CORE KNOWLEDGE CURRICULUM
Five-Year Analysis of Implementation and Effects in Five Maryland Schools

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THE CENTER

Every child has the capacity to succeed in school and in life. Yet far too many children, especially those from poor and minority families, are placed at risk by school practices that are based on a sorting paradigm in which some students receive high-expectations instruction while the rest are relegated to lower quality education and lower quality futures. The sorting perspective must be replaced by a "talent development" model that asserts that all children are capable of succeeding in a rich and demanding curriculum with appropriate assistance and support.

The mission of the Center for Research on the Education of Students Placed At Risk (CRESPAR) is to conduct the research, development, evaluation, and dissemination needed to transform schooling for students placed at risk. The work of the Center is guided by three central themes — ensuring the success of all students at key development points, building on students' personal and cultural assets, and scaling up effective programs — and conducted through research and development programs in the areas of early and elementary studies; middle and high school studies; school, family, and community partnerships; and systemic supports for school reform, as well as a program of institutional activities.

CRESPAR is organized as a partnership of Johns Hopkins University and Howard University, and supported by the National Institute on the Education of At-Risk Students (At-Risk Institute), one of five institutes created by the Educational Research, Development, Dissemination and Improvement Act of 1994 and located within the Office of Educational Research and Improvement (OERI) at the U.S. Department of Education. The At-Risk Institute supports a range of research and development activities designed to improve the education of students at risk of educational failure because of limited English proficiency, poverty, race, geographic location, or economic disadvantage.

ABSTRACT

This is the final report from a five-year, matched-control study of five Maryland schools that began implementation of the Core Knowledge Sequence in the fall of 1994. This report provides both longitudinal implementation and outcome data. The data allow for a few guarded statements regarding the extent to which Core Knowledge (CK) can assist schools in improving student achievement as measured by multiple achievement tests. The data are more valuable for examining the contexts and conditions in which a particular reform can/cannot enjoy relatively full implementation.

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INTRODUCTION

The evolution of research on school improvement has moved from questions of, "What works?" to the more complex, "What works where, when, with what level of support?" and, of course, "Why?" Lee Cronbach once argued by analogy that the question, "Is it better to eat out or eat at home?" could only be answered "after we knew whether we are located in Fresno or San Francisco, and who is cooking at home." It is true that some school reforms have tended, on average, to produce academic gains, and that there are others that have produced virtually no empirical evidence of improved student achievement (Herman, et al., 1999). Yet, the research literature is even clearer that issues of context, fiscal and institutional support, and the presence/absence of major interruptions or countervailing forces play major roles in determining the effectiveness of any specific intervention at any specific school (Stallings & Kaskowitz, 1974; Crandall, et al., 1982; Stringfield, et al., 1997; Teddlie & Reynolds, 2000; Fullan, 1999).

In this longitudinal study of the Core Knowledge Sequence (Core Knowledge Foundation, 1993, 1998), we first address questions of implementation in general and within contexts. We next turn to questions of general effects. Finally—and most importantly—we will turn to questions of facilitators of and barriers to the implementation of the Core Knowledge curriculum, all within the context of Maryland's aggressive efforts at systemic school improvement.

In order to address those questions, we will begin by providing overviews from three perspectives. The first is Maryland's use of a state testing program as both a yardstick for measuring school improvement and a spur toward further improvement. The second is the Core Knowledge program and previous research on the program. The third is a summary of findings from the first three years of this longitudinal study, which sets the stage for this fifth-year analysis.

Maryland School Performance Assessment Program (MSPAP)

The Maryland State Department of Education holds individual schools accountable for student performance primarily through the Maryland School Performance Assessment Program (MSPAP), which began implementation in 1993. MSPAP was designed by the state of Maryland to measure "how well students relate and use knowledge from different subject areas and how well they apply what they have learned to solve real world problems." It assesses not only basic skills and knowledge (reading, writing, and mathematics skills) but also "higher order skills such as supporting an answer with information; predicting an outcome and comparing results to the prediction; and comparing and contrasting information" (Maryland State Department of

Education, 1999). Testing occurs each year in May in grades 3, 5, and 8 in six subjects (reading, writing, language usage, mathematics, science, and social studies).

MSPAP scores for each school in Maryland are published yearly (usually in early December) in the press and on the Maryland State Department of Education website. Schools judged as not making significant progress on MSPAP scores over time may be designated by the State Department of Education as "eligible for reconstitution," and be required to submit to close monitoring by state officials of their School Improvement Plan and its implementation. School systems often use MSPAP results as a primary measure of principals' effectiveness and as a basis for decisions about a principal's continued tenure at a school. Since declines in a school's MSPAP scores may bring serious repercussions, all Maryland schools (including those implementing various reforms) take MSPAP very seriously.

The Core Knowledge Curriculum

Core Knowledge is a phrase used by E.D. Hirsch (1987, 1996) to describe what he sees as a common core of information needed by all citizens in order to survive and prosper in a given culture. Hirsch has expressed concern that schools in the United States have drifted away from teaching all students a common core of knowledge. Hirsch argues that the result is a general lack of learning and a specific growth in the gap of necessary knowledge between the children of affluence and the children of various disadvantages, such as poverty and cultural difference.

Hirsch and his colleagues at the Core Knowledge Foundation have developed the *Core Knowledge Sequence* (Core Knowledge Foundation, 1993a, 1995, 1998) which specifies a common core of content for American schools and provides a planned sequential curriculum in language arts, history, geography, mathematics, science, visual arts, and music for students in kindergarten through grade eight. The topics specified in the *Sequence* are further elaborated in a series of books, carrying the titles *What Your* [First, Second, etc.] *Grader Needs to Know* (Core Knowledge Foundation, 1991, 1992a, 1992b, 1993b, 1993c, 1996a, 1997). Together, the volumes form a spiraling curriculum designed to infuse one-half of each school day with "Core Knowledge." For example, in Core Knowledge, all first graders study Egyptian history. In fourth grade, the study of world history and cultures is expanded to the early and medieval African kingdoms and medieval China.

Among the current generation of "whole-school" reforms, Core Knowledge is unique for several reasons. First among these is that Core Knowledge specifies a detailed curriculum framework throughout the entire kindergarten-through-grade-eight range. None of the other national reform groups is so specific regarding such areas as literature, history, geography, or the

arts. Second, Core Knowledge has been silent as to desired methods for instruction. Core does not tell teachers "how to teach." Third, Core is silent on implementation strategy. Hirsch and his colleagues are deliberately non-prescriptive as to "scale up" techniques, allowing each school to implement via their own chosen route.[1]

Findings from the First Three Years of the Maryland Core Knowledge Study

Fourth- and fifth-year data gathering and this final report were both influenced by findings from the first three years of the study (McHugh & Stringfield, 1999) as well as the national Core Knowledge study (Datnow, Borman, & Stringfield, in press). Among these had been the following:

- Teachers at all schools reported that first-year implementation of the Core Knowledge content had been quite demanding. A wide range of tasks, from forming teams and coordinating within and across grades to finding age-appropriate materials had occupied teachers at all schools. Initial implementation would have been extraordinarily difficult had all the schools not received modest ($22,000 per school) grants from the Abell Foundation.

- Second-year implementation had been easier, with less "starting from scratch" work, and more time to develop and refine units. While all schools continued trying to deepen their Core Knowledge use, by the end of year two, the research team had identified our issues and two general problems that influenced schools to varying degrees. The two enduring problems were as follows:

    - Conflicts between Core Knowledge and some of the districts' pre-existing curricular requirements made it difficult for some of the schools to teach all of the Core topics; and
    - Preparing students for MSPAP became the central emphasis in all schools in the study (McHugh & Stringfield, 1999).

Four additional factors had clearly come into play to varying degrees within the five schools:

- Bringing newly arrived teachers into the logic and up to a level of preparedness to teach Core Knowledge topics had become a challenge for all of the schools, with some proving more adept at responding than others.

[1] Note that in recent years the Core Knowledge Foundation has begun offering, but not requiring, a variety of supportive consultation and training services.

- Where split-grade classes had been formed, teachers clearly struggled to manage two grades of Core content and materials.

- Teachers and schools experienced a general shortage of time for individual and team planning. While this problem is hardly unique to Core schools, the need for coordination and collaboration was felt by teachers to be particularly acute in these schools.

- The reduction in foundation support in year two (from $22,000 to $5000) caused an immediate shrinkage in schools' ability to replace worn or lost materials, and to buy new materials as needs arose. No school district took up the slack.

- Third-year implementation saw increased differentiation in level of implementation among the five schools. Several of the themes that had been present but not critical in year two gathered additional weight in year three. Among them were the importance of common planning time, bringing new teachers into a school or grade, conflicts with the district curriculum (including, in one instance, the introduction of a conflicting reform in one school), and a lack of perceived connections between Core and MSPAP. In general, teachers remained enthusiastic about participation in Core Knowledge. However, teachers in schools that were not clearly moving toward strong implementations voiced words of caution, not about the reform itself, but about investing in a reform that the school or district might not support long-term. Finally, third year achievement data, while not uniform across the five schools, tended to provide modest to fairly strong support for participation in the reform.

We will build on several of those first three years' themes as we explore data from years four and five.

DESIGN OF THE MARYLAND CORE KNOWLEDGE STUDY

Sample of Schools

Each of the six pilot schools was demographically matched with a similar, within-district school, so that each Core Knowledge school would have a reasonable control against which it could be compared. Data gathering at one of the original six Core Knowledge schools was discontinued after one year because its matched control school became a Core Knowledge school in the 1995-96 school year. Therefore, the current study examines implementation and outcome data from the remaining five Core Knowledge schools and five matched controls. As will be described below, a second of the matched controls became a Core Knowledge school in Fall 1997, during the fourth year of the study, and one of the original Core Knowledge schools completely abandoned the program in year five of the study. A demographic description of those five experimental and five matched control schools is provided in Table 1.

Sample of Students

Two full cohorts of students in the Core Knowledge and the control schools were initially selected to be followed for three years, and the younger cohort was followed for a total of five years. The Comprehensive Test of Basic Skills, Fourth Edition (CTBS/4) (CTB/McGraw Hill, 1989) was administered to all first- and third-grade students in each pilot and each control school in the fall of 1994. These first- and third-grade students were retested with the CTBS/4 in the spring of 1995, in the spring of 1996 when they were in second and fourth grade, and in the spring of 1997 when they were third and fifth graders. The younger cohort was retested in the spring of 1998 and in the spring of 1999 when they were in fourth and fifth grades. The six testing periods provide information about the cumulative effects of five years of Core Knowledge implementation, though developments at several schools over the course of the five years make analysis problematic. As mentioned above, one of the Core Knowledge schools where implementation had been decreasing steadily since year 2 abandoned the program completely in year 5 of the study. Redistricting occurred at another of the schools, so that few of the original students remained in the fifth grade class in year 5 of the study. And one of the control schools became a Core Knowledge school in year 4. For these reasons, we will present data for each pair of schools, but not present an average of all schools in this report.

As can be seen in Table 2, a total of 1207 children were tested in the first and third grades combined at the beginning of the study in the fall of 1994. Full three-year data sets were available on 708 of these students in the spring of 1997, for a total of 59% of the total initial sample of experimental and 58% of total original sample of control students. By year five, the

original first grade cohort, now in fifth grade, had shrunk dramatically. Table 2 summarizes the number of students tested at each school over time.

Table 1
Demographics of the Schools Participating
in the Maryland Core Knowledge Study

School	Location	Enrollment (K-5) 1994	Enrollment (K-5) 1999	Free/Reduced Lunch 1994	Free/Reduced Lunch 1999	Special Education 1994	Special Education 1999
Experimental A	Rural	399	388	46.0%	43.8%	15.2%	13.7%
Control A	Rural	441	456	36.9%	35.5%	7.5%	16.0%
Experimental B	Rural	179	191	37.8%	37.7%	11.2%	13.1%
Control B	Rural	210	209	24.4%	23.4%	16.6%	23.5%
Experimental C	Suburban	572	416	12.7%	19.7%	11.7%	12.0%
Control C	Suburban	538	567	19.4%	16.8%	12.9%	12.7%
Experimental D	Urban	445	416	34.5%	33.6%	7.7%	9.1%
Control D	Urban	366	450	51.9%	61.8%	14.5%	15.8%
Experimental E	Urban	476	453	63.4%	73.3%	11.1%	7.7%
Control E	Urban	419	356	67.8%	66.0%	9.0%	16.0%

Reasons for shrinkage from the original sample included families moving, retention or special education assignment, and, in the case of Pair C, the redrawing of school attendance boundaries (resulting in more than a 33% change in the student body, so that CTBS testing was not even attempted at those schools in year 5).

Process-Implementation Measures

In the five years of the study, detailed classroom-level observations have been made in the Core Knowledge schools. Regular instruction and selected "specials" (art, music, library, computers) were observed. Over the first three years of the study, a total of approximately 200 one-hour observations were conducted. An additional 10 to 12 hours of classroom observation occurred during year 5 in three schools where implementation continued and the student population had not changed significantly. Data collected provided evidence

Table 2
Number of the Initial Sample of Students in the Study over Time
(Cohort 1 = 1st graders in Fall 1994; Cohort 3 = 3rd Graders in Fall 1994)

Pair	School Type	Fall 94	Spring 97	Spring 98	Spring 99	% of Original Sample Year 3	% of Original Sample Year 5
Pair A	Core Knowledge						
	Cohort 1	84	44	36	25	52%	30%
	Cohort 3	45	20			44%	
	Control						
	Cohort 1	66	36	30	24	55%	36%
	Cohort 3	60	32			53%	
Pair B	Core Knowledge						
	Cohort 1	28	19	16	15	68%	54%
	Cohort 3	24	21			88%	
	Control						
	Cohort 1	25	23	16	18*	92%	72%
	Cohort 3	19	13			68%	
Pair C	Core Knowledge [school catchment area redistricted in July 1998]						
	Cohort 1	116	81	72	--	70%	--
	Cohort 3	80	47			59%	
	Control						
	Cohort 1	91	63	47	--	69%	--
	Cohort 3	83	53			64%	
Pair D	Core Knowledge						
	Cohort 1	60	36	28	27	60%	45%
	Cohort 3	82	37			45%	
	Control						
	Cohort 1	50	24	16	14	48%	28%
	Cohort 3	66	22			33%	
Pair E	Core Knowledge						
	Cohort 1	72	38	28	25	53%	34%
	Cohort 3	56	37			66%	
	Control						
	Cohort 1	57	18	16	13	31%	23%
	Cohort 3	43	31			72%	

* Two students were not tested in Year 4 but were tested in Year 5

provided evidence about the implementation of Core topics and classroom- and school-level

effects of the Core curriculum. Where practical during these visits to schools, interviews with teachers and administrators were also conducted to gauge school staff perceptions of the ongoing innovation. In addition, researchers led focus groups with third- and fifth-grade teachers at each school during year three, and had interviews or informal discussions with a number of teachers in year 5.

Also, in years three and five, a survey was sent to each regular classroom teacher in participating schools to gain a broader overview of implementation issues and to assess the level of implementation of Core Knowledge across the schools. The questionnaire was divided into two parts. The first part asked teachers a range of questions related to the Core Knowledge implementation, including questions about the resources that have aided them in the implementation, the instructional methods used in their classrooms, and the time they spent teaching Core Knowledge topics. Most questions in the first section allowed teachers to respond with a choice of answers; others were open-ended. The second part of the survey listed the Core Knowledge topics in the 1995 *Core Knowledge Sequence*. Teachers were asked to check off each topic they had taught or planned to teach in the 1996-97 and 1998-99 school years. The questionnaires allowed for anonymity; however, teachers were identified by school and by grade level. (See Appendix 1 for more information.)

Outcome Measures

Two different tests, the Maryland School Performance Assessment Program (MSPAP) (Yen & Ferrara, 1997) and the Comprehensive Test of Basic Skills, Fourth Edition (CTBS/4) (CTB, 1991), were used in this evaluation.

The CTBS/4 is a norm-referenced, multiple-choice test that has been found in a variety of studies to possess reasonable psychometric properties. It was chosen for this study, in part, because at the beginning of the evaluation all elementary schools in Maryland were required to administer it at certain grades. In the Maryland Core Knowledge study, the two subtests of Reading Comprehension and Mathematical Concepts and Applications are administered and reported each year. Those subtests were considered to be the more nearly "higher order" subtests in the CTBS/4's basic skills areas.

The Maryland School Performance Assessment Program is a 'next generation' performance-based testing program. The test is given to all third, fifth, and eighth graders across the state. A total of approximately 150,000 students take the test each year. MSPAP covers six content areas: reading, writing, language usage, mathematics, science, and social studies. The first four are defined by Yen and Ferrara (1997) as follows:

> READING: The reading domain is defined by three purposes for reading—reading for literary experience, for information, and to perform a task. (p. 62)
>
> WRITING: The writing domain is defined by three purposes for writing—to inform, persuade, and express personal ideas—and four steps in the writing process—prewriting/planning, drafting, revising, and proofreading. (p. 63)
>
> LANGUAGE USAGE: The single language usage outcome incorporates correctness and completeness features in the appropriate use of English conventions (e.g., punctuation, grammar, spelling) across a variety of writing purposes and styles. (p. 63)
>
> MATHEMATICS: The mathematics domain is defined by nine content outcomes and four process outcomes. The Maryland outcomes are a close adaptation of the widely known NCTM Curriculum and Evaluation Standards for School Mathematics (National Council of Teachers of Mathematics, 1989). The MSPAP open-ended mathematics tasks require students to solve multi-step problems; make decisions and recommendations; communicate their ideas, understanding, and reasoning in mathematics; and explain the processes they used to solve problems. (p. 64)

The final two areas, which were not summarized by Yen and Ferrara, are:

> SCIENCE: The science domain covers the content areas of life science, physical science, and earth/space science, and four process outcomes which include interpreting and explaining information, demonstrating ways of thinking inherent in science, using the processes of science, and applying science to solve problems.
>
> SOCIAL STUDIES: The social studies domain encompasses the content areas of political systems, geography, national and world history, and economics and the process outcomes of gathering, interpreting, and explaining information, demonstrating positive self-concept and empathy toward others, and expressing appropriate understanding and attitudes.

IMPLEMENTATION ISSUES

We still understand the great literature that the children should share. And we still feel that Core Knowledge is a great equalizer—that every child in here is getting the same exposure to historical events, scientific concepts, and literary activities. That is probably the legacy that Core Knowledge will give us—that every child in here, regardless of their background, now has a similar educational background.

—TEACHER AT A SCHOOL WHERE IMPLEMENTATION OF CORE KNOWLEDGE HAD DECREASED OVER TIME DUE TO DISTRICT PRESSURES

Summary

As the following section will document, by year 5 the five original schools ranged from a fully implementing school (that had influenced its entire district to adopt Core Knowledge[2]) to a school that had completely abandoned the curriculum. Two schools had diminished implementation due to district curricular requirements related to MSPAP, and one had diminished implementation because of the other whole-school reform model it had adopted and teacher preferences for district social studies and science curricula. Because there was such diversity over the five years in the experiences of the five Core Knowledge schools participating in this study, it is useful to present case studies of the implementation processes we observed. These case studies will identify several key issues (to be discussed in detail following this section) that influenced the degree to which the schools were implementing the Core Knowledge curriculum after five years.

Case Studies of Core Knowledge Implementation in Maryland

Core Knowledge Institutionalized and Spread

The experience of School B over the past five years represents an advantageous scenario for Core Knowledge implementation. Five years after Core Knowledge was first introduced into the school, implementation had flourished there and spread to the rest of the school district (thus transforming the control school into a Core Knowledge school in year 4 of the study). Led by the same principal and virtually the same teaching staff, the school had enjoyed a stability over the five

[2] Recall that the sixth original school was dropped from the study when, after one year of implementation, the entire district implemented Core Knowledge. Therefore, the six-school, five-district project had resulted in two districts' choosing to implement Core Knowledge district-wide.

years that helped to solidify Core Knowledge within the building. Teachers remained enthusiastic about the curriculum and had participated both locally within their district and at national conferences in sharing their experiences in creating units and specific lesson plans based on Core Knowledge topics. The principal had led the staff in integrating the learner outcomes and indicators specified as fundamental by the State Department of Education (and tested by MSPAP) with Core Knowledge curriculum content, and the school had shown notable gains on MSPAP by year 3 of implementation. The recognition for its achievements received by the school from the state of Maryland contributed to the school district's decision to implement the Core Knowledge curriculum districtwide. The district has also not overreacted to the isolated dips that have occurred in the school's MSPAP scores, but has remained supportive of the Core Knowledge implementation at the school.

Core Knowledge Holding, but Threatened

School A

By the end of year 3 of implementation, School A seemed well on its way to fully institutionalizing the Core Knowledge curriculum (McHugh & Stringfield, 1999). Implementation levels of Core Knowledge content were high throughout the school, and teachers were optimistic about the reform continuing to play a dominant role at the school. During year 4 of the program, however, a change in leadership at the district level had a significant impact on Core Knowledge implementation at School A. The superintendent (who himself had just the year before come into the district) brought in a new associate superintendent for instruction who was particularly concerned about the school's dip in MSPAP scores at the end of Year 3. This administrator told the principal after visiting the school for the first time: "I think you focus too much on content, and not enough on process."

The school has modified its first and second grade reading program to be more like a Success for All program (Slavin et. al., 1996) in an attempt to teach basic reading skills and bolster reading scores. It has also been forced to adapt its reading program at the higher grade levels in such a way that it is less possible to integrate reading and social studies Core Knowledge content in the way they were able to do it in the early years of implementation. The school was also not able to connect the teaching of writing to Core Knowledge content as it had in the past; instead, it has been forced to be more 'process-oriented' to prepare students for writing on the MSPAP. The district also imposed its own science curriculum on the school, so there is less freedom to use Core Knowledge science units.

The staff was no longer able to focus its common planning time on Core Knowledge to the same extent as in the early years of implementation. Teachers had to focus considerable

attention during year 5 on the district math curriculum, which was in the process of being developed and was delivered in small chunks to the teachers throughout the year. The new leadership in the district had also not supported the interaction between Core Knowledge schools in the county for shared planning.

Though still headed by the same principal as five years ago, the school has experienced considerable staff mobility that has also affected implementation levels of Core Knowledge. As one veteran teacher at the school lamented:

> Of the 23 who originally started all this, there are just six of us left. For various reasons, the staff has had a great mobility rate. And so at this time Core Knowledge is not nearly as emphasized as it was. Many of the people are going along with the curriculum, but the enthusiasm and the whole reason we started it, the fact that it was ours, [that] we created the curriculum [and] did the hard work finding the materials. The ownership is not there.

This teacher believes that "if the staff had stayed intact," there would have been more commitment to tackling the big task of aligning the Core curriculum with the MSPAP outcomes and indicators. Even though the school continues to have common planning time, there is no longer the same "enthusiasm of cohesiveness about this school that just rejuvenated everybody." Our discussions with new teachers confirmed that even the positive attitudes they held regarding Core Knowledge did not produce the same levels of commitment to full implementation that veteran teachers at the school exhibited.

The staff at School A voiced considerable uncertainty about the fate of Core Knowledge at their school under current district leadership and the MSPAP-driven focus on process rather than content. But the principal expressed optimism that the current participation of a Core Knowledge supporter in the development of content standards at the state level may bode well for the future of Core Knowledge both at the school and in the state of Maryland.

School C

As we previously noted (McHugh & Stringfield, 1999), implementation of Core Knowledge had decreased at School C by the end of year 3, probably due to significant staff turnover through retirements and to district curricular requirements. While implementation levels are still considerably lower than at School B, Core Knowledge has since survived a transition in principals as well as staff at the school. Though the new principal and assistant principal (who came in year 4 of this study) had no previous experience with Core Knowledge, there was sufficient commitment to the curriculum among the remaining teachers to generate support from

the administration. The assistant principal had previously read one of E.D. Hirsch's books and was committed to the teaching of content as well as process.

The school's administration perceives the district as neither actively supporting nor opposing Core Knowledge. At the same time, the school is constrained by many district curriculum requirements that limit both classroom time for teaching Core Knowledge content and professional development time for teachers to grow in their ability to plan and teach Core Knowledge units. It is in social studies and science that the school is most able to use Core Knowledge content, and teachers seek to integrate Core social studies and science material into the district-mandated reading program when possible. They also seek to use Core content in exercises from the district-mandated writing curriculum when possible. The school still sends teachers to Core Knowledge national conferences (giving new teachers priority, and using the proceeds from student fundraising projects to cover those costs). But the use of staff development time in the school calendar is dictated by district priorities. This significantly affects the ability of the school's teachers to work together to develop lesson plans integrating Core Knowledge content with the performance assessments required to prepare students for MSPAP.

The school was also significantly affected by redistricting during year 5 of this study. Because of overcrowding at School C and two nearby schools, a new school was built and School C lost a third of its students[3] and at least one teacher in every grade. The loss of teachers was very demoralizing to the rest of the staff (even though class size did not change). The school lost at least one "leader" in Core Knowledge (a fourth grade teacher), but there remained at least one teacher in every grade who has been with Core Knowledge since the start and who acted as mentors for the new teachers who entered.

For the time being, Core Knowledge appears to be holding at a reduced level at School C though continued staff mobility may further threaten the program there. The fact that the school is the only one in its large district implementing Core Knowledge may also not bode well for the program's future, since there is no district support and many district factors working against the program. On the other hand, School C's dramatic improvement in MSPAP scores over the past several years may help raise the profile of Core Knowledge, even though the dramatic shift in population served makes it impossible to attribute these academic achievement gains specifically to the Core Knowledge curriculum.

[3] Because of this change in student population, it is particularly hard to draw any conclusions about the impact of Core Knowledge on fifth year student outcomes, as we argue more fully later in this report.

Core Knowledge Substantially Adapted

While Core Knowledge implementation at School D appeared to be off to a solid start in years 1 and 2 of this study, during year 3 (1996-97) the school became part of a group of schools implementing another major curricular reform (Direct Instruction). This second reform significantly altered the instructional delivery of every teacher in the building. Although Core Knowledge remained part of that program, the major emphasis in 1996-97 was on the Direct Instruction reading program (which cannot easily accommodate the literature dimension of Core). The teachers in that school reported that the time demands of the new reform during its first year seriously interfered with their ability to implement Core Knowledge. Since Direct Instruction mandated a specific reading curriculum as well as spelling, language usage/writing, and mathematics, there was considerably less of the school day left for Core Knowledge content.

The Core Knowledge dimension of this curricular reform focused on social studies and science, and the school specifically scheduled a 'literature' period which was aimed at allowing time for some Core Knowledge literature content. Lesson plans for Core Knowledge units were provided to the school by a local foundation as part of this new reform during years four and five. While teachers found these plans useful and did implement a number of Core units, they did not choose to use Core Knowledge material for all their social studies and science units as would have been possible under the new reform, but continued to use other curricular materials (especially district provided materials) as well. Though the principal claimed at the end of year 5 that the school was fully implementing Core Knowledge and has lost nothing of Core by adding the other reform, there is much less evidence of the Core Knowledge curriculum in the classrooms of School D.

Since year 3 of this study, professional development time at the school has been devoted much more to the new reform than to the Core Knowledge component, and teachers did not perceive themselves as having enough common planning time or support from the Core Knowledge network that would have been useful in advancing and sustaining committed implementation of the program.

In addition, while the school still had the same principal five years after introducing Core Knowledge, there had been significant staff mobility, and many teachers had not been part of the original group that began implementation of the program in 1994-95. We believe this has also contributed to a diminished implementation of Core Knowledge.[4]

Core Knowledge Eventually Abandoned

School E enthusiastically began implementation of the Core Knowledge program in year 1 (1994-95) and hosted many visitors who came to observe the program in action. But by year 2, the school had been identified by Maryland State Department of Education as eligible for reconstitution because it had not made sufficient progress in raising student academic achievement as measured on MSPAP. After this decision, state and district administrators worked closely with the school to restructure educational delivery, and Core Knowledge was not a part of either the state's or the district's plan.[5]

The school's "reconstitution eligible" status diverted the principal and staff from focusing on implementing Core Knowledge. The school's master teacher did not have time to assist teachers with Core implementation because of her own teaching responsibilities. The school also did not make the transition to seeking other grant sources to assure effective implementation of Core Knowledge. It was with great difficulty that some teachers in this school hung on to Core Knowledge. As one teacher commented in year 3:

> We have so many things that we have to do to meet state outcomes and guidelines. We have a state person who shows up sometimes to see that we are on task according to our building plan. Then we have the city, and they're telling us that we need to do this, and we need to do that. It makes it very difficult and very overwhelming. But before reconstitution, when we first initiated Core, everybody in the building loved it. We still love it. It's just that when you are divided in three different ways, it's very difficult.

[4]The principal of School D emphasized that Core Knowledge has been very strong focus of grades six through eight at the school (grade levels not included in this five year study), and that a more departmentalized organizational model for grades three through five, beginning in the 1999-2000 school year, will facilitate higher levels of Core Knowledge implementation in those grades. This principal also stressed the difficulty in finding grade-level appropriate history texts to support Core Knowledge implementation.

[5] Paradoxically, the State Superintendent of Education remains a vocal supporter of Core Knowledge.

While almost two-thirds of classrooms exhibited some Core content during observations in year 3, the school was forced to use district curriculum, which "did not mesh easily" with Core. District administrators suggested that test scores might rise if attention shifted away from Core Knowledge, and teachers agreed. In year 4, only about a quarter of classrooms exhibited any Core content during observations, and implementation was minimal. The principal provided neither leadership for the program nor support for teachers in implementing the Core Knowledge curriculum. Staff morale continued to decline, as discipline and safety issues compounded problems of low student achievement. By year 5, a new principal had taken the helm, and she reported that the school was no longer using the Core Knowledge curriculum.

Survey Evidence Regarding Implementation Levels of Core Knowledge Curriculum

Table 3 below illustrates some of the implementation issues described above, summarizing changes in content area implementation from year 3 to year 5 based on responses from teacher surveys.[6] As the table indicates, implementation held relatively steady at School B. But the other school thought in year 3 to be moving towards institutionalization (School A) has had a sizeable decline in implementation. School C, where diminished implementation was noted in year 3, appears to be maintaining the Core Knowledge curriculum, though still not at the levels of School B. Implementation at School D continued to diminish in language arts, due to the other adopted reform. At the same time, implementation of Core Knowledge World Civilization and American Civilization topics at School D appears to have stabilized or even increased, which may be due to lesson plans on these topics made available to the school by the local foundation sponsoring the new reform. Since School E had officially abandoned the Core Knowledge program, teachers at that school weren't surveyed. For comparison purposes, we also include data from "Control" School B, which adopted the Core Knowledge curriculum in year 4 of the study. Note that in this district-supported implementation, the second year implementation level was relatively high.

[6] As part of our Spring 1997 and Spring 1999 surveys of teachers, we included ALL topics listed in the *Core Knowledge Sequence* for each grade level. Teachers were asked to indicate which topics they had taught or planned to teach during that school year. We could not know from the survey in what depth teachers covered particular content areas, only whether they reported covering the various topics.

Table 3

Percentages, by school, of Core Knowledge content items that teachers reported they had taught/were planning to teach (Data from 1996-97 and 1998-99)

Content Area	School A		School B		School C		School D		School E		Control B
	1997	1999	1997	1999	1997	1999*	1997	1999*	1997	1999	1999
Poems	83%	38%	83%	98%	28%	38%	62%	36%	31%	--	69%
Sayings	99%	72%	100%	100%	42%	69%	70%	58%	51%	--	90%
Stories	85%	46%	82%	84%	58%	72%	57%	8%	46%	--	64%
World Civilization	93%	45%	80%	74%	73%	76%	54%	72%	52%	--	95%
American Civilization	100%	73%	94%	81%	59%	69%	48%	59%	53%	--	92%
Geography	100%	64%	84%	83%	72%	91%	21%	4%	42%	--	89%
Science	98%	53%	96%	79%	72%	67%	37%	16%	25%	--	91%
Mean School Percentage	94%	56%	88%	86%	58%	69%	50%	36%	43%	--	84%

* Data based on much smaller number of responses than 1997. See Appendix for further cautions regarding interpretations of these percentages.

Teacher responses to a survey question about their confidence that Core Knowledge would be a dominant part of their school's curriculum corresponded with this picture of implementation of specific Core topics. Confidence was high at School B, where implementation remained high and the district was supportive. It had declined considerably since year 3 at School A, where there were many new teachers and much uncertainty about what the district would require in the future. Teachers responding at Schools C and D had mixed views, but generally thought Core would continue even if it wasn't dominant.

Conclusions Regarding Implementation of Core Knowledge in Maryland

In the following section we discuss further the issues of implementation that occurred during the five years of this study. The experiences of the schools in this study suggest that the existence of a high-stakes testing program like the Maryland School Performance Assessment Program and interpretation of the results by district and state administrators are probably the key factor in determining the fate of reform programs that appear headed toward implementation and later institutionalization, such as Core Knowledge. Our study suggests that it is difficult but possible to sustain Core Knowledge in a high stakes testing state with a test completely uncorrelated with Core Knowledge content if the following conditions obtain (in order of importance, based on our

interviews):

1. The school district is supportive of Core Knowledge and does not mandate curricular changes that threaten Core Knowledge implementation when test scores dip;
2. The school is perceived as succeeding in teaching basic reading and math skills that are not addressed directly in the Core Knowledge curriculum, and is not pressured to implement another major school-wide reform simultaneously in order to address the teaching of basic skills;
3. The school's staff does not experience major mobility over time;[7]
4. Sufficient funding is found beyond the additional seed funding to provide for purchase of materials, common planning time, and participation in the Core Knowledge national network (conferences, etc.), especially for new teachers.

Maryland School Performance Assessment Program (MSPAP)

Implementing the Core Knowledge curriculum in ways that will prepare students to do well on MSPAP has been a challenge for the five schools in this study. While Core Knowledge focuses on specific *content*, students are tested each year on the more process-oriented skills described above. Principals and teachers at Core Knowledge schools must contend with district administrators who often emphasize process [e.g., particular skills tested on MSPAP] over content. As one principal related, "the meaningful use of knowledge is the big, big, important thing" on the MSPAP. In such an environment focused on performance tasks and performance assessment, teachers and administrators must continually think about and help students to understand and communicate how content from such units as the medieval period and Renaissance applies to their lives today.

While one of the Core Knowledge schools in this study has been particularly successful in accomplishing this integration between the Core Knowledge curriculum and the performance outcomes tested on the MSPAP, this task of integration has proved particularly challenging to the others. As one teacher put it: "The Maryland State outcomes seem to be directing instruction in Maryland schools to an extent where Core is often difficult to implement. The students seem to enjoy Core, but for state-driven reasons, only about half of Core can be combined with half of Maryland outcomes." Another teacher was more blunt: "It seems to be at odds with MSPAP."

[7] Although this did not occur in our study, there is no theoretical reason why significant numbers of new teachers could not be successfully introduced to Core Knowledge. We assume such an introduction would require professional development, money for materials, and team support.

District Curriculum

Of primary importance in the ability of a school to adequately implement Core Knowledge is the degree to which it is allowed to deviate from its district's pre-existing curriculum. The Core Knowledge Foundation estimates that the Core Knowledge sequence should be the basis of about 50% of a school's curriculum. For schools required to teach significant parts of their district's curriculum (usually because the district believes its curriculum will improve MSPAP scores), there simply was not sufficient time to satisfactorily implement Core Knowledge. Conversely, for schools in districts that were more flexible, teachers were better able to cover more Core Knowledge content. In our study those more flexible districts were also relatively small. We also found that districts which had been more flexible became less flexible as administrators changed and schools did not demonstrate sufficient progress on the MSPAP. One of the two schools that appeared on the way to institutionalization of Core Knowledge in year 3 was struggling by year 5 to maintain the program as the district became more and more demanding about implementation of its curriculum.

One teacher described her frustration in trying to meld Core Knowledge with the district-mandated curriculum. "We have a curriculum, and we're held accountable to that, as we all know, through MSPAP. I'm very, very torn because I feel I have to get this in and the Core curriculum is very...it's challenging, it's enriching, it's stimulating. But you have to constantly balance and weigh what to do, and we can't get everything in. And that's just very frustrating." Another summarized the problem: "It is difficult to juggle doing justice to Core and attempting to complete other curriculums."

In one school, there were growing numbers of teachers who viewed the Core Knowledge sequence as supplemental to the district curriculum. As one second-year teacher commented:

> I did not do a lot of Core this year, but I really used it to enrich my social studies or my English units. And I just think that if you're going to implement Core in a school, if you just don't have a strong curriculum to begin with, then maybe that's something that would be a useful curriculum to have as a base. But, this [Core] was really a supplementary curriculum.

Within this study, when conflicts between central administration and the Core Knowledge curriculum were not clearly resolved in favor of the Core Knowledge curriculum, eventually the local curriculum predominated.

A New Reform

Attempting a new reform before a previous one is fully institutionalized is generally a step that

jeopardizes the earlier reform (Stringfield et al., 1997). Even adopting a reform that includes Core Knowledge as a constituent part, as was the case for School D in our study, has appeared to be detrimental to Core Knowledge implementation. The other reform has demanded most of the staff's professional development time, and has imposed curricular materials and scheduling requirements that have not allowed the school to implement Core Knowledge as fully as they had in the past.

Staff Mobility

Our study has shown that relatively high levels of staff mobility at some schools tended to impede implementation/institutionalization of Core Knowledge, even when newer teachers were positively disposed towards the program. In general, teachers new to a school had difficulty implementing Core Knowledge. The staff development time and funding available in years one and two had greatly diminished by year three. In addition, in many cases the previous teacher had left no Core Knowledge lesson plans, assessments, or resources. This lack of curriculum materials also affected teachers who changed grades.

There appeared to be no specific, structured method of training new teachers or assuring curriculum materials bought through Core Knowledge-specific grants remained at any school. Although some schools developed methods of accumulating materials into "binders" or "logs," this process of documenting the curriculum was not used in all schools. When it was used, these valuable records were sometimes incomplete. Comments from the teacher focus groups and survey responses revealed that, for the most part, it was the unspoken responsibility of experienced Core teachers to train and assist new teachers. While this worked well in some schools, in others there was no attempt to integrate new teachers into Core Knowledge. As one first-year teacher commented, "All I know about [Core Knowledge] is that there's that book for each grade and those are the things you are supposed to cover. That's all I really know."

Continued Funding to Provide Resources, Including Planning Time and Conferences

Importantly in this study, all of the initial teachers and schools received external funding to provide initial classroom and library materials in support of Core Knowledge. New teachers, or teachers moved to a new grade, generally had to purchase materials from their own salaries.[8] Through

[8] Continued funding is particularly important for teachers who are new to the school or are moved to a new grade. Our experience has been that teachers tend to view the materials they have helped develop for their classroom as their own, and that those teachers tend to take those materials with them if they leave a school. The new teacher then faces the challenge of 'gearing up' to Core lessons, which involve an unusually large amount of not-traditionally-provided materials. In the first two years of the Maryland Core Knowledge project,

analyses of the qualitative interview and observational data collected in the first two years of the evaluation, we found that there were a number of factors that facilitated successful early implementation, including extra funding for start up, common planning time, and attendance at the Core Knowledge National Conference (Stringfield & McHugh, 1997). In subsequent interviews and teacher surveys, we probed into the importance of these factors for continued implementation.

Extra funding to support Core Knowledge. The Abell Foundation provided $22,000 to each school in year one and $5,000 in year two. When the Abell funding ended after two years, local school districts did not replace the grant money. Schools reported finding it difficult to reallocate within-school funds for Core purposes. Resources such as trade books needed to be replaced, and it was widely viewed as essential to have (and maintain) a photocopier for developing Core curriculum. Some principals were successful in raising extra money to fund common planning time, purchase some new resources, and pay for travel costs to the Core Knowledge National Conference. For example, at one school the proceeds from student fundraising projects were devoted to sending newer teachers to Core Knowledge National Conferences.[9] It did not appear that implementation declined due to lack of funding. Rather, those who could sustain commitment to the program managed to find resources.

Importance of common planning time. Common planning time among teachers was a feature that facilitated the successful implementation of Core Knowledge. Being able to share ideas and the workload with other teachers of the same grade level lightened the burden, especially in years one and two. As one teacher commented, "I'm typically a very independent person. Coming here and having to work as a team my first year was very awkward for me. But I can't imagine doing Core without it."

Decreased time for common planning appeared to be detrimental to implementation. As one teacher from a school where implementation had decreased significantly commented: "If common planning time is a piece…love of learning might infect other teachers and subsequently the students. Without common planning time, it's been a lonely adventure." Again, however, lack of planning time did not appear to be directly due to lack of funding as much as to other priorities set by the principal. At another school where implementation had decreased due to district pressure, the principal still sought to maintain common planning time for teachers.

Involvement in the Core Knowledge national network. While the large majority of teachers had at least minimal involvement in the Core Knowledge national network through its

schools received funding to assist with these unusual purchases, but from year three forward, individual teachers were expected to pay for the great majority of their own materials.

[9] Note that a school serving a relatively affluent community can raise much more money through 'fundraisers' than can a school serving a high poverty community.

publications (e.g., *What Your [X] Grader Needs to Know* and *Core Knowledge Sequence: Content Guidelines for Grades K-6)*, there was a large diversity in experience with other Core Knowledge schools or the national conferences. Teachers at the school that had adopted another reform appeared least well-connected to the national network (staff development was focused more on the other reform model). While many teachers emphasized the helpfulness of the national conference, teachers at schools where there were opportunities to attend the national conferences continued to feel somewhat isolated if their district had few, if any, other Core Knowledge schools. Opportunities to visit other Core Knowledge schools declined substantially over the five years of the study, and even some school principals did not appear to be aware of what other Core Knowledge schools within the state were doing. Our discussions and observations convinced us that more communication among Core Knowledge schools in Maryland, and especially the sharing of specific lesson plans created for Core Knowledge content that had been helpful in preparing students for the MSPAP, would be particularly beneficial.

Summary

Though implementation of the Core Knowledge curriculum was a challenge for most teachers involved in this study, it was a challenge they enjoyed and embraced. Over and over we heard teachers who acknowledged all the work involved praise the richness of the curriculum and conclude they were glad to be teaching it. As one put it: "It is exciting to teach and lends itself well to hands-on learning. There are many opportunities to write and make cross-curriculum connections. Children of all abilities thrive in a Core environment and soak up information like sponges. Even children with learning disabilities and handicaps can tell you everything about the War of 1812." Another concluded: "It's the best curriculum overall that I have work with in 28 years." With committed, focused leadership and a team of teachers who begin the program together and remain together over time, Core Knowledge can be successfully sustained at high levels. But the evidence from this study indicates that competing reforms and competing demands from districts and the State Department of Education tend to derail Core Knowledge implementation and may leave only remnants of recognizable Core curriculum within a school. Maryland's high stakes testing program influenced districts' openness to the Core Knowledge curriculum. It appears to have driven schools to seek out competing reform programs that are perceived by administrators as having a more obvious linkage to short-term increases on MSPAP scores.

STUDENT ACADEMIC OUTCOME DATA

What type of curriculum works best, with which students, is an empirical question, and it is time we answered it empirically.

— Ed Zeigler, *Education Week,* June 17, 1998

We examined academic outcomes using the Comprehensive Test of Basic Skills, Fourth Edition (CTBS/4) and the Maryland School Performance Assessment Program (MSPAP). Neither test is designed for, nor deliberately aligned with, the Core Knowledge curriculum. To that extent each measure becomes a demanding, but not highly specific, test of the topics taught in Core Knowledge. However, the theory underlying Core Knowledge is that adding specific content to curriculum will increase the literacy of American students. Therefore, based on the promises inherent in the reform itself, we have used the CTBS/4 and the MSPAP to gauge if the implementation of Core Knowledge increases knowledge, specifically in the areas of reading comprehension and the ability to apply basic knowledge to show understanding in reading selections, develop written responses, solve multi-step mathematics problems, conduct science investigations, and demonstrate understanding of social studies concepts.

CTBS/4 Results

The CTBS/4 was given in the fall and spring of the 1994-1995 school year in grades one and three in experimental and matched control schools. Grades one and three were chosen to provide longitudinal coverage of all elementary grades while providing an overlap, at grade three, within three years. The fall administration provided a pre-test score and the spring administration provided a year-one measure. The CTBS/4 was again given to these same children in the spring of 1996 when they were in second and fourth grade and in the spring of 1997 when they were third and fifth graders. The tests were also administered in Spring 1998 and Spring 1999 to the cohort that was in fourth and fifth grades in those years, respectively.

Implementation issues make it problematic to present five-year gain scores for students at all five pairs of schools. One of the Core Knowledge schools had very low implementation levels and had abandoned the program by year 5. Redistricting at another school dramatically changed the student population in year 5, making it impossible to calculate five-year gains. One of the control schools became a Core Knowledge school in year 4. For these reasons, we do not

present average gains (aggregated over the five pairs of schools) for years 4 and 5.[10]

In this section we present results of the reading comprehension subtest of the CTBS/4.[11] It would be preferable to use multi-level modeling (Bryk, Raudenbush, & Congdon, 1994) for performing quantitative statistical analyses on this data set. However, this option is implausible because only five, and in some instances just three, schools are available for analysis. Therefore, the statistical analyses reported in the following section will use the student as the level of analysis.

During the first three years of the study, first graders who moved to third grade exhibited a net mean gain of 4.8 NCEs[12] at the five Core Knowledge schools. The size of the change varied greatly among the five Core Knowledge sites and among the five control schools. The Core Knowledge schools produced greater gains than their matched control schools in four of five cases. However, the difference in gains so greatly favored the control school in Pair E (the site at which teachers reported the lowest levels of Core implementation) that the whole-group mean increase was lower for Core Knowledge than for control schools (+4.8 NCEs versus +6.4 NCEs). When that troubled implementation site and its matched control school are excluded from analysis, students at Core Knowledge schools outgained their control school counterparts (8.1 to 4.2 NCEs).

[10] Appendix 3 presents average NCE scores for each pair of schools over this five year period for those students who remained in the same school for five years. As a bridge to school-level MSPAP scores presented in the next section, we also present at the end of Appendix 3 the NCE average for the entire fifth grade class in each school in Spring 1999 (which may differ significantly from the NCE average of the smaller group of students who have been in the same school for five years).

[11] Though we have also been tracking changes in the CTBS/4 mathematics concepts and applications subtest, we do not include any analysis of the mathematics results in this section because the Core schools did not change their mathematics curricula as a result of the Core Knowledge implementation. For informational purposes only, the mathematics results are presented in the Appendix.

[12] The Normal Curve Equivalent, or NCE, scale is an equal distribution scale with a mean of 50 and a standard deviation of 21.06. NCE scores are equal to percentiles at the first, fiftieth, and ninth-ninth percentiles.

Table 6
Average NCE gains in CTBS *Reading Comprehension* for students moving from *first through third* grade (Fall 1994 to Spring 1997)

	Pair A	Pair B	Pair C	Pair D	Pair E	Mean School Change	Mean School Change Without Pair E
Core Knowledge	8.2	5.2	13.8	5.2	-8.4	4.8	8.1
Control	5.6	-3.6	12.0	2.7	15.6	6.4	4.2

As Tables 7 and 8 indicate, students at Core Knowledge schools continued to outgain their control school counterparts in reading comprehension, except at the lowest implementing school. (The control school of Pair B that became a Core Knowledge school in year 4 continued to show smaller gains than the original Core Knowledge school.) It is the authors' judgment that by the end of four years of implementation, the implementation trajectories had become so differentiated as to make cross-site aggregation virtually meaningless, so no such aggregations are presented.

Table 7

Average NCE gains in CTBS *Reading Comprehension* for students moving from *first through fourth* grade (Fall 1994 to Spring 1998)

	Pair A	Pair B	Pair C	Pair D	Pair E
Core Knowledge	6.7	9.2	13.1	6.1	-12.3
Control	3.0	-.8	12.2	2.7	15.3

Control School B became a Core Knowledge School in Fall 1997.
Implementation at Core Schools A and D had diminished, though not to same extent as at Core School E.

Table 8
Average NCE gains in CTBS *Reading Comprehension* for students moving from *first through fifth* grade (Fall 1994 to Spring 1999)

	Pair A	Pair B	Pair C	Pair D	Pair E
Core Knowledge	7.4	6.1	NA	2.4	-21.8
Control	3.6	1.8	NA	-6.7	7.2

Implementation at Core Schools A and D had diminished.
'Control' School B continued its second year as a Core Knowledge school.
'Core' School E completely abandoned implementation.
Core School C had a major student population change and the school preferred not to undergo testing.

Since schools in this five-year study did not change their mathematics curricula as a result of the Core Knowledge implementation, we would not necessarily expect an effect on measures of mathematics achievement. As the full tables in Appendix 2 indicate, cohorts at two of the Core Knowledge schools showed greater gains over five years than their control school counterparts on the CTBS/4 mathematics concepts and applications subtest, while cohorts at two of the control schools outgained their Core Knowledge school counterparts. (Fifth year data were not available at the fifth set of schools, due to the redistricting.)

Results from the Maryland School Performance Assessment Program (MSPAP)

In *The Schools We Need & Why We Don't Have Them*, Hirsch (1996) wrote that his "interest in and sympathy for the idea [of performance-based assessments] are of long standing." Hirsch has long advocated for the use of such tests (Hirsch, 1977). In the 1970s and 1980s, he performed research on and conducted experiments with performance-based writing tests. His studies and the work of others led him to revise his opinion about this method of assessment. While Hirsch states that he continues to believe that such tests have some advantages, he writes: "The best uses of performance tests are as lower-stakes 'formative' tests, which help serve the goals of teaching and learning within the context of a single course of study" (1977, p. 263). He no longer believes "that such an approach to large-scale assessment could possibly be accurate, fair, and reasonable in cost" (1977, p. 183).

Hirsch's views apparently are not shared by the Maryland State Department of Education. MSPAP is a high-stakes test. The scores are used as a measure of schools, and by implication, the professionals working in them.

Analysis of the impact of the Core Knowledge curriculum on student achievement using MSPAP scores is problematic, since change over time is in school-level scores, not the more clearly relevant change in students over time. Because individual student scores are not available for MSPAP, we are not able to distinguish between students who have been in the Maryland Core Knowledge or control schools from the beginning of the implementation and those students new to the schools. This limitation requires us to assume that non-longitudinal students' parents chose to bring their children to the experimental (Core) and control schools for reasons independent of the ongoing Core Knowledge implementation. Our observations over five years consistently have been that virtually all new-to-the-schools parents did not know that their children's new schools were (or were not) Core Knowledge schools until after they had enrolled. Therefore, we believe that the threat posed to the validity of MSPAP findings is minimal. In this context MSPAP becomes a conservative test of the effects of the Core curriculum. Presumably it would be more difficult to show any reform's effects on measures that include students who did

not receive the full treatment.

Since the change measure does not follow a cohort over time, we present both third- and fifth-grade MSPAP scores for each pair of schools over the period 1994-1999, together with five-year gain scores, in Appendices 4 and 5. The scores from the 1994 MSPAP administration are used as a pre-Core-implementation measure, and are compared with the 1999 (end of fifth year) test results to calculate a five-year gain score.

Because of the various implementation issues over the five year period discussed above, we do not believe it is appropriate to present an average gain score for Core Knowledge schools compared to control schools. (One school abandoned the program; a control school became a Core Knowledge school; one school's student population dramatically changed in year 5.) There is also considerable volatility over time in school-level MSPAP scores (particularly in small schools, where the percentage scoring satisfactorily or above can be greatly affected by a small number of students), and so the five-year gain scores may also not reflect the degree of student achievement progress that has actually occurred at each school. (Some schools made considerable gains before year 5, which were not reflected in the year 5 data.)

Analysis of the tables in Appendices 4 and 5 indicate that some Core Knowledge schools produced higher gains than their control schools and the state average, while others did not. Some Core Knowledge schools met or exceeded the state average by year 5 of this study, but not all schools had managed to reach the state average after five years, much less the standard of 70 percent of students performing satisfactorily set by the state. Only in third grade reading and social studies did all four implementing Core Knowledge schools meet or exceed the state average on the MSPAP in year 5. Three of the four schools met or exceeded the state average in third grade mathematics, language usage, and science, and in fifth grade science, writing, mathematics, and language.[13]

Given the varying degrees of Core Knowledge implementation and mobility of student populations across the five pairs of schools, it is difficult to interpret the impact of Core Knowledge on MSPAP scores. While it is not possible to draw conclusions about the direct impact of Core Knowledge on MSPAP scores, these results do suggest that it is *possible* for schools which use the Core Knowledge curriculum to succeed particularly well in improving student achievement on standardized tests.

SUMMARY

The experiences of the five Core Knowledge schools in this five-year study indicate that full implementation is possible, even in a state with a high-stakes test like the Maryland School Performance Assessment Program (MSPAP). At the same time, the existence of a high-stakes testing program is probably the key factor in determining the fate of reform programs such as

[13] See full tables in Appendix.

Core Knowledge. Our study suggests that it is difficult, but indeed possible, to sustain Core Knowledge in a high-stakes testing state if the following conditions are met (in order of importance, based on our interviews):

1. The school district is supportive of Core Knowledge and does not mandate curricular changes that threaten Core Knowledge implementation when test scores dip;
2. The school is succeeding in teaching basic reading and math skills that are not addressed directly in the Core Knowledge curriculum, and is not tempted to implement another major school-wide reform simultaneously to address the teaching of basic skills;
3. The school's staff does not experience major mobility over time;
4. Sufficient funding is found beyond the additional seed funding to provide for purchase of materials, common planning time, and participation in the Core Knowledge national network (conferences, etc.).

In general, the presence of an actively involved implementation leader has also been critical to implementation.

A Core Knowledge advocate might argue that an increase in the scores on CTBS/4 and MSPAP would be irrelevant. They might contend that if a student clearly learns information in school that is beyond what is traditionally taught, and that student's scores do not drop as a result of participation in Core, then Core participation has exhibited worth at no cost on the locally valued measures. (Such an argument would focus attention on the *value* of the Core Knowledge content itself, a focus that the Core Knowledge Foundation would probably find laudable.)

Overall, longitudinal gains as measured on the Comprehensive Test of Basic Skills in reading comprehension have tended to favor Core Knowledge schools that had at least moderate levels of implementation. In general, CTBS/4 gains were greater in Core Knowledge schools in the area of reading comprehension, an area most plausibly linked to Core, than in mathematics, in which schools reported no Core-specific changes. Changes in scores from 1994 through 1999 on both third-grade and fifth-grade MSPAP show a mixed pattern, and it is difficult to interpret the impact of Core Knowledge on MSPAP scores, since implementation in different subject areas is not uniformly high. These results do suggest, however, that it is possible for schools that use the Core Knowledge curriculum to succeed particularly well in improving student achievement on standardized tests.

Ironically, given the impact of Maryland's Student Performance Assessment Program (MSPAP) on implementation decisions throughout the course of this study of Core Knowledge,

the impact of this curriculum on student achievement is difficult to measure precisely. This five-year study has documented how high-stakes testing influences implementation of the Core Knowledge program and shown that it is possible, under the conditions outlined above, to both fully implement Core Knowledge and produce student achievement results that satisfy and even exceed state expectations. Just as clearly, the study demonstrates that the presence of MSPAP increased the challenge in trying to implement and institutionalize the Core Knowledge curriculum.

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APPENDICES

1. Core Knowledge Teacher Survey Return Rates

2. Average NCE Gains in CTBS Math Concepts: Years 3, 4, and 5

3. Average CTBS Reading Comprehension and Math Concepts NCE scores over Five Years by School

4. MSPAP Results for 3rd Grade by School, 1994-99

5. MSPAP Results for 5th Grade by School, 1994-99

Appendix 1
Core Knowledge Teacher Survey: Methodology and Return Rates

Surveys containing questions about teachers' experiences preparing for and teaching the Core Knowledge curriculum and checklists of Core Knowledge topics, by grade, were prepared for the Maryland Core Knowledge study. Surveys were distributed to participating schools in May 1999. Each regular teacher in grades one through five received a questionnaire. Since there was a new principal at School E who said that the school was not implementing Core Knowledge, we did not attempt to survey teachers there. We did, however, survey teachers at "Control" School B, which began implementing Core Knowledge in year 4 of this study.

The overall return rate for the surveys was high at the high implementation school, but considerably lower at schools where interviews indicated lower levels of implementation. This probably reflects a lower level of commitment to Core Knowledge in general among the staff at those schools.

Percentage of Questionnaires Returned by School and Grade

School	Gr. 1	Gr. 2	Gr. 3	Gr. 4	Gr. 5	Overall
A	100% (3)	100% (3)	0% (0)	33% (1)	67% (2)	60%
B	100% (1)	100% (1)	100% (1)	100% (2)	100% (1)	100%
C	33% (1)	33% (1)	0% (0)	33% (1)	0% (0)	20%
D	0% (0)	0% (0)	100% (3)	0% (0)	0% (0)	20%
Con. B	100% (1)	100% (1)	100% (1)	100% (1)	100% (1)	100%

Appendix 2
Average NCE Gains in CTBS Math Concepts: Years 3, 4, and 5

Table A

Average NCE Gains in CTBS *Math Concepts* for Students Moving from *First through Third* Grade (Fall 1994 to Spring 1997)

	Pair A	Pair B	Pair C	Pair D	Pair E	Mean School Change	Mean School Change without Pair E
Core Knowledge	2.2	-2.3	15.1	10.4	-20.1	1.1	6.4
Control	2.2	0.8	17.8	4.0	3.2	5.6	6.8

Table B

Average NCE Gains in CTBS *Math Concepts* for Students Moving from *First through Fourth* Grade (Fall 1994 to Spring 1998)

	Pair A	Pair B	Pair C	Pair D	Pair E
Core Knowledge	1.2	7.9	0.9	7.4	-25.7
Control	0	-10.3	3.7	-1.8	3.2

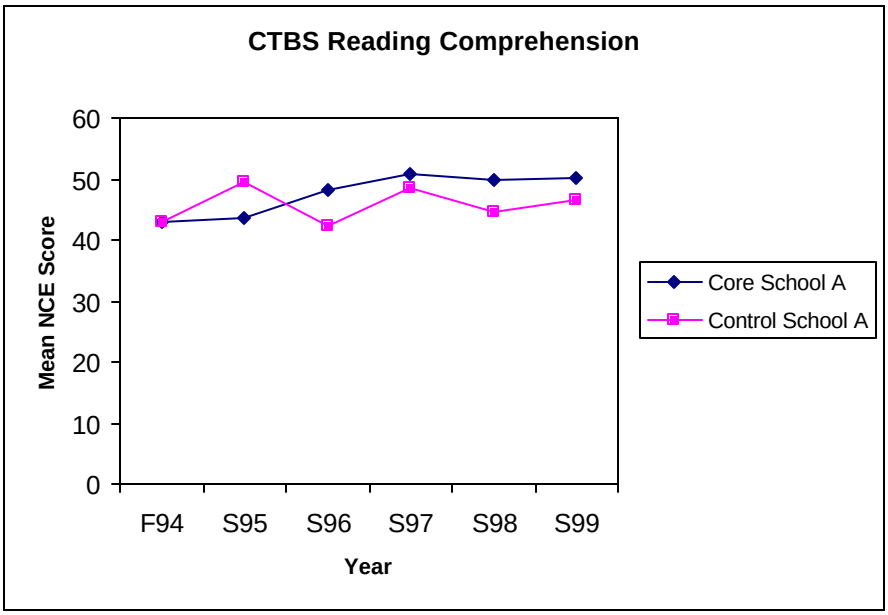
Table C

Average NCE Gains in CTBS *Math Concepts* for Students Moving from *First through Fifth* Grade (Fall 1994 to Spring 1999)

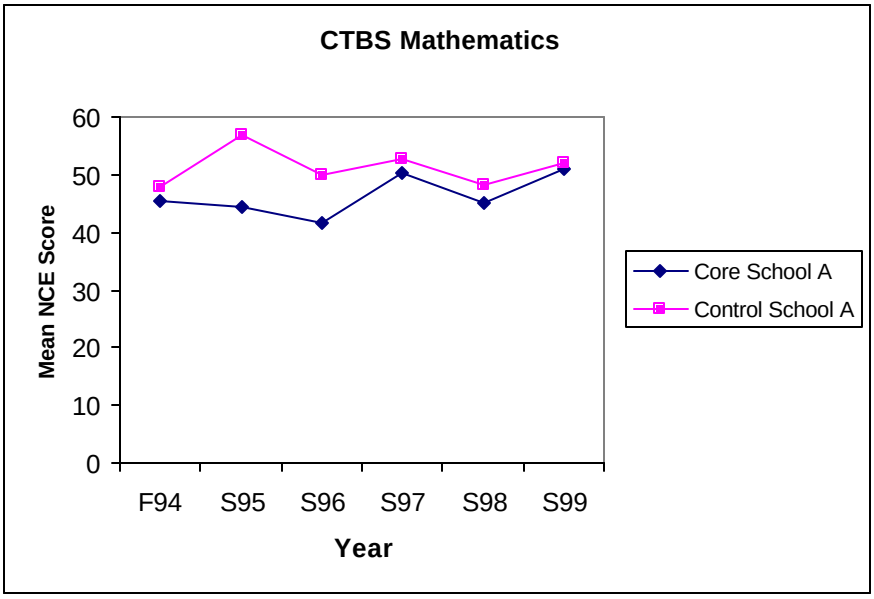
	Pair A	Pair B	Pair C	Pair D	Pair E
Core Knowledge	5.6	-5.1	NA	13.6	-28.4
Control	4.3	0.4	NA	-1.8	13.2

Appendix 3
Average CTBS Reading Comprehension and Math Concepts

NCE scores over Five Years by School
Average NCE Scores in CTBS for Students Moving from First to Fifth Grade

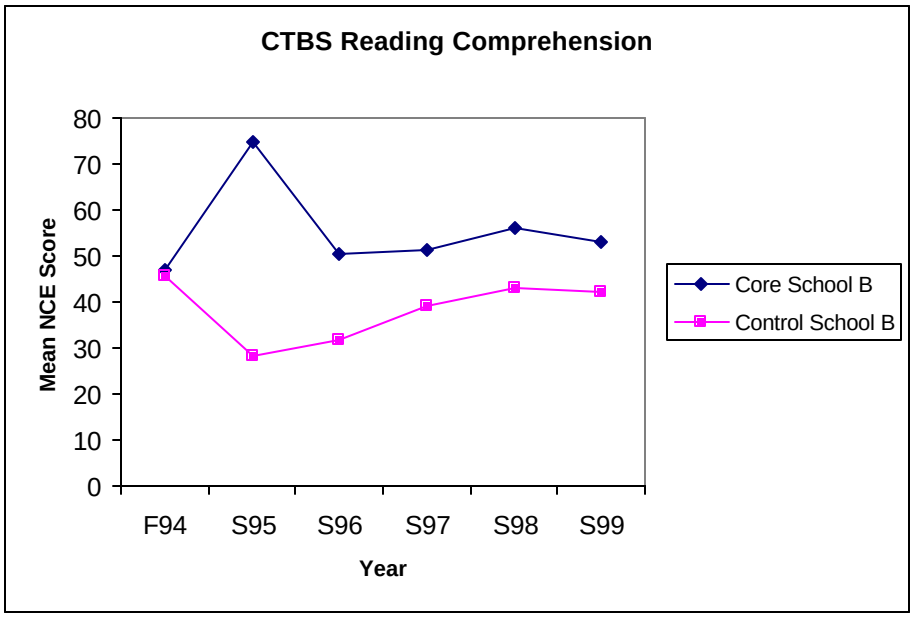


Average Spring 1999 NCE score for entire 5th grade class
(larger than cohort in school since first grade):
Core School A: 46.1 Control School A: 46.6

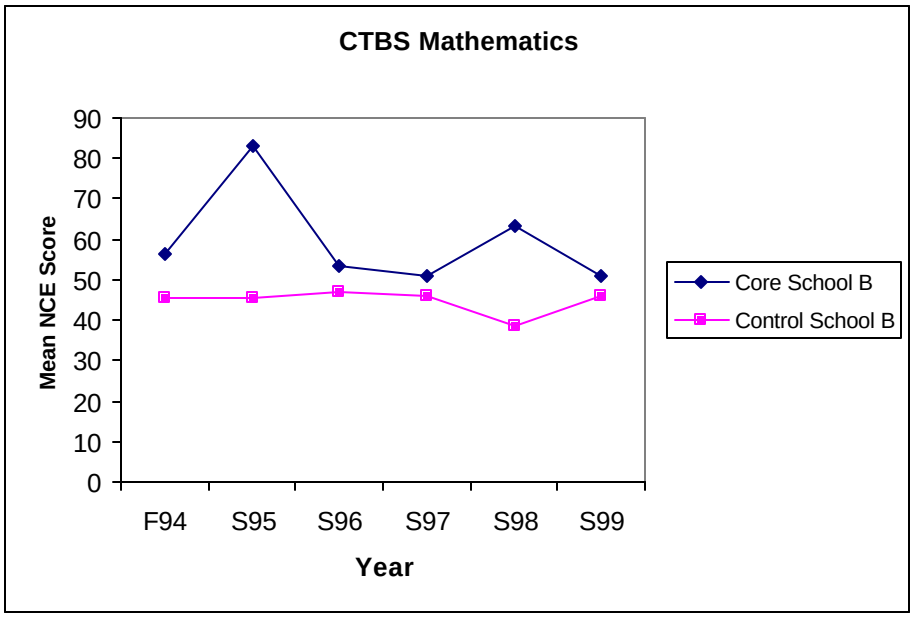


Average Spring 1999 NCE score for entire 5th grade class
(larger than cohort in school since first grade):
Core School A: 47.1 Control School A: 48.4

Average NCE Scores in CTBS for Students Moving from First to Fifth Grade

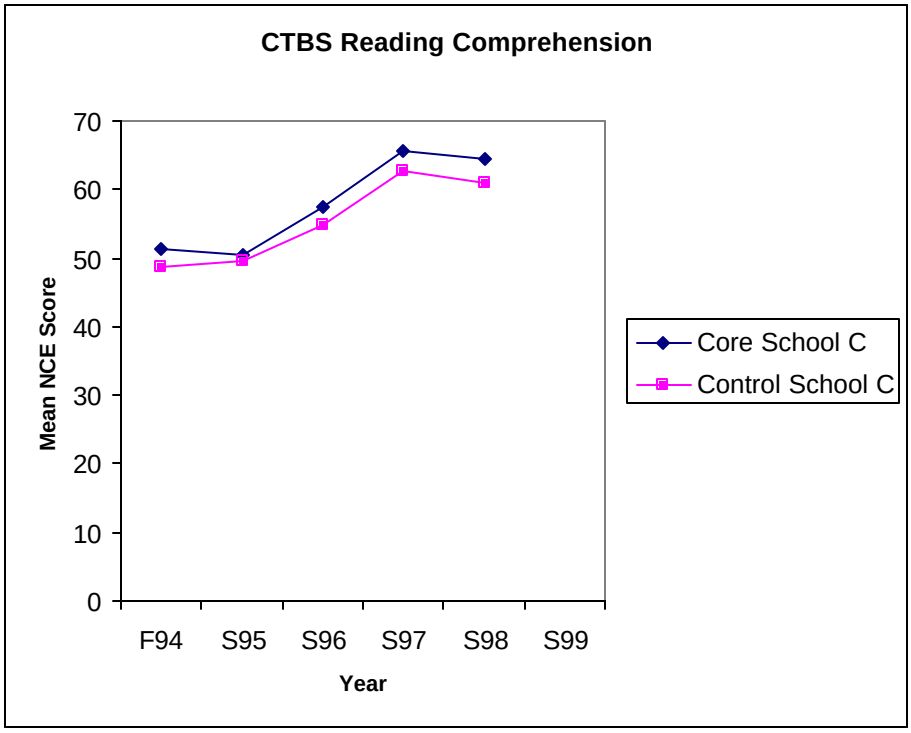


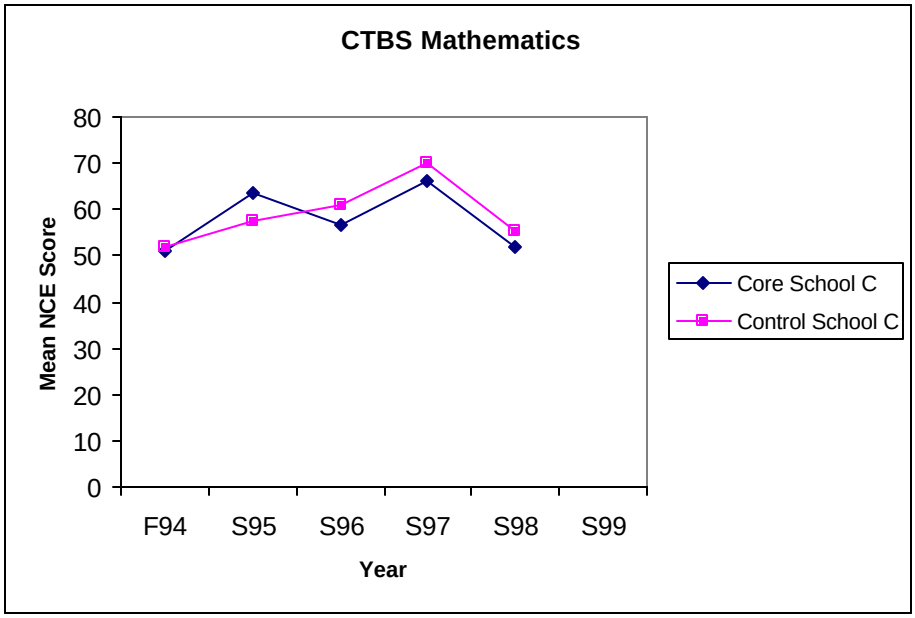
Average Spring 1999 NCE score for entire 5th grade class
(larger than cohort in school since first grade):
Core School B: 53.5 Control School B: 44.8



Average Spring 1999 NCE score for entire 5th grade class
(larger than cohort in school since first grade):
Core School B: 49.6 Control School B: 47.4

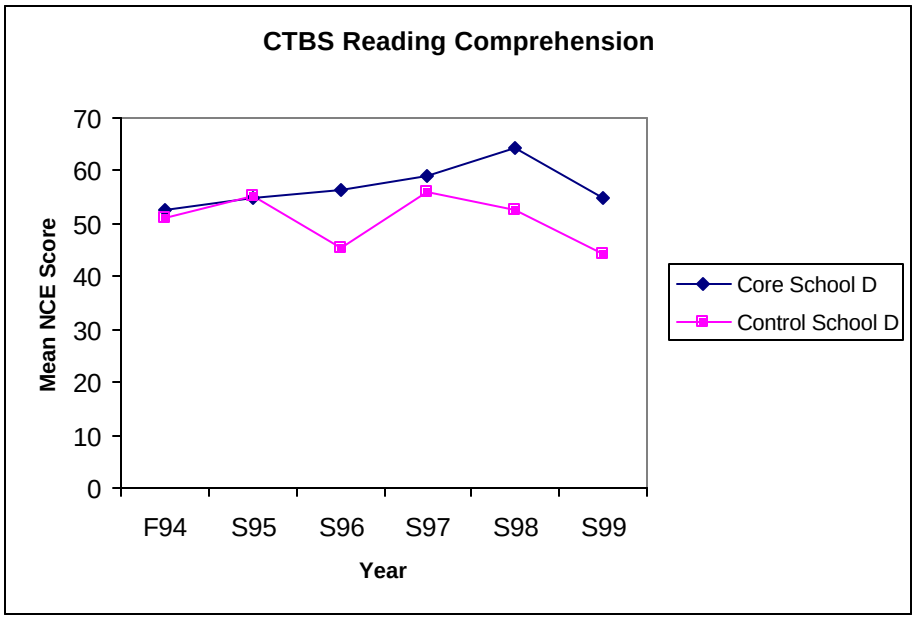
Average NCE Scores in CTBS for Students Moving from First to Fifth Grade



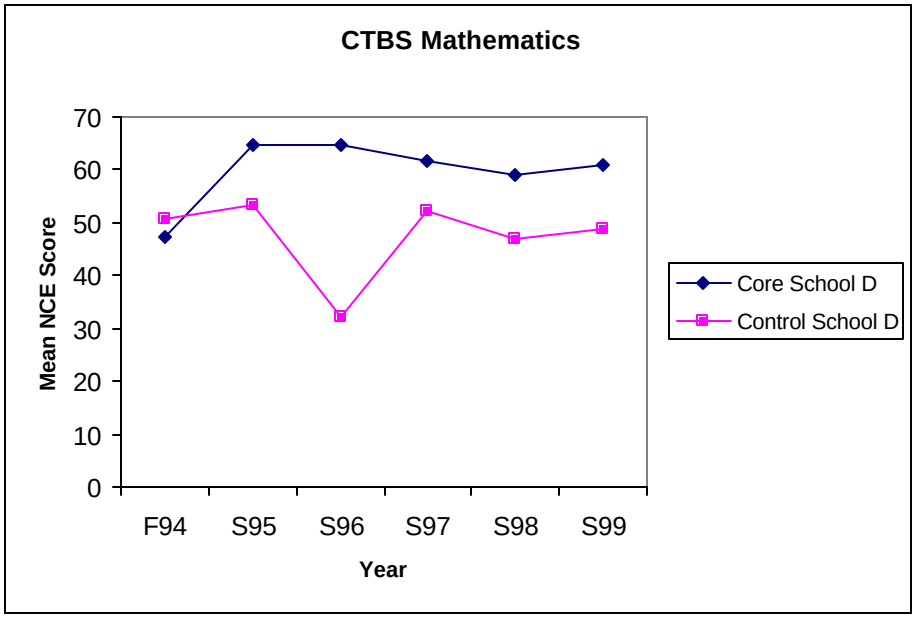


Spring 1999 CTBS/4 Scores not available

Average NCE Scores in CTBS for Students Moving from First to Fifth Grade

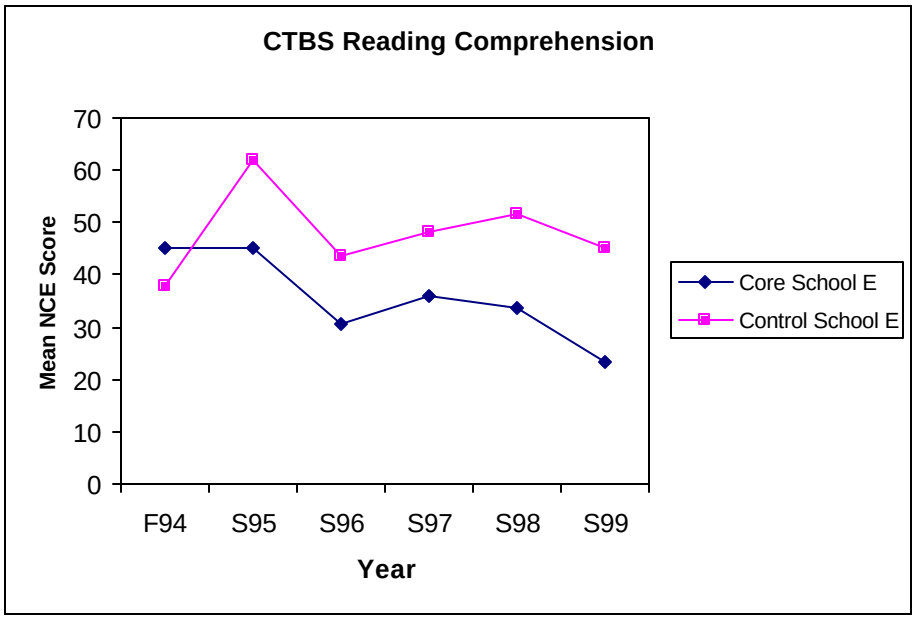


Average Spring 1999 NCE score for entire 5th grade class
(larger than cohort in school since first grade):
Core School D: 51.8 Control School D: 32.1

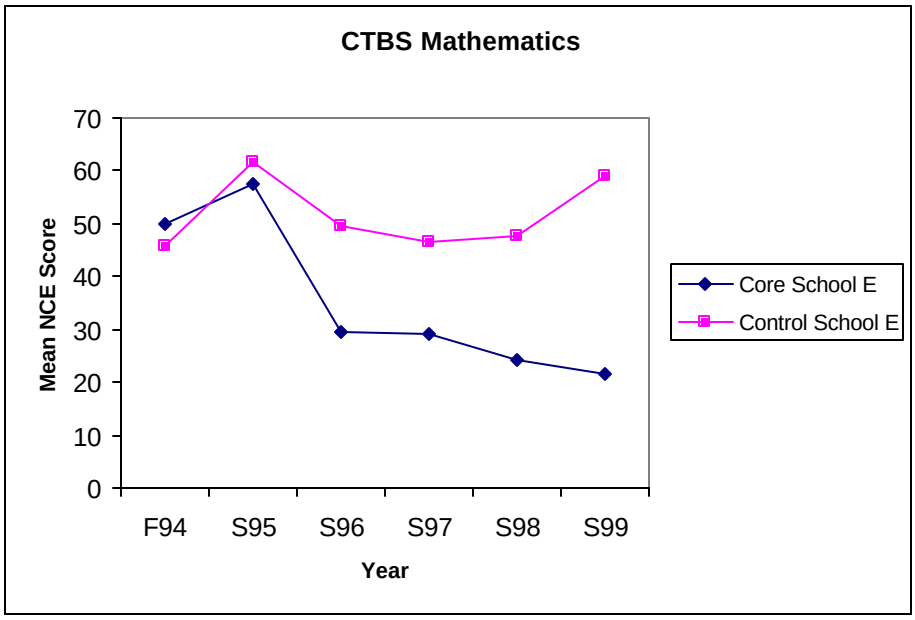


Average Spring 1999 NCE score for entire 5th grade class
(larger than cohort in school since first grade):
Core School D: 58.4 Control School D: 37.2

Average NCE Scores in CTBS for Students Moving from First to Fifth Grade



Average Spring 1999 NCE score for entire 5th grade class
(larger than cohort in school since first grade):
Core School E: 23.9 Control School E: 35.8



Average Spring 1999 NCE score for entire 5th grade class
(larger than cohort in school since first grade):
Core School E: 22.7 Control School E: 44.6

Appendix 4
MSPAP Results for 3rd Grade by School, 1994-99

Maryland School Performance Assessment Program
for MD CORE and Control Schools, 3rd Grade Reading, 1994-1999

SCHOOL	*GRADE 3 – READING*						*GAINS*
	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*1994 - 1999*
Core School A	27.0	32.5	25.0	24.1	31.4	46.2	19.2
Control School A	10.2	25.4	30.8	41.5	58.5	50.7	40.5
Core School B	40.0	60.9	76.2	85.0	80.0	58.3	18.3
Control School B	20.8	35.3	63.2	36.4	72.2	35.0	14.2
Core School C	40.0	41.0	45.2	59.3	54.5	57.4	17.4
Control School C	41.3	55.0	55.1	53.8	62.9	54.3	13.0
Core School D	25.4	47.1	35.7	46.4	42.2	41.5	16.1
Control School D	32.3	25.5	36.8	21.9	46.7	41.8	9.5
Core School E	16.9	5.7	2.7	8.8	10.3	16.0	-0.9
Control School E	12.1	5.8	9.4	9.1	12.2	13.8	1.7
State Average	30.6	34.0	35.3	36.8	41.6	41.2	10.6

Maryland School Performance Assessment Program
for MD CORE and Control Schools, 3rd Grade Mathematics, 1994-1999

SCHOOL	*GRADE 3 - MATHEMATICS*						*GAINS*
	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*1994 - 1999*
Core School A	32.6	28.9	23.4	23.9	37.9	40.7	8.1
Control School A	5.1	16.9	29.5	44.6	61.4	41.0	35.9
Core School B	61.1	60.0	60.9	86.4	51.2	56.0	-5.1
Control School B	20.0	41.2	55.0	34.6	52.2	38.5	18.1
Core School C	41.3	39.7	50.6	70.7	67.3	64.6	23.3
Control School C	71.3	80.0	68.9	71.2	54.7	50.5	-20.8
Core School D	23.9	45.6	28.6	45.9	31.3	32.3	8.4
Control School D	37.1	31.4	17.6	20.3	33.0	24.7	-12.4
Core School E	9.2	4.3	2.7	8.6	5.3	3.9	-5.3
Control School E	3.4	17.4	7.5	9.1	6.5	12.1	8.7
State Average	33.9	42.0	38.7	41.4	41.6	38.9	5.0

Maryland School Performance Assessment Program
for MD CORE and Control Schools, 3rd Grade Social Studies, 1994-1999

SCHOOL	*GRADE 3 - SOCIAL STUDIES*						*GAINS*
	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*1994 - 1999*
Core School A	28.3	37.8	23.4	16.9	34.5	45.8	17.5
Control School A	11.9	22.0	15.4	40.0	56.1	61.5	49.6
Core School B	44.4	48.0	56.5	72.7	69.8	50.0	5.6
Control School B	24.0	41.2	50.0	26.9	65.2	38.5	14.5
Core School C	40.0	45.1	40.4	56.4	53.4	53.1	13.1
Control School C	60.0	68.8	48.5	66.3	58.2	64.4	4.4
Core School D	23.9	48.5	30.0	37.7	34.4	44.6	20.7
Control School D	38.7	23.5	23.5	21.9	46.3	36.0	- 2.7
Core School E	7.7	2.9	1.4	4.3	10.6	9.8	2.1
Control School E	10.3	10.1	11.3	6.1	12.7	15.9	5.6
State Average	32.4	38.0	29.1	35.8	41.0	41.5	9.1

Maryland School Performance Assessment Program
for MD CORE and Control Schools, 3rd Grade Science, 1994-1999

SCHOOL	*GRADE 3 - SCIENCE*						*GAINS*
	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*1994 - 1999*
Core School A	21.7	40.0	29.7	15.5	27.6	35.6	13.9
Control School A	6.8	23.7	32.1	44.6	61.4	46.2	39.4
Core School B	66.7	68.0	60.9	90.9	72.1	50.0	-16.7
Control School B	24.0	41.2	65.0	23.1	73.9	34.6	10.6
Core School C	45.0	48.8	43.8	62.8	50.9	55.1	10.1
Control School C	48.8	68.8	59.2	68.3	52.0	52.5	3.7
Core School D	23.9	48.5	28.6	45.9	40.6	43.1	19.2
Control School D	38.7	39.2	32.4	20.3	38.9	21.3	-17.4
Core School E	23.1	10.1	4.1	8.6	10.6	9.8	-13.3
Control School E	10.3	11.6	9.4	10.2	7.3	10.1	-0.2
State Average	34.8	41.1	36.0	38.2	39.4	38.7	3.9

Maryland School Performance Assessment Program
for MD CORE and Control Schools, 3rd Grade Writing, 1994-1999

SCHOOL	*GRADE 3 - WRITING*						*GAINS*
	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*1994 - 1999*
Core School A	30.4	40.0	37.5	32.4	41.4	47.5	17.1
Control School A	18.6	28.8	47.4	47.7	61.4	61.5	42.9
Core School B	50.0	72.0	69.6	86.4	60.5	46.2	-3.8
Control School B	32.0	41.2	60.0	38.5	69.6	53.8	21.8
Core School C	35.0	43.9	58.4	57.4	55.2	69.4	34.4
Control School C	46.3	55.0	47.6	65.4	55.1	64.4	18.1
Core School D	25.4	54.4	35.7	50.8	51.6	46.2	20.8
Control School D	40.3	39.2	41.2	29.7	41.1	44.0	3.7
Core School E	26.2	7.1	10.8	17.1	14.9	25.6	- 0.6
Control School E	15.5	13.0	24.5	10.2	12.7	27.5	12.0
State Average	35.2	39.3	40.9	40.0	46.9	47.1	11.9

Maryland School Performance Assessment Program
for MD CORE and Control Schools, 3rd Grade Language Usage, 1994-1999

SCHOOL	*GRADE 3 - LANGUAGE USAGE*						*GAINS*
	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*1994 - 1999*
Core School A	19.6	28.9	31.3	32.4	32.1	38.6	19.0
Control School A	11.9	35.6	41.0	46.2	61.1	55.6	43.7
Core School B	47.1	62.5	85.7	100.0	77.5	56.0	8.9
Control School B	24.0	41.2	57.9	45.0	61.1	55.0	31
Core School C	43.8	55.1	70.9	60.7	58.3	63.8	20.0
Control School C	52.5	52.5	53.5	71.2	62.6	69.3	16.8
Core School D	28.4	50.0	47.1	60.7	65.6	58.5	30.1
Control School D	45.2	33.3	38.2	34.4	46.5	37.9	-7.3
Core School E	18.5	15.7	8.1	18.6	17.4	27.2	8.7
Control School E	12.1	15.9	28.3	16.3	34.0	24.6	12.5
State Average	34.2	43.0	45.2	49.5	49.4	46.8	12.6

Appendix 5
MSPAP Results for 5th Grade by School, 1994-99

Maryland School Performance Assessment Program for MD CORE and Control Schools, 5th Grade Reading, 1994-1999

SCHOOL	*GRADE 5 - READING*						*GAINS*
	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*1994 - 1999*
Core School A	23.4	37.5	42.9	20.0	31.1	40.4	17.0
Control School A	20.5	22.2	19.1	33.9	31.3	41.3	20.8
Core School B	52.9	16.1	47.6	64.0	38.5	48.0	-4.9
Control School B	50.0	26.1	54.2	38.5	63.2	60.0	10.0
Core School C	35.0	22.7	31.8	51.2	66.7	81.5	46.5
Control School C	56.9	34.9	44.3	38.3	55.4	40.4	-16.5
Core School D	29.8	33.8	31.3	37.8	27.6	36.7	6.9
Control School D	18.6	20.4	30.5	14.7	21.1	22.4	3.8
Core School E	16.7	6.8	1.6	5.9	15.5	6.0	-10.7
Control School E	14.1	4.3	9.4	16.9	27.8	47.1	33.0
State Average	30.2	29.5	33.7	35.6	40.4	41.4	11.2

Maryland School Performance Assessment Program for MD CORE and Control Schools, 5th Grade Mathematics 1994-1999

SCHOOL	*GRADE 5 - MATHEMATICS*						*GAINS*
	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*1994 - 1999*
Core School A	26.0	31.6	40.0	27.1	19.2	28.6	2.6
Control School A	27.3	26.4	25.0	39.0	59.4	46.7	19.4
Core School B	66.7	29.4	60.0	88.9	58.6	65.4	-1.3
Control School B	47.1	34.8	57.7	53.3	75.0	33.3	-13.8
Core School C	47.5	41.2	39.1	69.2	80.8	81.4	33.9
Control School C	67.1	66.1	74.4	62.9	75.7	63.0	-4.1
Core School D	38.1	48.5	45.3	44.6	17.1	48.3	10.2
Control School D	21.4	31.5	30.5	17.6	9.4	14.7	-6.7
Core School E	13.9	11.9	3.2	11.8	6.6	10.5	- 3.4
Control School E	25.4	10.0	17.0	15.3	28.3	31.0	5.6
State Average	42.1	44.7	47.8	48.2	47.9	46.2	4.1

Maryland School Performance Assessment Program

for MD CORE and Control Schools, 5th Grade Social Studies 1994-1999

SCHOOL	*GRADE 5 - SOCIAL STUDIES*						*GAINS*
	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*1994 - 1999*
Core School A	26.0	24.6	48.0	39.6	45.2	38.1	12.1
Control School A	29.5	30.6	38.2	50.8	47.8	45.3	15.8
Core School B	42.9	20.6	52.0	70.4	44.8	61.5	18.6
Control School B	47.1	30.4	50.0	60.0	65.0	50.0	2.9
Core School C	41.3	44.7	42.4	57.1	72.7	80.0	38.7
Control School C	59.8	55	51.1	41.2	62.1	61.1	1.3
Core School D	31.0	44.1	46.9	43.2	34.2	41.7	10.7
Control School D	22.9	29.6	28.8	19.1	25.0	20.6	- 2.3
Core School E	13.9	8.5	6.3	13.2	13.2	5.3	-8.6
Control School E	15.5	12.9	15.1	8.5	30.4	45.2	29.7
State Average	32.7	38.4	42.8	43.7	43.8	43.7	11.0

Maryland School Performance Assessment Program
for MD CORE and Control Schools, 5th Grade Science 1994-1999

SCHOOL	*GRADE 5 - SCIENCE*						*GAINS*
	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*1994 - 1999*
Core School A	20.0	33.3	46.0	37.5	45.2	36.5	16.5
Control School A	27.3	25.0	27.9	45.8	66.7	49.3	22.0
Core School B	57.1	32.4	52.0	74.1	75.9	73.1	16.0
Control School B	41.2	26.1	76.9	66.7	75.0	50.0	8.8
Core School C	51.3	45.9	45.7	67.0	72.7	82.9	31.6
Control School C	61.0	58.7	58.9	53.6	71.8	63.0	2.0
Core School D	26.2	47.1	45.3	31.1	35.5	63.3	37.1
Control School D	22.9	27.8	35.6	11.8	20.3	25.0	2.1
Core School E	19.4	13.6	3.2	8.8	9.2	10.5	-8.9
Control School E	12.7	12.9	18.9	10.2	28.3	47.6	34.9
State Average	38.7	41.2	44.8	46.3	51.6	51.7	13.0

Maryland School Performance Assessment Program for MD CORE and Control Schools, 5th Grade Writing 1994-1999

SCHOOL	*GRADE 5 - WRITING*						*GAINS*
	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*1994 - 1999*
Core School A	24.0	35.1	24.0	22.9	32.9	31.7	7.7
Control School A	20.5	25.0	17.6	32.2	30.4	50.7	30.2
Core School B	47.6	29.4	48.0	55.6	75.9	42.3	-5.3
Control School B	29.4	30.4	61.5	53.3	70.0	50.0	20.6
Core School C	30.0	31.1	32.6	48.4	67.7	61.4	31.4
Control School C	36.6	43.1	50.0	39.2	55.3	39.8	3.2
Core School D	32.1	32.4	37.5	39.2	22.4	40.0	7.9
Control School D	27.1	22.2	39.0	17.6	25.0	27.9	0.8
Core School E	20.8	13.6	14.3	7.4	17.1	3.5	-17.3
Control School E	21.1	8.6	24.5	18.6	26.1	28.6	7.5
State Average	33.2	36.7	42.3	39.3	42.0	38.6	5.4

Maryland School Performance Assessment Program for MD CORE and Control Schools, 5th Grade Language Usage 1994-1999

SCHOOL	*GRADE 5 - LANGUAGE USAGE*						*GAINS*
	1994	*1995*	*1996*	*1997*	*1998*	*1999*	*1994 - 1999*
Core School A	18.0	36.8	32.0	31.3	37.5	25.8	7.8
Control School A	27.3	20.8	20.6	40.7	52.2	50.7	23.4
Core School B	40.0	35.3	65.2	60.0	70.4	83.3	43.3
Control School B	41.2	18.2	66.7	46.2	63.2	33.3	-7.9
Core School C	42.5	46.9	43.2	67.1	74.4	87.3	44.8
Control School C	54.9	51.9	55.7	54.3	63.4	60.6	5.7
Core School D	35.7	48.5	40.6	37.8	54.7	70.0	34.3
Control School D	27.1	22.2	39.0	19.1	41.1	26.7	-0.4
Core School E	29.2	23.7	27.0	7.4	31.5	21.1	-8.1
Control School E	31.0	7.1	34.0	30.5	47.6	35.7	4.7
State Average	35.0	39.6	45.3	46.8	51.4	51.0	16.0