipment
4. Role Changes
5. Coordination/Commitment
6. Inservice Requirements

V. Program Considerations (8–12 pages)

A. Implementation Strategy (2 pages)
B. Operation and Maintenance (2 pages)
C. Role Requirements (2 pages)
D. Outcomes (Test Data) (2–4 pages)