

Chapter 1

In *A Place Called School*, John Goodlad noted that "Teachers both condition and are conditioned by the circumstances of schools. . . .time is virtually the most precious learning resource they have at their disposal. . . .differences in using time create inequities in opportunity to learn" (Goodlad, 1984, pp. 29-30). The availability of time becomes a basic framework for learning. However, Goodlad notes other issues embedded in changing the amount of instructional time that is available. "We must not stop with providing only time. I would always choose fewer hours well-used over more hours of engagement with sterile activities. Increasing [time] will in fact be counterproductive unless there is, simultaneously, marked improvement in how time is used" (Goodlad, 1984, p. 283).

"The school schedule is a series of units of time: the clock is king. . . .The flow of all school activity arises from or is blocked by these time units. 'How much time do I have with my kids?' is the teacher's key question. A student. . .sees five or six teachers per day . . .and is known a little bit by a number of people, each of whom sees him in one specialized situation. . . .Save in extracurricular or coaching situations, . . .there is little opportunity for sustained conversation between student and teacher. . . .One must infer that careful probing of students' thinking is not a high priority" (Sizer, 1985, pp. 79-82). Coverage of content within subjects is a priority. "If some imaginative teacher makes a proposal to force the marriage of, say, mathematics and physics or to require some culminating challenges to students to use several subjects in the solution of a complex problem, and if this proposal will take 'time' away from other things, opposition is usually phrased in terms of what may be thus forgone. If we do that, we'll have to give up [something]. . . there isn't time." (Sizer, 1985, p. 81).

A century ago, high school study centered around five or six subjects each year. The Carnegie unit created forty- to sixty-minute blocks daily for 36 to 40 weeks in each subject. The schedule reflected an industrial model in which students acquired fractionalized bits of information in proper sequence. Roughly seventy years later, demands to improve the high school schedule led to a popular but quickly passing movement in the late 60s and early 70s known as flexible modular scheduling.

Numerous studies and reports during the 1980s called for substantive changes in high schools. There are "problems most

of us agree need to be addressed in high schools, including frequent changing of classes, student failure to make connections between school success and achievement in the work world, and inability of students to apply or think critically in mathematics and other disciplines because the curriculum fails to address topics in depth" (Cawelti, 1989, p. 30). Altering the content and processes of classroom instruction is called for in order to incorporate "higher order thinking skills, depth of curriculum, a sequential building of knowledge and skills, and the integration of practical learning with academics" (McDonnell, 1989, p. 35).

School restructuring through reexamination of everything from school governance to instructional methodologies became the education wave of the 1990s. One indicator of restructuring is the growing support for changing the high school schedule to create longer blocks of time for instruction.

The importance of time as an influencing variable for instructional effectiveness has been documented (Siefert & Beck, 1984, Walberg, 1988, Dewalt & Rodwell, 1988, Cotton, 1990). How time is used is a significant factor in students' achievement. In a 1984 study on the use of time, an average of 54.2% of algebra class time (28 of 55 minutes) was engaged time (Siefert & Beck, 1984). Given a longer block of instructional time in algebra, educators reasoned that student achievement might improve if time were used in ways that maintained student engagement.

Scheduling has become a critical feature in restructuring efforts (Canady, 1995). Gordon Cawelti identified block scheduling as one of seven indicators of high school restructuring cited in the 1994 report, *High School Restructuring, A National Study*. In that study, block scheduling was defined as "[organizing] at least part of the daily schedule into larger blocks of time (more than 60 minutes, for example) to allow flexibility for varied instructional activities" (Cawelti, 1994, p. 23).

The Emergence of Block Scheduling

The National Council of Teachers of Mathematics called for major shifts in the classroom environment in mathematics to create communities of learners, reasoning as opposed to memorizing algorithms, solving problems as opposed to finding answers, connecting mathematics to other subjects as opposed to covering content (NCTM, 1991). Students must have time to engage in two-way discourse, ask questions, use tools to reason, investigate,

explore independently and in groups, use computers, calculators, materials, models, and written expression to acquire mathematical knowledge. "At the present time, teachers are often faced with trying to teach mathematical inquiry in time periods that are entirely inappropriate. Changes, such as meeting classes less often but for a longer period of time, should be explored" (NCTM, 1991, p. 190).

The structural dimension of schooling is important; the organizational form influences what students learn. "The school schedule is an untapped resource. . . .With open minds and equal doses of creativity and technical expertise . . . teachers can harness this power" (Canady & Rettig, 1993, p. 314).

The 1994 government-sponsored report *Prisoners of Time* called for radical reorganization of the school day to support increased learning by both students and teachers. One goal of block scheduling is to reduce time spent on routine non-instructional activities (starting class/opening activities, ending class/clean-up activities, changing class/passing time) in the belief that minimal time lost to such activities can increase actual learning time and result in improved student achievement.

A North Carolina Department of Public Instruction survey found that, following implementation of a block schedule, 80% of teachers saw a positive effect on student grades and test achievement. Differing percentages of teacher/respondents indicated regular use of problem-solving (58%), cooperative learning (48%), lecture (35%), computer activities (30%), projects (26%), Socratic dialogue (18%), student research (18%), guest speakers (10%), and field trips (8%). Sixty percent (60%) of the teachers said that they had changed their ways of teaching (Averett, 1994).

Another study found through teacher surveys and interviews that block schedules influenced teacher selection of instructional strategies and provided more opportunities to vary activities in class--using cooperative learning, more project work, and more hands-on activities (Sessoms, 1995). In that study, teachers on an alternate day block schedule reported modest increases in their use of lecture and no change in their use of interdisciplinary teaching. Sessoms noted that teachers must attend to the use of time, realizing that the selection of strategies are within their (the teacher's) control.

In the November, 1995 issue of *HORACE*, a newsletter from the Coalition of Essential Schools, author Kathleen Cushman writes that "typically, schools move to longer blocks for purposes of depth or integration of disciplines" (Cushman, 1995, p. 3). Teachers are able to get to know individual students better and thus, respond to student needs more appropriately. Teachers are able to introduce material, then coach students to apply their learning, synthesizing and understanding and making the learning more meaningful.

Cushman (1995) suggests that a block schedule permits schools to address some of the current 'woes of schooling' including the demand to deepen student engagement; to take students beyond recall of facts to high level thinking; to reinvent the role of teacher as coach; to get to know individual students better; to integrate disciplines while providing opportunities for students to practice relevant applications.

There are opposing voices regarding the potential benefits of block scheduling to improving mathematics instruction. Zalman Usiskin, mathematics educator and director of one of the largest curriculum projects in the United States (the University of Chicago School Mathematics Project or UCSMP) has indicated that the implications of block scheduling may be different for teachers of different academic subjects. "Block scheduling would seem to hamper those students who have difficulty concentrating in classes, or who are absent more than others, or who have difficulty learning mathematics" (Usiskin, 1995, p. 8). He notes an absence of research on performance in mathematics classrooms operating under a block schedule. "Furthermore, our small bit of research in this area indicates that mathematics teachers' views toward block scheduling are quite mixed and that student performance is not likely to improve. . . .At this point, there is no research to support the movement to block scheduling based on a hope that student performance [in mathematics] will increase. . . .However, there is anecdotal evidence that extended periods can have value in mathematics classrooms" (Usiskin, 1995, pp. 8-10). However, the lack of research evidence for mathematics particularly has not dissuaded school divisions from implementing block scheduling.

In 1994-95, approximately 100 high schools in Virginia (Rettig, 1994) and many others across the nation offered extended blocks of time in the daily schedule. The number of schools utilizing a block schedule continued to rise and by 1996-97, 170 of 292 high schools in Virginia (58.2%) were using block schedules (Rettig, 1996). Of that number, 88 schools (51.8%) had an

alternate day block schedule that offered from six to eight classes. Another 78 schools (45.9%) used a 4x4 semester block schedule and four schools (2.3%) reported using some other form of block schedule.

Alternate day block schedules were implemented in the two high schools (Hamilton High School and Russell High School) in Newton, Virginia in 1993-94. Newton (pseudonym) is an urban center (population 100,000) located in the Blue Ridge mountains of western Virginia. The total high school enrollment (slightly fewer than 3000 students in grades 9-12) is divided between the two comprehensive high schools and one off-site alternative education program.

In a report to the School Board prior to the adoption of the block schedule, representatives from Russell High School predicted that implementation outcomes would include: (1) improved student performance and achievement; (2) improved attendance and behavior; and (3) instruction more like that found in programs for academically talented students such as the various regional Governor's Schools for Science and Technology. These are programs known for individualized instruction, flexible schedules, extensive use of community resources, mentor/internships, extended research projects, presentations, and alternative assessments. Informal print materials from high schools across the Commonwealth of Virginia praised the block schedule as beneficial to students, offering time for projects, interdisciplinary teaching, variety in the classroom, respect for student learning styles, variety in student groupings, use of simulations, active, hands-on learning, time for teachers to identify student needs and respond to them (diagnostic teaching), use of community resources, greater use of technology resources, less lecture, more student involvement in lessons, and teachers functioning as facilitator and coach rather than lecturer.

Block Scheduling in First-Year Algebra

Often an instructional problem like high failure rates in algebra motivates educators to seek solutions. Restructuring the schedule and changing the ways teachers use time can become part of a solution. Newton Schools provides an illustration of this phenomenon. In Newton's high schools, as in other schools across the nation, the ninth-grade year (first year of high school) is a difficult year of transition for many students. The typical ninth-grade mathematics course (first-year algebra) is a course with high failure rates. During the four years prior to implementation of the block schedule, for example, 388

students out of 1284 who took first year algebra received an F. The failure rate of high school students enrolled in first year algebra in Newton's two high schools from 1990 to 1993 was 30%. An additional 326 students (another 25%) received a D. One possible solution to the problem of student failure in algebra was offered by the claim that block scheduling "can help address existing problems such as the very high failure rates in ninth grade algebra" (Canady in Cushman, 1995, p. 4). However, Canady did point out that "if teachers do not alter techniques to utilize extended blocks of time effectively and efficiently, the promise of the block scheduling movement will die, as did the flexible modular scheduling effort of the 1960s and 1970s" (Canady and Rettig, 1995, p. 205).

In *Research Issues in the Learning and Teaching of Algebra* (NCTM, 1989), mathematics teachers were asked to organize material to capture and sustain interest so that students are engaged sufficiently to acquire knowledge [of algebra]. Algebra may be viewed from at least "three perspectives--as generalized arithmetic, as a series of representation systems (graphical, numerical, symbolic, natural language), or as a set of rules" (Wagner & Kieran, 1989, p. 221-224). Depending on the teacher, instruction may be rule- and skill-oriented, function-oriented, or problem-oriented. There may be technology support for algebra instruction or instruction may be heavily technology-dependent. Instruction may proceed from a logical/deductive point of view or from a numerical/inductive point of view. There is a continuum from skill-oriented instruction to problem-based instruction and individual algebra teachers design lessons which represent different points along that continuum. Learning experiences for students may focus on various combinations of key concepts, explicit procedures, informal explorations, multiple representations, relevant applications, and small group or whole group interactions. The preference of the teacher to define mathematics as a "process of clever analysis of important problems" as opposed to "a language that can be mastered best by repeated practice" (Davis, 1989, p. 269-270) may influence the teacher's personal satisfaction with and utilization of extended blocks of instructional time.

Mathematics teachers have been encouraged by their professional organization (National Council of Teachers of Mathematics) and the *Professional Standards for Teaching Mathematics* (NCTM, 1991) to incorporate manipulatives and discovery activities which recognize student learning style differences; to help students see big concepts and not get lost in fragmented skills; to use technology along with various grouping practices; to integrate

the curriculum with interdisciplinary applications; to offer students non-routine problems which encourage them to demonstrate learning in open-ended ways; to talk and write about what they are doing, looking to their peers for validation. For teachers to incorporate these strategies into mathematics lessons, they would need extended periods of instructional time. To arrange these longer time blocks, the high school schedule would need to reduce the number of classes students must attend each day. "Because teachers are granted longer blocks of instructional time, they are encouraged to break away from over-reliance on lecture and discussions as the primary (often only) model of teaching" (Canady & Rettig, 1993, p. 312).

Canady (1995) proposes a model lesson format for use in a block schedule based upon observation of the most successful teachers using such schedules. According to Canady, those teachers typically use 25-40 minutes of explanation (usually whole group with modeling and demonstration of the lesson objective), followed by 40-60 minutes of application (often using varied groupings and high levels of student activity in a 'hands-on' approach), and concluding with 15-30 minutes of synthesis (closure opportunity for students to connect the explanation to the application and then summarize with reflections and review.)

As one teacher put it, "We have taught in small blocks of time and fractionalized a primarily skill-oriented approach to mathematics for nearly a century. . . .We are entering an age where students will be asked to complete thought-provoking tasks. . . .Our students deserve an education which enables and requires them to reflect, to discover their own learning, and to connect all subject matter" (DeJarnett, 1995, p. 7).

In Newton, the decision to implement a block schedule was influenced by claims that student achievement would improve. Further support for extending class time resulted from persuasive arguments that teachers would be able to offer lessons characterized as more varied, relevant, motivating, and appropriately challenging to meet the needs of a diverse student population. The potential of the block schedule was promising and the initial anecdotal evidence along with a few early studies of outcomes of the block schedule were encouraging.

Research Problem

There is a shortage of specific evidence related to the impact of block scheduling on mathematics teaching and learning in general or on algebra instruction in particular. Although advocates of a block schedule claim that the block can

contribute to lowering the high failure rate in first year algebra, experts within the mathematics community are divided as to whether block schedules are beneficial to learning mathematics. The opportunity exists for effective implementation of block schedules to facilitate reforms in algebra instruction consistent with recommendations of the National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards* and *Professional Standards for Teaching Mathematics*. In fact, accomplishing the goals of reform (in education generally or in mathematics education in particular) may require that the high school schedule reduce the number of classes students must manage each day while providing more time for teachers to incorporate multiple and varied strategies into mathematics lessons. "There is some evidence that mathematics teachers are less likely to change their teaching methods under a block schedule than are teachers in other areas" (Kramer, 1996, p. 759).

Purpose and Research Question

The change from six daily fifty-minute classes to three extended (doubled) blocks alternating with three others every two days has been a structural reality at Hamilton and Russell High Schools since 1993-94. The purpose of this study was to describe algebra instruction during the extended block. The study, conducted during the 1996-97 school year, was intended to provide thick descriptions of the algebra lessons in several teachers' classrooms based on observations of lessons and surveys and interviews of teacher perceptions. These descriptions (cases) represent the reality and the perceptions of those closest to the classroom as well as the perceptions of the researcher. The primary research question at the heart of the study was "What kind of learning experiences are evident in algebra classes in a block schedule?" For this study, block schedule is defined as an alternate-day 100-minute block schedule. In this schedule, students are assigned three 100-minute block classes one day with three different classes assigned the following day. Each class meets 45 times during each of two semesters (with one Carnegie unit of credit earned for successful completion at the end of the school year.)

Related questions examined in the course of the study were

1. How prepared was the teacher to teach algebra in the block schedule?
2. What is the level of teacher satisfaction with the block schedule?
3. What is the typical instructional design of the algebra lesson (strategies used; frequency; duration?)

4. What is the student response (engagement and achievement?)
5. What advice might the teacher offer to another teacher whose school was planning to implement the same type of block schedule (benefits, impediments?)

Significance of the Study

This study was conducted to inform local practice and decision-making with regard to the current high school scheduling model specifically for algebra. Information from the study is important to understanding the reality of algebra instruction as the school division moves to require all students entering high school to enroll in a mathematics course at the level of first-year algebra or higher. It was hoped that a detailed description of algebra instruction at the classroom level would provide a means to determine whether the expected instructional benefits of the block schedule were being realized. By identifying advantages and shortcomings of the block (from the perspective of the algebra classroom,) future modifications would be more sensitive to local instructional needs. Finally, implications for future staff development would emerge from the school site.

In addition to providing data for local planning and decision-making, this study contributes evidence relating to block scheduling and algebra instruction at the high school level. Lessons can be learned from the experiences of others. Thus, the images contained in a portrait of several algebra teachers' classrooms might be useful to others wishing to "use the particular [cases] to say something about the general. [This is called] the 'concrete universal'. . . .a true rendering of universal features through exemplification" (Eisner, 1991, p. 203).

The final product offers rich details of specific algebra classroom settings and the events that occurred there as well as perspectives gleaned from conversations with the algebra teachers. It was hoped that this would provide useful information for individuals considering a similar block schedule for their high school and wishing to gain insight from the experiences of others.

Organization of the Document

Chapter 2 presents the research methodology used in the study. The research design was grounded in qualitative research strategies using classroom observation, surveys, and structured interview questions as data sources when developing each individual case record.

Chapter 3 contains the individual case summaries, presented as thick descriptions of the teachers' lives (classroom scenarios) supported by evidence taken from the teacher survey and the individual interview. The design of the presentation incorporates all data sources within the classroom scenario. Teacher background and other distinctive features of the case are presented as part of the case report.

Chapter 4 examines the findings from the study based upon comparisons across cases for similarities and differences.

Chapter 5 presents implications and suggestions for further research.