Data Resources:

Achievement C Testing

ACT Newsroom: ACT National and State Scores

http://www.act.org/news/data.html

Advanced Placement Courses and Exams: College Board

Home page http://apcentral.collegeboard.com/members/1,3050,,00.html

State scores

http://apcentral.collegeboard.com/program/research/1,3061,150-160-0-4541,00.html

Achievement C Testing

ACT Newsroom: ACT National and State Scores

http://www.act.org/news/data.html

Colorado Department of Education CSAP Summary Data 1997-2005

http://www.cde.state.co.us/cdeassess/csap/as_latestCSAP.htm

National Aeronautics and Space Administration. (2005). NASA Space Settlement Contest. http://www.nas.nasa.gov/About/Education/SpaceSettlement/Contest/

Appendix

Appendix 1:

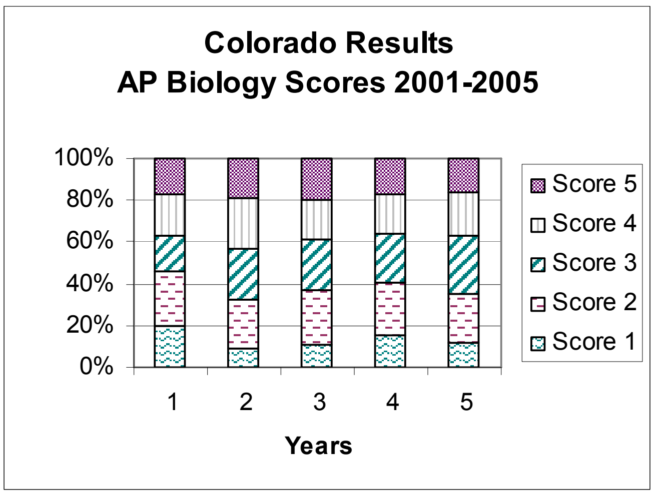
Assessments and Score Patterns in CSAP Results: Mathematics

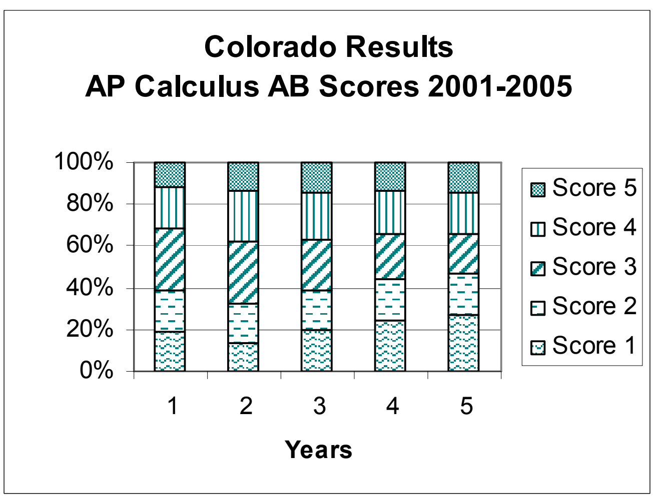
grade/ starting date		5th	6th	7th	8th	9th	10th
2000 8th grade	**p + a**				**35**	**na**	**27**
	p				24	na	24
	a				11		3
2001 8th grade	**p + a**				**39**	**31**	**27**
	p				25	22	23
	a				14	9	4
2002 8th grade	**p + a**				**39**	**31**	**27**
	p				26	23	23
	a				13	8	4
2001 5th grade	**p+a**	**52**	**51**	**41**	**41**	**33**	
	p	35	35	28	25	23	
	a	17	16	13	16	10	
2002 5th grade	**p+a**	**55**	**52**	**42**	**44**		
	p	35	34	27	29		
	a	20	18	15	15		
2003 5th grade	**p + a**	**56**	**53**	**44**			
	p	36	35	28			
	a	20	18	16			
2004 5th grade	**p+a**	**58**	**56**				
	p	36	34				
	a	22	22				
2005 5th grade	**p+a**	**63**					
	p	36					
	a	27					

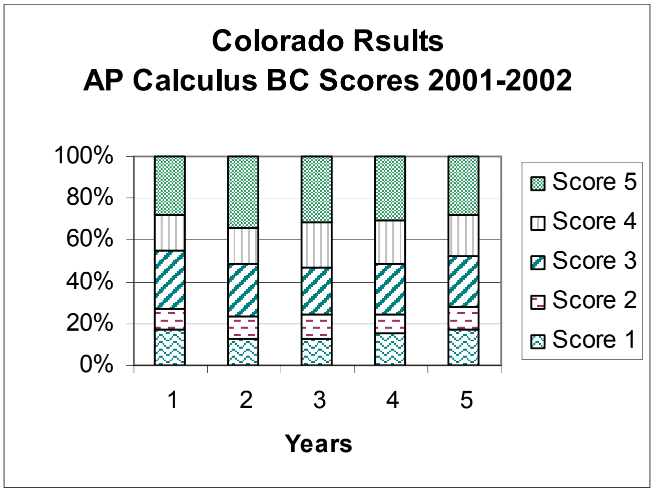
Note: proficient (p) & advanced (a) in percent of students

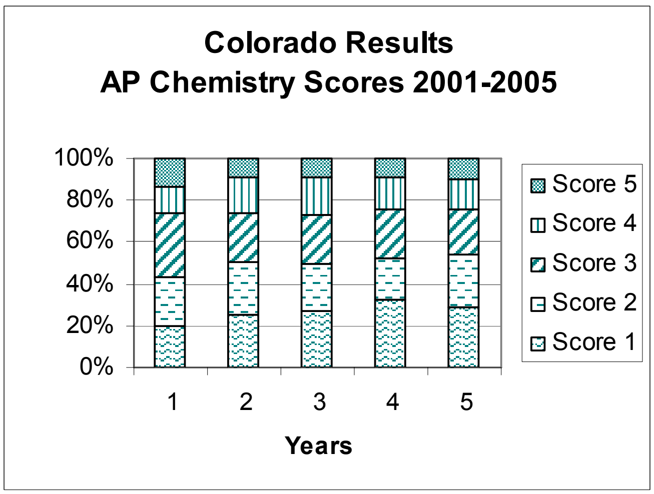
Appendix 2

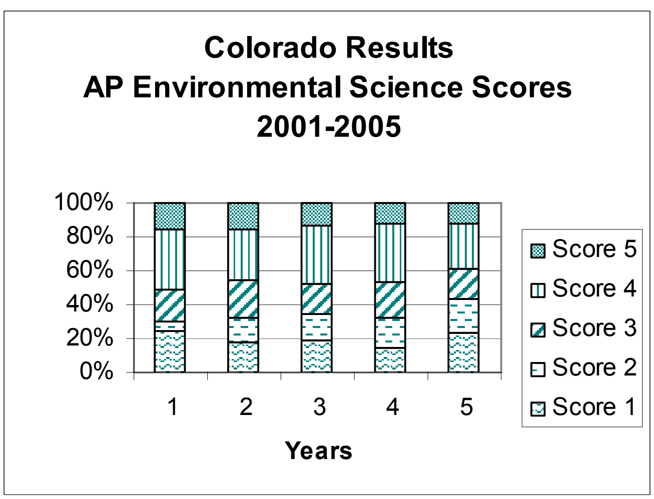
Graphic representation of Advanced Placement (AP) scores earned by Colorado high school students after a year of coursework. The range of the final exam scores is 1 (low) - 5 (high). Depending on the university, credit may be awarded to students who score at the 4 or 5 level. From 2001 to 2005 in the sciences and mathematics exams, 29 percent to 48 percent of the students scored at the 1 or 2 level. This may indicate that these students were neither ready academically for the rigor of the courses nor ready for college level coursework.

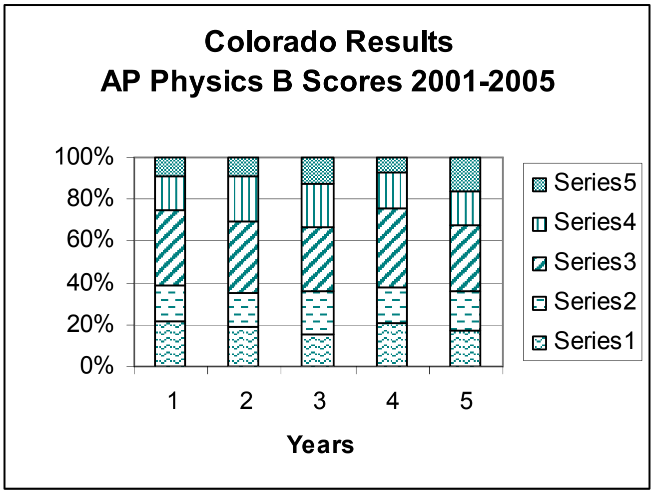


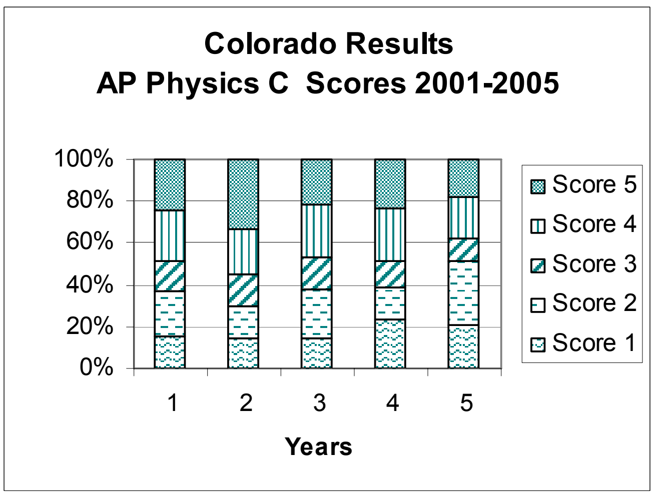


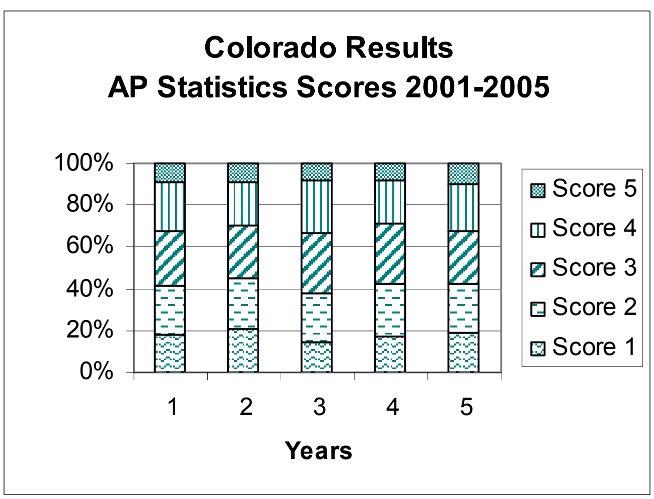

Colorado Rsults
AP Calculus BC Scores 2001-2002
100%
80%
60%
40%
20%
0%
1
2
3
4
5
Years
Score 5
Score 4
Score 3
Score 2
Score 1


Colorado Results
AP Chemistry Scores 2001-2005
100%
80%
60%
40%
20%
0%
1
2
3
4
5
Years
Score 5
Score 4
Score 3
Score 2
Score 1


Colorado Results
AP Environmental Science Scores
2001-2005
100%
80%
60%
40%
20%
0%
1
2
3
4
5
Years
Score 5
Score 4
Score 3
Score 2
Score 1


Colorado Results
AP Physics B Scores 2001-2005
100%
80%
60%
40%
20%
0%
1
2
3
4
5
Years
Series5
Series4
Series3
Series2
Series1


Colorado Results
AP Physics C Scores 2001-2005
100%
80%
60%
40%
20%
0%
1
2
3
4
5
Years
Score 5
Score 4
Score 3
Score 2
Score 1


Colorado Results
AP Statistics Scores 2001-2005
100%
80%
60%
40%
20%
0%
1
2
3
4
5
Years
Score 5
Score 4
Score 3
Score 2
Score 1

RESEARCH REPORT

Fall 2005

Time for a Change:

The Promise of Extended-Time Schools for Promoting Student Achievement

Massachusetts 2020 Education Opportunity

Massachusetts 2020

Massachusetts 2020 is a nonprofit operating foundation with a mission to expand educational and economic opportunities for children and families across Massachusetts. Massachusetts 2020 was founded in 2000 by Chris Gabrieli, a civic and business entrepreneur, and Jennifer Davis, former U.S. Department of Education Deputy Assistant Secretary and Executive Director of the Mayor of Boston's 2:00-to-6:00 After-School Initiative. Over the last five years, Massachusetts 2020 has been a lead partner in launching eight major initiatives, including: Boston's After-School for All Partnership, the largest public/private partnership dedicated to children in Boston's history; the Keeping Kids on Track Statewide Campaign, in partnership with the five largest United Way organizations in Massachusetts; the statewide Middle School Initiative, in partnership with Citizen Schools, the Nellie Mae Education Foundation, the L.G. Balfour Foundation and several other funders; the Transition to Success Pilot, which documented the academic impact of six after-school programs; the School Sites Initiative, expanding after-school programs in 17 Boston schools; the Literacy Coaching Initiative, supporting 40 after-school programs with literacy specialists; and Partners for Student Success, with Boston Public Schools and Boston After School & Beyond, focused on providing children in low performing schools in-school and after-school enrichment and support programs. In 2004, Massachusetts 2020 launched a research and policy effort to restructure public schools to extend their day and year. In 2005, the Massachusetts legislature passed a budget that included funding to support this policy reform.

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Claire Kaplan,
Principal, CEK Strategies

Massachusetts 2020 gratefully acknowledges The L.G. Balfour Foundation, a Bank of America Company, for its support of this research project.

For more information

A copy of this report and its executive summary can be downloaded from Massachusetts 2020's website at www.mass2020.org or can be requested by calling 617-723-6747, ext. 3900.

Massachusetts 2020 Education Opportunity

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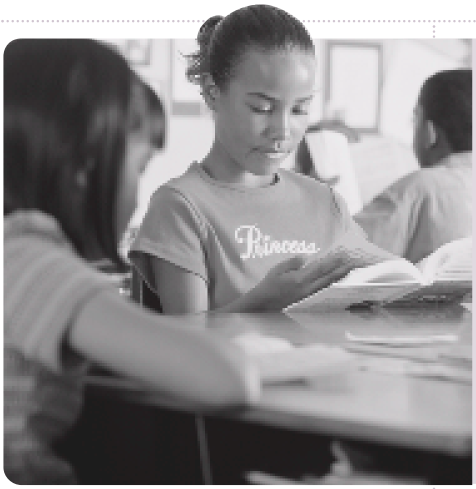


> "**Learning** in America is a prisoner of time. For the past 150 years American Public Schools have held time constant and let learning vary…. The boundaries of student growth are defined by schedules for bells, buses and vacations instead of standards for students and learning."
>
> *— National Education Commission on Time and Learning, 1994*

If we interpret low academic performance of students as primarily the result of ineffective schools, we ignore the fact that only 20% of a child's waking hours are spent in school.

1 | Introduction

WHY DO AMERICAN PUBLIC SCHOOLS OPERATE ON A CALENDAR OF 180 SIX-HOUR DAYS? Few educators would honestly respond that this schedule represents the ideal time needed for all students to achieve high standards. Instead, this calendar is a vestige of a nineteenth-century agrarian economy. It is not designed to meet the educational demands of the Information Age. Despite its irrelevance to the learning needs of today's students, the conventional school schedule is adhered to almost universally across the country. Almost. Some schools have in fact managed to break free from this "prison of time," as the national commission put it so eloquently over a decade ago. Some schools have shown that it is possible to build significantly more time into their days and years for the express purpose of enhancing teaching and learning. They have acted on the insight that in this age of high expectations and rigorous accountability, the decades-old school calendar can no longer accommodate their ambitious mission of ensuring that all students reach proficiency. Most of all, these schools offer some strong examples of exactly how much more can be accomplished when the conventional school schedule is shelved in favor of one that is truly responsive to the needs of students and teachers.

This report details the work of a handful of these "extended-time schools," and describes and analyzes their effective practices. This study is not intended to suggest that extended-time schools automatically produce better results. Neither is it meant to prove that simply by extending time alone, schools will offer a superior educational product. Rather, this research was conducted to understand how these particular schools, which have already demonstrated themselves to be effective, capitalize on the additional time, and what benefits the schools' educators perceive the additional time delivers. It is hoped that their examples are both inspirational and informational for those who seek to operate schools that purposely break from the conventional schedule in order to bring all their students to proficiency.

The Missing Element in School Reform

Since the passage of the Massachusetts Education Reform Act in 1993, this state has been a leader in standards-based education reform. Both its learning standards (curriculum frameworks) and its well-aligned assessment test (MCAS) are considered substantive and sensible.[1] Equally impressive, the funding of districts and schools through the foundation budget formula has made Massachusetts one of the few states in the country where per-pupil spending in the lowest quartile of districts (based on socioeconomic status) actually exceeds per-pupil spending in the highest quartile.[2]

Despite this state's achievements in establishing an exemplary standards-based education system, however, the goal of the system—universal educational proficiency—still appears out of reach. From year to year, MCAS results reveal pronounced socio-economic and racial achievement gaps. The percentage of students scoring "proficient" and "advanced" on the tenth grade math and English language arts 2005 MCAS tests in the most affluent school districts in the state was three times the percentage of students in the poorest districts. The percentage of African-American and Hispanic students who score in the proficient range is roughly one-half to one-quarter the percentage of white and Asian students. These gaps persist in every grade and subject. Beyond the achievement gap among groups of students, universal proficiency at all grade levels seems elusive at best: proficiency rates (with the exception of tenth grade math) have remained essentially flat during the last three years (Figure 1). Federal law now mandates that by 2014 all students must demonstrate proficiency on statewide assessment exams. If Massachusetts stays on its current trajectory, this target—only nine years away—will most likely be missed.

In a state that has pumped billions of new funds into the public school system and has built an excellent model of integrated standards and accountability, why are the schools still not able to lift up all students to high standards of achievement? Part of the failure actually lies in the question itself, because it interprets the low academic performance of students as primarily the result of ineffective schools. In actuality, only 20 percent of a child's waking hours are spent in school today. Surely we cannot expect to fully shape student performance through such a relatively small fraction of students' lives.[4]

Furthermore, contemporary students are expected to know and do much more than students in previous generations were. Yet today's students spend the same number of hours in school as their pre-standards predecessors. The conventional school calendar of 180 six-and-a-half-hour days, a calendar that was designed originally to meet the labor needs of 19th century farmers, has remained unchanged for decades, even while expectations for learning outcomes have risen dramatically. We would never expect a long-distance runner to complete a 10-kilometer race in the same time that she runs a 5-kilometer one, but today's students have essentially been challenged to do just that.

Despite the overriding logic of building more time into students' education, almost no effort has been made to do so. Most observers agree that the spark that set off the education reform revolution around standards and accountability was the 1983 report, "A Nation At Risk," which famously declared that "the educational foundations of our society are presently being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people."[5] Since that report, the educational establishment has implemented four of the report's five principal recommendations, including developing learning standards and holding all students accountable to them. Just one recommendation has received no systemic action or consistent funding: the call for increased learning time (Table 1.)

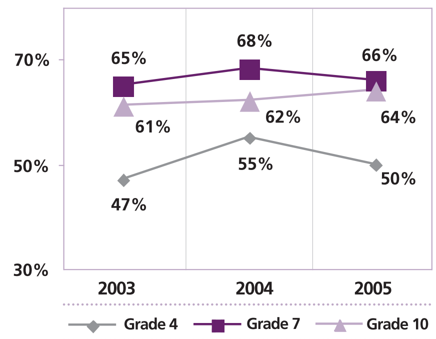
TABLE 1 A Nation At Risk: Then and Now

Recommendations of "A Nation at Risk" (1983)		Current Status of Educational Policy (2005)
#1 Implement rigorous standards	→	✔ Standards in place in 49 of 50 states
#2 Hold high expectations/strengthen accountability		✔ NCLB Act requires testing to state standards; 100 percent proficiency required by 2014
#3 Improve teaching profession	→	✔ Many efforts to improve professional development and teacher education
#4 Strengthen leadership and increase fiscal support	→	✔ Education is a domestic priority; significant funding increases at federal and state levels
#5 Increase learning time by extending school day and/or year	→	✘ School year = 180 days (no change) School day = 61/2 hours (no change)

FIGURE 1
Massachusetts Proficiency Rates

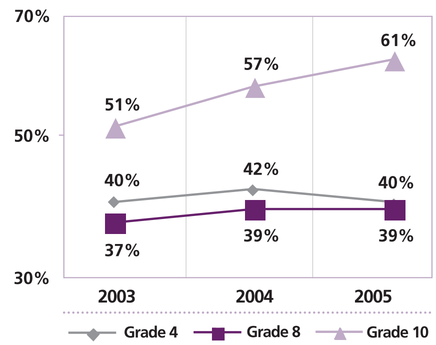
MCAS Scores (English Language Arts)

% Proficient



MCAS Scores (Mathematics)

% Proficient



The call for more learning time in schools is informed by what seems to be common sense: more time equals more learning.

One of the most powerful statements on the need for more learning time comes from Massachusetts's own Time and Learning Commission which in its 1995 report declared, "[I]t has become increasingly obvious that campaigns for higher standards of learning on the one hand, and [calls] for sufficient time to achieve those standards on the other, are wholly interdependent. They stand or fall together.... [O]nly more and better time will provide the teaching and learning needed to open the way for students to reach those standards."[6] Despite such an emphatic affirmation of the singular importance of increased learning time to the success of standards-based education reform, efforts to extend the school day have taken a back seat. With the other four reforms now solidly in place, the final core recommendation of the authors of "A Nation at Risk" must be addressed.

Why Extend Learning Time?

The call for more learning time in schools is informed by what seems to be common sense: more time equals more learning. Adding more time to the school day is not expected to negate the myriad of out-of-school influences on young people's performance in school, such as parenting, poverty, and health. But if more content is to be taught, there must be more time in which to teach it.

In practice, will additional time in school really make a difference in the degree to which all students can achieve proficiency on high standards? Research strongly suggests the answer is yes and that there are five distinct, but mutually reinforcing, means by which more time in school can actually boost learning.

- **MORE TIME ON TASK:** With longer days and, by extension, longer class periods, classroom learning is less rushed. Teachers have the flexibility that enables them to allow students to spend more "time on task," practicing and working with particular information and ideas. The amount of time on task is one of the most basic predictors of student performance.[7]
- **DEPTH AND BREADTH:** With more time, teachers can delve more deeply into subject matter, because they are no longer pressed by the clock to squeeze as much content as possible into a single lesson. Cognitive scientists have found that learning is most likely to endure when students have the opportunity to encounter subject material through a mixture of learning contexts and media. Such contextual variety is more likely to occur when the time is available to engage in several separate, but related and mutually reinforcing, activities.[8]
- **GREATER OPPORTUNITIES FOR PLANNING AND PROFESSIONAL DEVELOPMENT:** A longer day enables schools to build in time reserved for teachers to engage in common planning and on-site professional development, which, research shows, has the greatest impact on teachers' competence and, in turn, on students' proficiency.[9]
- **GREATER OPPORTUNITIES FOR ENRICHMENT AND EXPERIENTIAL LEARNING:** There is growing evidence that with the new mandates of No Child Left Behind (NCLB), subject material in schools is narrowing. In a high-stakes environment, schools often decide they must devote the bulk of their limited time to teaching English language arts and mathematics, the subjects in which their students are required to pass state exams. This reduced focus often acts to squeeze out non-tested subjects, like art, music, or even social science courses. More time, however, usually means that these "extras" can be re-included in the school day. Meanwhile, some research suggests that, in addition to broadening students' knowledge base, these "extras" often serve to better engage students in school and in learning generally.[10]
- **STRONGER ADULT-CHILD RELATIONSHIPS:** More time allows for greater interaction between teacher and student. A long history of quantitative and qualitative research demonstrates that the teacher-child relationship stands at the core of learning. Deepened relationships, not surprisingly, generally promote higher academic achievement.[11]

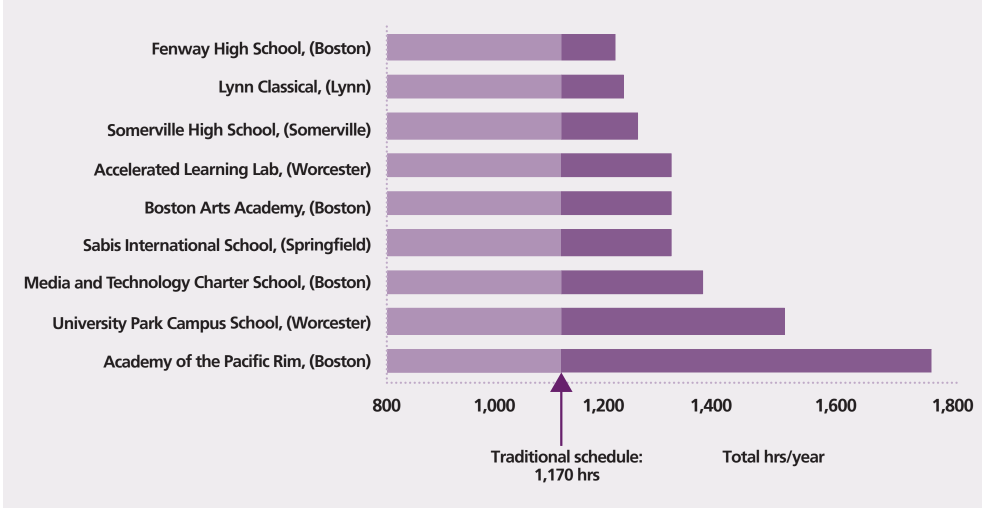
A growing number of charter schools and other innovative educational institutions have taken to heart these five benefits of extending school time. In Massachusetts, for instance, 82 percent of the 48 charter schools in operation during the 2003–2004 school year maintained a school week longer than the traditional 32.5 hours. About 50 percent maintained a school calendar longer than the typical 180 days. At the renowned KIPP Academies, a network of 45 middle schools throughout the country, students spend approximately 60 percent more time in school than students at conventional middle schools. In Boston and Worcester many pilot schools and a smattering of entrepreneurial district schools have also found ways to extend learning time for a substantial number, if not all, of their students.

Leaders in these schools place an unwavering priority on expanding learning time. They find ways to stretch resources and reorganize their schools to offer that time. With or without knowing it, each of these schools has put into practice the Massachusetts Time and Learning Commission's recommendation that "learning must be the constant, the fixed and unchanging goal, and time the variable that serves it."[12]

Both evidence and logic suggest that these extended-time schools have it right. In 2003, the Rennie Center for Education Research and Policy published a report called "Head of the Class: Characteristics of Higher Performing Urban High Schools in Massachusetts," which identified the nine highest-performing urban high schools in the state. While these schools are effective for a variety of reasons, it seems no coincidence that each one extends the total amount of time per year beyond the conventional schedule of 1,170 hours per year. (Figure 2.)

...unless and until policymakers and educators commit to making more learning time available, it seems inevitable that the vision of universal proficiency will remain out of reach.

FIGURE 2 Instructional Time in Higher-Performing Urban High Schools*



**All operational hours data were collected by Massachusetts 2020 from schools' reported schedules for SY 2002-03. Note that due to budget cuts at the district level, University Park no longer operates on extended hours.*

Of course, simply adding time to the schedule of any school, without having other significant elements in place, is unlikely to result in sizeable improvements in student performance. Time is not the driver of success; rather, it is a resource that educators can tap to make their work more effective. Visionary principals, talented teachers, committed parents, the consistent use of rigorous data and assessment tools, and the teaching of rich educational content, all tend to be more effective when more time is available.

Massachusetts has taken great strides to enable today's public school students, especially those who are academically at-risk, to achieve at the high levels expected of them and to receive a well-rounded, enriching education that equips them with 21st century skills and knowledge. But because time is so central to the learning equation, unless and until policymakers and educators commit to make more learning time available, the vision of universal proficiency that the state has set forth will remain out of reach.

Research Project

Extending the school day and year is not easy. The conventional calendar remains one of the most intractable features of the American educational system. Altering the traditional school schedule has significant ramifications for parents, students, teachers, and school administrators. This reform impacts student and family schedules, transportation arrangements, teacher compensation, pedagogy and curriculum, and other issues.

This research project was fundamentally designed to understand how these challenges can be overcome by studying schools that have actually overcome them. How are schools able to implement a change of such magnitude in effective and sustainable ways? To provide insight on this question, Massachusetts 2020, with support from The L.G. Balfour Foundation, a Bank of America Company, engaged in a year-long study of extended-time schools to consider the range of issues that these schools have had to deal with in breaking with the conventional school calendar.

To determine which schools would be most fitting for this research project and to limit the number to a manageable research sample size, we first defined an extended-time school as any school that requires all its enrolled students to attend school for at least 15 percent more hours than do schools in the district with a conventional schedule. We then developed a basic filter to identify those public elementary and middle schools in Massachusetts and in nearby states that would provide us the most valuable data sources. We decided that schools worth exploring should meet the following criteria:

- More than 50 percent of the student body qualified for free or reduced lunch
- Located in a city with population greater than 50,000
- Incorporated unique approaches to using additional time
- Showed positive learning outcomes

We selected seven schools that represented different types (district, charter, and pilot[13]), grades served, and locations (Table 2.) We also decided to examine on a more minimal basis an eighth school, University Park Campus School, which is no longer an extended-time school but had successfully operated as an extended-time school for its first six years.[14] The final research cohort was narrowed down from a list of about a dozen possible choices. Because of funding and other issues, Massachusetts 2020 decided to visit eight of the schools, with preference given to those located in Massachusetts.

TABLE 2 Names and Characteristics of Profiled Schools

School Name	Location	School Type	Grades Served (Enrollment)	Total Hours Per Year (% more than district)	% Free and Reduced Lunch
Community Day Charter School	Lawrence, MA	Commonwealth Charter	K-8 (306)	1,480 (28%)	68%
KIPP Academy of Lynn	Lynn, MA	Commonwealth Charter	5-8* (75)	1,870 (60%)	87%
KIPP Academy New York	Bronx, NY	New York City Charter	5-8 (250)	1,870 (58%)	95%
Murphy School	Boston, MA	District	K-8 (951)	1,605 (45%) **	69%
Roxbury Preparatory Charter School	Boston, MA	Commonwealth Charter	6-8 (190)	1,592 (43%)	67%
Timilty Middle School	Boston, MA	District	6-8 (661)	1,281 (15%)	83%
University Park Campus School	Worcester, MA	District	7-12 (220)	1,440 (22%) ***	73%
Young Achievers Science and Mathematics Pilot School	Boston, MA	Citywide District Pilot	K-8 (296)	1,446 (30%)	64%

**School opened in September 2004 and at the time of the site visit served only fifth graders. The school has plans to add one grade each year over the next three years. **The Murphy School does not technically fit our definition of an extended-time school because not all children are required to attend for a longer day, but one third of school population (307 students) participates in a school-run extended-day program. Hours shown are for students enrolled in the extended-day program. ***Hours shown are based on the school's schedule when University Park operated as an extended-time school.*

At each of these schools, the Massachusetts 2020 research team conducted a one- or two-day site visit, which included class observations, interviews, and focus groups with a wide variety of stakeholders (administrators, teachers, students, and parents). The data collected from these visits and from follow-up communications focused on six core questions:

A. How does the school use the additional time (i.e., structure its schedule for students) and how are the needs of students and teachers addressed through the schedule design?

B. How does the academic program capitalize on the extended time and what are the outcomes in student learning?

C. How does the additional time affect staffing (e.g., teacher schedules, pay, recruitment, job expectations, etc.)?

D. What are the added costs associated with the extended time and how are revenues generated to cover these additional costs?

E. What are the reactions of students, teachers, and parents to the non-traditional school schedule?

F. What other factors, in addition to extended learning time, contribute to the school's effectiveness?

Rather than present individual case studies of each of these schools, we have organized this report into subject areas that respond to these questions. We have drawn upon data from each school to develop a cross-sectional analysis of the successes and challenges of these eight extended time schools, with the chapters arranged in the following order: (a) student schedules; (b) learning outcomes; (c) staffing; (d) finances; (e) stakeholder reactions; and (f) other characteristics of successful schools.

Altering the traditional school schedule has significant ramifications for parents, students, teachers, and school administrators.

Regardless of the specific scheduling approach, the additional hours generally translate into greater academic support for all students and a greater variety of enrichment activities.

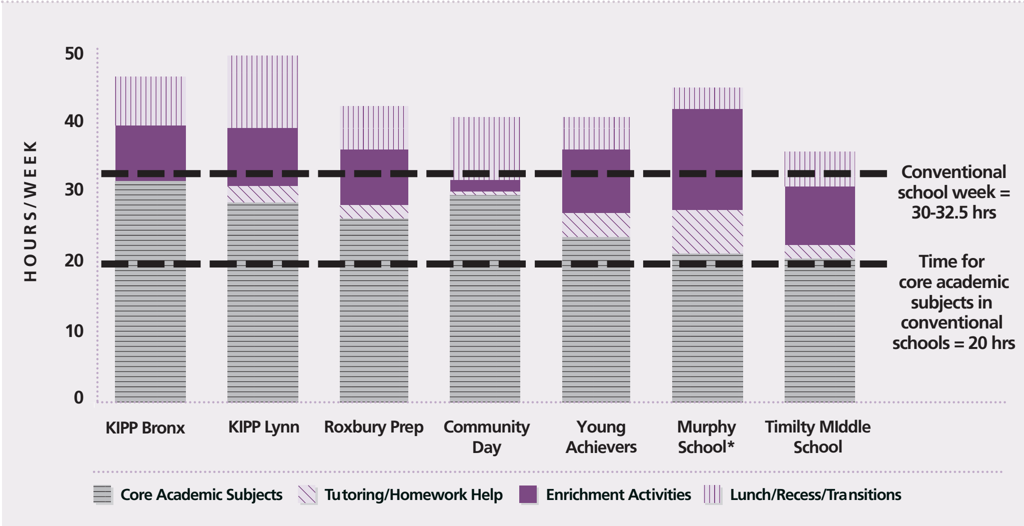
2 | Scheduling: How Extended-Time Schools Use Additional Time

Students at the extended-time schools profiled spend 15-60 percent more time in school than do their counterparts at traditional schools. Not including the additional summer or weekend programming that takes place at some of these schools, students attend school for an additional 6-20 hours per week. The schools examined for this project use this time to incorporate a mixture of the following into their schedule:

- Longer class periods for core academic subjects
- Extra class periods of math and/or English
- Professional development and planning
- Extracurricular and enrichment activities
- Tutoring and homework help
- Community-building activities and events

Regardless of the specific scheduling approach, the additional hours generally translate into greater academic support for all students and a greater variety of enrichment activities. Figure 3 below shows how the schedules of seven of the profiled schools break down into four basic categories (core academics, enrichment, tutoring, and transitions/lunch). It is followed by further detail on several schools' approaches to scheduling.

FIGURE 3 Use of Time at Extended-Time Schools



Notes: Totals based on sixth grade schedules at all schools except KIPP Academy Lynn, which, at the time of this study, served only fifth grade. Core academic subjects include: math, English language arts, science, social studies, and foreign languages (if they are a required part of the curriculum). Enrichment, electives, and other activities include: art, PE, music, dance, clubs, computers, advisory/homeroom, foreign languages (if they are offered as an elective), and other school-wide community-building activities. For the Murphy School the schedule of students in the extended-day program is shown. Though not shown here, most schools also offer optional after-school, Saturday, and summer programming.

Longer class periods for core academic subjects

Many schools use the additional time in the school day to schedule longer class periods. In the typical middle school, for example, when students have different teachers for each subject, the class period lasts about 50 minutes. Many teachers and administrators in these extended-time schools believe 50-minute class periods are too short to cover the required material, answer all student questions, and ensure that students fully grasp the concepts presented. They therefore lengthen their classes to

90 or even 120 minutes. In some cases, only math and English classes are lengthened, while in others, all subjects are allotted more time each day. When the University Park Campus School in Worcester, Massachusetts functioned as an extended-time school from 1997 to 2003, its academic schedule included 90-minute class periods for all core academic subjects. Teachers used these 90-minute class periods to incorporate more project-based learning, allow more time for practicing key skills, and cover material in greater depth. For University Park, the principal reason for adopting a longer school day was, in fact, to allow for these longer class periods.

Teachers point out that although longer class periods can be very beneficial, teachers do need to rethink how they plan for and organize the class period. Longer class periods require teachers to adjust their curriculum and lesson plans. Most schools have found it necessary to provide additional professional development and planning opportunities for teachers so that they can learn how to take full advantage of the longer blocks of time.

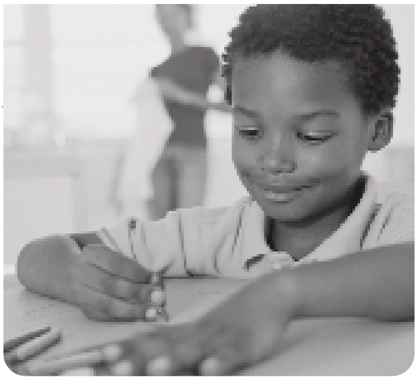
Extra class periods of math and/or English

Under pressure to improve student performance in English and math and to meet rigorous state standards, many extended-time schools offer extra classes in these two core subjects. At Roxbury Preparatory Charter School, for example, every student takes two 50-minute math classes and two 50-minute English classes daily, with the content of each class varying somewhat. In English, for example, one class concentrates primarily on reading, while the other focuses primarily on writing and grammar. The two classes are closely connected and the two individual teachers work together to plan curricula, but the double class structure ensures that students get practice every day in both reading and writing. Similarly, the double math classes at Roxbury Prep allow teachers to cover more material and give students more time to practice basic math skills. One math period centers on math procedures, skills, and operations, while the other addresses problem-solving and the real-world application of math skills. Like students at Roxbury Prep, students at KIPP Academy New York, KIPP Academy Lynn, and Community Day Charter School spend a full two hours a day on English and two hours a day on math, although, unlike at Roxbury Prep, these students generally have the same teacher for the full two-hour block. At Young Achievers, the English class has been transformed into a two-hour Humanities class for upper-grade students. The class combines the curricula of English language arts with the social sciences by building skills learned in English—reading comprehension, writing and communication—and applying them to the social studies curriculum.

In addition to requiring extra class periods of math and English, some schools designate a short period of time each day, often 20-30 minutes, for students to practice core skills in these two areas. For example, the Timilty Middle School and Roxbury Preparatory Charter School have adopted a program called Drop Everything and Read (DEAR) which requires students to spend time reading independently each day. This practice flows from research that highlights the importance of daily silent reading in improving student's literacy skills. Similarly, KIPP Academy New York has students begin the day with a special "Thinking Skills" period. During this 20-minute period, students work to solve a specific problem (usually a math problem) that requires them to think through and process numerous pieces of information. The purpose of these exercises is to improve student's analytical, problem-solving, and critical thinking skills.

While many schools without extended schedules offer more time for math and/or English language arts, they often do so by cutting time spent on other core academic subjects and enrichment activities. Extended-time schools are able to offer extra support in these key subject areas without sacrificing time allotted for other classes.

Most schools have found it necessary to provide additional professional development and planning opportunities for teachers so that they can learn how to take full advantage of the longer blocks of time.



While many schools without extended schedules offer more time for math and/or English language arts, they often do so by cutting time spent on other core academic subjects and enrichment activities.

Professional development and planning

Some schools also take advantage of additional time to allow more opportunity for professional development and planning. Three schools—Timilty Middle School, Young Achievers Science and Mathematics Pilot School, and Roxbury Preparatory Charter School—structure the weekly schedule around a longer school day for students Mondays through Thursdays, but operate an abbreviated day for students on Fridays. This arrangement leaves teachers a solid two- to three-hour time block in which to participate all together in professional development and curriculum-planning sessions.

At the Timilty Middle School, students are dismissed at 11:50 a.m. on Fridays. Teachers remain at school until 2:00 p.m. to participate in a collaborative professional development session with other teachers in the same subject area. Science teachers, for example, have dedicated time to review the alignment between state standards and each segment of their own curriculum to ensure proper pacing. Math teachers, meanwhile, have learned about technology applications for teaching middle school math. Similarly, at Young Achievers, teachers gather for planning and professional development from 1:30 p.m. to 4:00 p.m. on Fridays. During the first half hour teachers and other staff participate in a school-wide staff meeting, while the last two hours are reserved for teachers to meet in teams either by grade level or subject to plan and discuss curriculum.

At Roxbury Prep, teachers participate on Fridays in three different meetings from 2:00 p.m. to 5:00 p.m. For the first hour, teachers meet by discipline in what the school calls "inquiry groups." These groups focus on a specific topic each week. Topics are identified by the groups themselves and are intended to enhance teaching. Each week one or two teachers presents to the group about a possible teaching strategy or class activity and then leads a group discussion. The goal of these sessions is to develop teaching skills by examining a range of strategies for teaching specific types of material. The co-director responsible for curriculum development works closely with the group leaders each week to help plan the session. During the second hour, teachers meet in grade-level teams to talk about the progress (or struggles) of particular students and other issues affecting their classes. In the last hour, all the teachers come together to discuss school-wide issues. Teachers at Roxbury Prep find this time on Friday afternoons highly productive and feel strongly that it helps them to hone their craft.

Of course, the drawback to these Friday afternoon sessions is that students are not in school during this time. The schools do, however, make an effort to help families identify alternative programming for these afternoons. For example, when Young Achievers first changed its schedule to include early dismissal on Fridays, the school conducted a needs assessment of all families to find out what resources and supports families would require. Based on the response, the school found community centers that could offer Friday-only after-school care for the parents who wanted it, and established a formal connection with four different agencies to provide this care. Administrators also worked with the Boston Public Schools' transportation department to bus students directly to the sites on Friday afternoons.

Extracurricular and enrichment activities

As Figure 3 (page 10) shows, much of the extended-time (i.e., those hours that exceed the traditional 30 to 32.5-hour school week) is devoted to enrichment activities such as dance, drama, art, sports, apprenticeships, foreign languages, and experiential learning. Principals, parents and students alike believe that one of the advantages of an extended-time school is the wide range of activities that can be offered without compromising time spent on core academic subjects. These schools average roughly nine hours per week of enrichment programming compared to approximately four hours per week at most schools.

Some schools have chosen to concentrate on one specific extracurricular activity instead of offering a broad range of activities. For instance, KIPP Academy New York, which focuses on music, requires all students to participate in the school's string and rhythm orchestra. Other schools, like Young Achievers and the Murphy School, offer students a broad range of enrichment activities, from music lessons to engineering projects to chess, and often partner with community organizations or institutions of higher education to deliver these specialized activities. These schools tend to focus more on exposing students to many different enrichment areas and helping them to identify their own skills and interests over time. Table 3 shows the wide variety of extracurricular activities that take place during the school day at extended-time schools.

TABLE 3 Activities, Electives, and Enrichment at Extended-Time Schools

School	Middle School Weekly Activity Schedule
Community Day Charter School	• Students have two 50-minute PE classes • Students may elect to take instrument lessons during their daily recess
KIPP Academy New York	• 5th grade: two periods of PE, two periods of music, and two periods of electives (choices include sports, technology, art, and African dance) • 6th-8th grade: Orchestra four days per week for a total of 8-10 hours.
KIPP Academy Lynn	• Two 90-minute periods of "Challenge," a PE class that is focused on team building and goal setting • Four 60-minute elective periods (choices include step class, chess, basketball, art, and chorus)
*Murphy K-8 School**	• Two periods of PE, two periods art/music, and two periods of computers/research • 8-15 hours of electives (choices include instrumental music, computer lab, yoga, dance, an engineering program called "Destination Imagination", crochet, swimming, and French.)*
Roxbury Prep	• Two 50-minute PE classes and two 50-minute computer classes • Four 50-minute elective periods (choices include art, drama, engineering design, computer web design, Tae Kwon Do, world dance, knitting, instrumental music, soccer, basketball, softball, and field hockey.)
Timilty Middle School	• Eight 50-minute periods of electives (students chose two of the following each semester: art, dance, theater, Japanese, Chinese, or PE)
Young Achievers Science & Mathematics Pilot School	• One 45-minute PE class and one 60-minute art class • Approximately 4.25 hours of electives (choices include: hip hop/Latin dance, drumming, woodworking, chess, theater, introduction to photography, music technology, basketball, soccer, swimming, and golf)

**The Murphy School is an exception. Electives described take place during the extended-day program.*

A Unique Tutoring Model: Media and Technology Charter High School

The Media and Technology Charter High School (MATCH), an extended-time school in Boston, has incorporated an extensive tutoring program into its educational model. The 180 students at MATCH receive one-on-one or one-on-two tutoring from a designated tutor for at least 400 hours per year. In past years, MATCH hired work-study students from local colleges to provide this tutoring, but in 2004 MATCH stepped up its tutoring program by creating MATCH Corps. MATCH Corps is comprised of 45 recent college graduates hired to work full time at MATCH for one year, providing intensive tutoring to students. MATCH Corps tutors receive a monthly stipend of $600 and a free room in a dormitory built on the top floor of the school building, which MATCH owns.

MATCH Corps tutors are integrated tightly into the school. Tutors receive approximately 150 hours of training before school begins and work closely with teachers to plan for tutoring sessions. Teachers observe tutoring sessions daily to ensure that time is being used productively. MATCH Executive Director Alan Safran explains that the tutoring program has tremendous benefits. Because nearly all students enter MATCH below grade level in core subjects, the individual tutoring is essential to help them first catch up and then master new material. As recent college graduates, the tutors also become good mentors and role models for the high school students, who aspire to complete college themselves. Each tutor is assigned to only four students in the school and remains with these four students throughout the year, thus allowing tutors and students to forge strong relationships. Tutors then rely on this relationship to push their students to do their work and to persevere in this challenging, AP-for-All high school.

At each school, the weekly schedule has evolved over time to address the specific needs of its students and each school continuously revisits the schedule to ensure that it supports the school's overall goals.

Community-building activities and events

Some schools also take advantage of additional hours by convening special community-building activities and events. For example, many schools hold special whole-school meetings on Fridays. These meetings are designed to strengthen the sense of community within the school and to reinforce specific school values. Each Friday afternoon, Roxbury Prep ends the week with a 40-minute community meeting. The meeting is essentially student-run, though teachers and administrators help to organize it. A central event of the meeting is the awarding of the school's "spirit stick" to one deserving student. The winner of the "spirit stick" is selected by teachers based on his or her behavior and effort during that week. The meeting also features student presentations on academic lessons (e.g. poetry readings, science experiments, etc.), recommended books for independent reading, and skills learned through enrichment classes (e.g., songs, dances, art exhibits, drum performances, etc.).

Young Achievers also holds a 40-minute community meeting on Fridays where students share both positive and negative experiences they had during the week, make presentations on what they learned in class, and discuss various school issues. KIPP Academy Lynn ends its Fridays with a one-hour school-wide meeting called "Songfest." At Songfest, students compete in short academic contests to answer questions about material covered during the week. Songfest also includes 10-15 minutes of "shout-outs," an opportunity for students and teachers to briefly acknowledge someone at the school for something they did during the week. The meeting concludes with 15-20 minutes of songs based on academic material (such as social studies lessons, multiplication tables, science concepts, etc.) that students have learned in class. According to school founder and director Josh Zoia, "Songfest is an opportunity to end the week on a very positive note and to build school spirit. It is one of the things that makes kids love attending KIPP Academy Lynn despite the additional homework and longer school days."

The schedules analyzed for this report are hardly static. At each school, the weekly schedule has evolved over time to address the specific needs of its students and each school continuously revisits the schedule to ensure that it supports the school's overall goals. Schools agree that there is no magic amount of time. The schedules they develop must balance the available resources, student needs, and teacher capacity. At the same time, they do approach scheduling with a basic understanding that their schedules need to be developed around their learning goals, rather than starting with a fixed schedule and squeezing learning time into it. The result is that while each school uses the time in its school day differently, the teachers and administrators believe that it is the time over and above the conventional 180 six-and-a-half-hour days that results in more learning and higher achievement. The next section explores just how more time can impact student learning.

3 | Impact of More Time On Learning

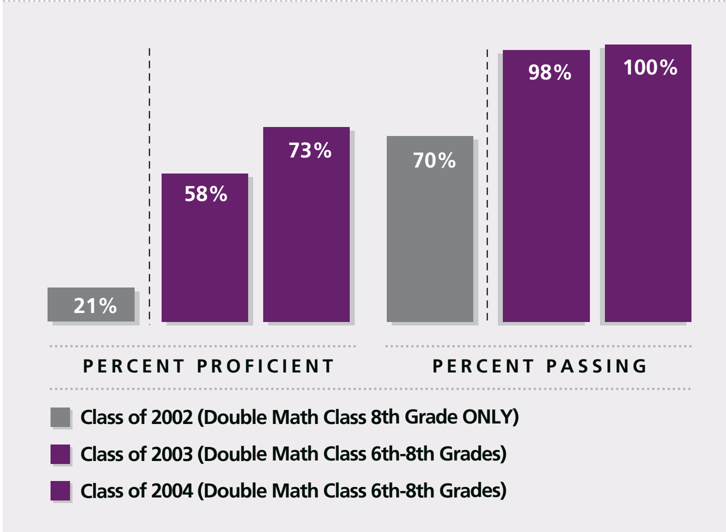
School leaders and policymakers who are considering adopting a longer school day are eager to understand how additional time translates into higher academic achievement. The extended-time schools examined through this research provide important answers to this central question. Classroom observations, and interviews with school leaders and teachers, revealed five key ways that additional time, if structured effectively, can promote student learning and achievement:

1. Increased "time on task"
2. Broader and deeper coverage of curriculum
3. More opportunities for experiential learning
4. Greater ability to work with diverse ability levels simultaneously
5. Deepened adult-child relationships

Increased time on task

Teachers at all of the schools examined through this research consider the additional time they have with students absolutely essential to helping students master the required material. Whether through extra classes, longer class periods, or individual tutoring sessions, students at these schools spend more time actively learning.

FIGURE 4 **The Impact of Double Math on Student Outcomes**
Percent of Roxbury Prep Students Achieving Proficiency and Passing 8th Grade Math MCAS *By Participation in Double Math Class*



Many teachers interviewed for this study felt strongly that one 50-minute math period per day, for example, is too little time both to provide remediation for students who enter the school behind grade level and to help students master the current year's curriculum. Teachers said that more time is required for all students to reach understanding, especially when new concepts are introduced. Further, students need time to practice what they have learned and to explore materials in different contexts before they can attain proficiency. At Community Day Charter School, teachers explained that with longer classes, if students are not grasping the concepts, teachers can back up a step or two and find different ways to approach the same material. Longer blocks of time also offer more opportunity for students to work on projects. "Generally the teaching quality is higher because we can build in more connections," explained one teacher.

School co-director Josh Phillips of Roxbury Prep points to quantitative evidence (Figure 4) that shows the effects on students in his school of spending additional time on math. Currently, Roxbury Prep students take two periods of math daily. However, students in Roxbury Prep's first graduating class (Class of 2002) did not have double math classes until their eighth grade year. In a comparison of test scores of this first class to the test scores of the class of 2003, which had had double math periods for all three years, 37 percent more students in the class of 2003 scored at the proficient level on the eighth grade math MCAS. This progress continued with the class of 2004, which had also participated in double math classes for all three years, and which had

Schools agree that there is no magic amount of time. The schedules they develop must balance the available resources, student needs, and teacher capacity.

"For a science teacher [longer classes] are a dream come true. You can do lots of labs. Now, [with the shorter class periods] it takes three days to complete a lab that we could have completed in one class."

— Teacher at University Park

52 percent more students scoring proficient than had the class of 2002. In addition, almost all students in the classes of 2003 and 2004 passed the eighth grade math MCAS, while only 70 percent of the students in the class of 2002 had passed the test. The dramatic improvement in test scores solidly affirmed Roxbury Prep's decision to require double math classes for all students and suggests that the pedagogical premise upon which this decision was based—more time equals more learning—is legitimate.

Longer class periods are particularly useful in science, because they allow time for labs and experiments to be completed in a single session. These time-consuming hands-on activities allow students to experience a concrete application of concepts being studied, to formulate and test hypotheses, and to become more deeply engaged in learning. The very existence of labs implies having time to set up and clean up. Moreover, for students to extract meaning from the lab, a teacher needs time to draw connections between the lab and the material he or she is teaching. A science teacher at University Park in Worcester explained, "For a science teacher [longer classes] are a dream come true. You can do lots of labs. Now, [with the shorter class periods] it takes three days to complete a lab that we could have completed in one class."

In schools that offer specialized tutoring sessions, students also spend more time on task. Teachers explain that these sessions are vital when students come into school behind grade level, especially if they are English-language learners and/or do not have access to adequate educational supports at home. In these cases, teachers explained that the opportunity to work individually or in small groups with students outside the classroom is one of the greatest benefits of the longer school day. At Roxbury Prep, teachers indicated that this tutoring is especially important because in the fast-paced atmosphere of the classrooms, teachers are not always able to address the needs of each individual student in class. Regular and designated times for tutoring, however, enable teachers to more effectively pinpoint material that is unclear to students and to help them work through it. The fact that most students enter the school scoring well below grade level on standardized tests suggests that such individualized attention is needed broadly.[15] The school has structured its eight-hour day to include more windows of time during which this individual tutoring can take place.

Broader and deeper coverage of curriculum

Another critical benefit of additional learning time is that teachers can use the time to cover material in greater depth and thus provide more context for what students are learning. Science and social studies teachers, in particular, explained that the extra time allows them to spend more time exploring the material. Students can ask more questions and the teacher can follow the students' interests by delving into more detail on specific topics. For example, when a particular event in history sparks students' interests, teachers can feed that interest by talking more in-depth about the topic and having students investigate further. "There is less pressure to move on to the next lesson," explained one teacher at the Timilty School. A teacher at University Park, a school which no longer has an extended-time schedule due to budget constraints, spoke wistfully about the years when she taught 90-minute classes. "The amount of material I could get through was amazing. You could introduce a concept, introduce primary sources to study it, have kids explore it in a group, and then come back and discuss the subject more in detail."

With more time, teachers also feel they do not have to make as many tough choices about what to cover in their classes. For example, some English teachers who had taught in schools with a conventional schedule expressed the frustration they often felt when they were forced to choose between reading and writing/grammar in their classes there. Teachers knew it was important to cover all of these areas each day, but there was no way to accomplish this within one 50-minute period.

More opportunities for experiential learning and enrichment programming

Many studies have shown that consistently attending after-school enrichment programs can decrease the academic achievement gap, especially among children from lower socioeconomic levels.[16] In addition, these activities help build 21st century skills and help prepare students for success in college and in the workforce. As author Richard Rothstein puts it, "The [academic] advantage that middle-class children gain after school and in the summer likely comes mostly from the self-confidence they acquire and the awareness they develop of the world outside their homes and immediate communities, from organized athletics, dance, drama, museum visits, recreational reading, and other activities that develop their inquisitiveness, creativity, self-discipline, and organizational skills."[17]

Many extended-time schools recognize the importance of these types of extracurricular and enrichment activities and devote a significant portion of the day to them. For example, at Young Achievers Science and Mathematics Pilot School, eighth graders participate in a community activism internship to complete their graduation requirement. This weekly, six-month internship involves students in community-development projects in order to demonstrate to students how they can apply their science, math, and technology skills to bring positive changes to their communities. At their placement at the Dudley Street Neighborhood Initiative, for instance, students developed a youth newsletter to inform their peers about land use issues in the Dudley Square neighborhood. Others worked with Habitat for Humanity staff to create ways for the children of families striving to own a home to become involved in that process. Young Achievers has also developed a wide number of partnerships with other organizations to furnish students with many experiential educational opportunities. Classes take frequent field trips with an educational focus—field trips that are only possible because of the extra time in school. For instance, fifth graders worked with the Roxbury-based organization Alternatives for Community and Environment (ACE) on a study linking pollution and asthma rates, and created public service announcements for local television programs. In addition, many classroom curricula incorporate environmental studies using the urban wilds located near the school.

But these activities are not self-contained. At Young Achievers, teachers often try to connect enrichment activities to core academic subjects. For example, students, who in their social studies class are studying slavery and the Underground Railroad are learning in art class about special quilt designs that were used during the Underground Railroad as a form of secret communication to runaway slaves. The designing of patterns also draws upon the skills they have gained through geometry class. The curricula are linked in order to help reinforce the lessons of each individual subject and to engage students more deeply. All elementary school students also take an African drumming class once or twice per week. The drumming teacher coordinates lessons with other teachers to include references to math, social studies, and English. Teachers argue that the drumming curriculum has a specific educational purpose and offers students a different point of entry into the curriculum.

At the Timilty School, all students are required to submit a project to the citywide science fair. At most Boston public schools, these projects are optional, and only a small fraction of the school's students choose to participate. The Timilty School faculty believes, however, that these hands-on projects offer critical learning opportunities that engage students more deeply in the science curriculum, and build skills, confidence, and knowledge. Thus, students spend time in science class planning the projects and exploring the concepts they are trying to demonstrate.

"I have students who are applying to college and come back here to middle school for recommendations. In many cases the students don't find teachers or other adults at their high schools who know them as well as we do."

— Teacher at Timilty Middle School

Academic Performance of Profiled Schools

Students at the extended-time schools profiled for this report generally out-perform students of comparable socioeconomic status at traditional public schools in their district.

For example, Figure 5 shows that, generally, the percentage of students achieving proficiency on MCAS at the four extended-time schools in Boston is higher than the percentage of students achieving proficiency throughout the district. This difference is even more dramatic in a similar comparison of students at Community Day Charter School to students attending the Lawrence Public Schools (Figure 6).

FIGURE 5 **Percent of Free and Reduced Lunch Students Achieving Proficiency on 2004 MCAS** *In Boston: Profiled Schools vs. District*

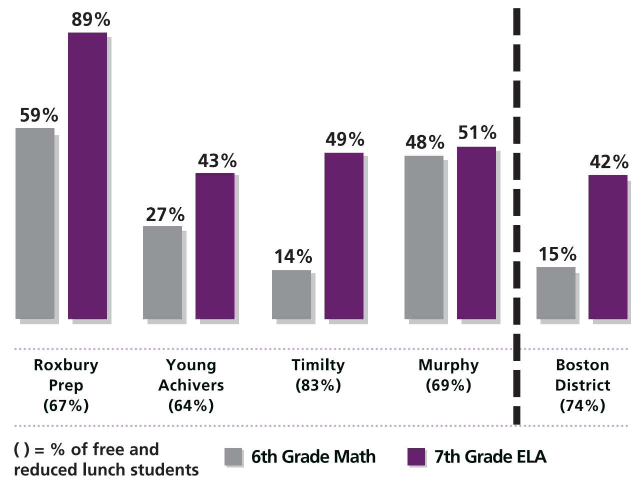


FIGURE 6 **Percent of Free and Reduced Lunch Students Achieving Proficiency on 2004 MCAS** *In Lawrence: Profiled School vs. District*

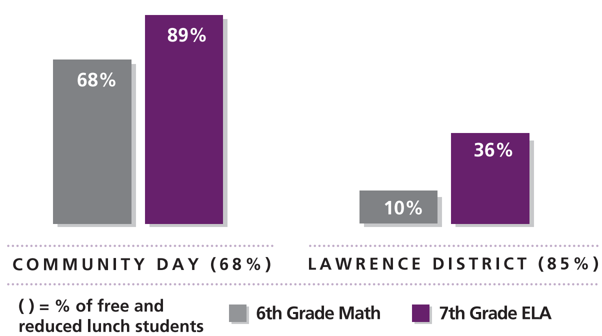
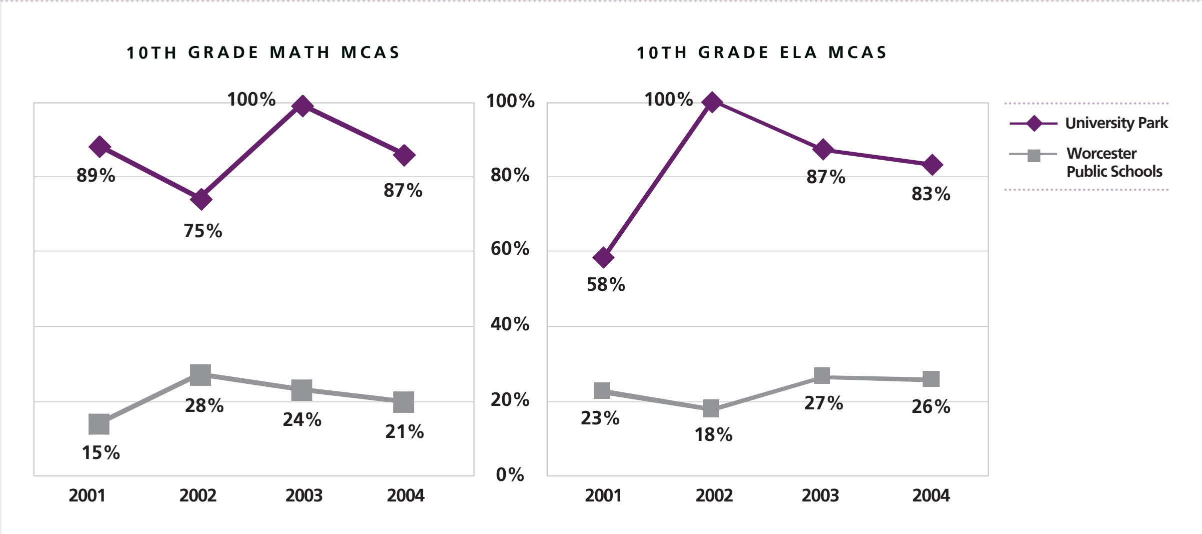


FIGURE 7 **University Park High School MCAS Performance**

Percent of Students Achieving Proficiency 2001-2004 (free and reduced lunch only)



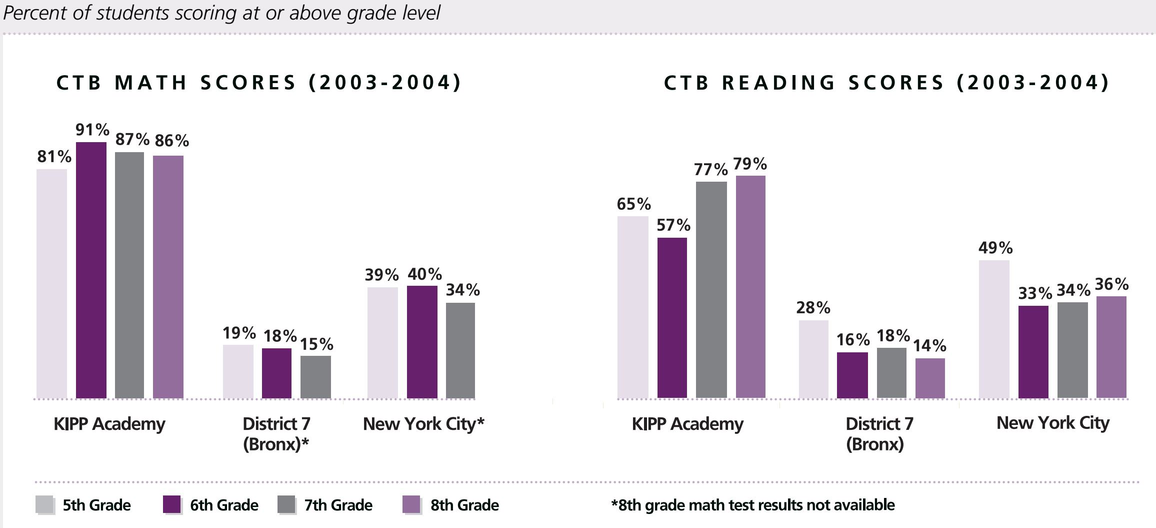
University Park High School in Worcester has also significantly outperformed other high schools in the district on MCAS, despite serving a higher number of free and reduced lunch students (Figure 7). Though University Park reverted to a more traditional schedule beginning with the 2002-2003 school year, scores have continued to remain strong; several teachers argue that these students are still benefiting from the additional academic assistance they received in earlier grades when the school did offer extended-time.

Students at KIPP Academy New York, who do not take the MCAS exam, also perform significantly better than students at other New York City Public Schools on a variety of other standardized tests. For seven years in a row, KIPP Academy New York, where approximately 95 percent of the student body qualifies for free and reduced lunch, posted the highest math and reading scores of all Bronx middle schools. Since 2003, the school has ranked in the top 10 percent of all NYC public elementary and middle schools on these tests. Figure 8 shows the academic performance of students at KIPP Academy New York compared to other students in the Bronx and in New York City as a whole.

Of course, a handful of examples do not prove definitively that extended learning time promotes higher academic outcomes for students. Many factors contribute to student academic performance and from this small sample size, we cannot isolate the impact of the extra time alone. Teacher quality, the influence of strong leadership, rigorous and continuous professional development, probably all contribute to the differences in academic performance. At the same time, many of the schools that boast stronger than average test scores do attribute much of their success to the additional time they offer compared to traditional schools.

FIGURE 8 **KIPP Academy New York Performance Compared to District and City Averages**

Percent of students scoring at or above grade level



“With longer classes every question is answered— no stone is left unturned. There is more individual attention.”

— Student at University Park

Greater ability to work with diverse ability levels simultaneously

The additional time also appears to offer teachers the opportunity to address the wide disparity in ability levels that they often encounter in a classroom of 25-30 students. According to the teachers in these schools, some students catch on quickly to new material, some need additional explanations and repeated practice, while still others require one-on-one assistance or material presented in a number of ways to achieve full understanding. In focus groups, teachers repeatedly suggested that longer classes allow them to work across these various ability levels. The longer classes enable teachers to divide the class into groups, for example, with each group working on different activities based on its specific needs. The teachers can then spend more time with groups that need additional assistance while still ensuring that other students are engaged in learning. These teachers argue that opportunities for group work are more limited with a shorter class time.

There is also more time to present material in different contexts without sacrificing required content. Some students learn better visually, some students learn better through repetition and practice, while others learn best through hands-on projects. More time allows teachers to present material in a variety of ways and, thus, cater to a diversity of learning styles.

Finally, teachers and students explain that more time in class and in individual tutoring sessions enables all students' questions to be adequately answered by the teacher. As a student in University Park put it, “With longer classes every question is answered—no stone is left unturned. There is more individual attention.”

Deepened adult-child relationships

Child development experts agree that students' healthy development and learning depends upon developing strong relationships with caring adults. Teachers can play a vital role in children's lives, serving not just as instructors but also as role models, mentors, and advocates. Through focus groups, students and parents alike repeatedly pointed to strong relationships with teachers as one of most positive aspects of their experience at the extended-time school. While their positive feelings may speak to the caliber of teachers working in the schools, these feelings are also likely bolstered by the long class periods teachers and students spend together and through the consistent contact students have with their teachers in a number of more informal contexts. At some extended-time schools, teachers play more roles than just that of a classroom teacher. They may lead special enrichment activities; they may tutor students individually; or they may monitor and assist in homework help sessions. This extra time, and the opportunity to see teachers in less formal contexts, seem at least partly responsible for the strong student-teacher bonds described at these schools. “I have students who are applying to college and come back here to middle school for recommendations. In many cases the students don't find teachers or other adults at their high schools who know them as well as we do,” says one teacher from the Timilty Middle School.

4 | How Extended-Time Schools Structure Staffing

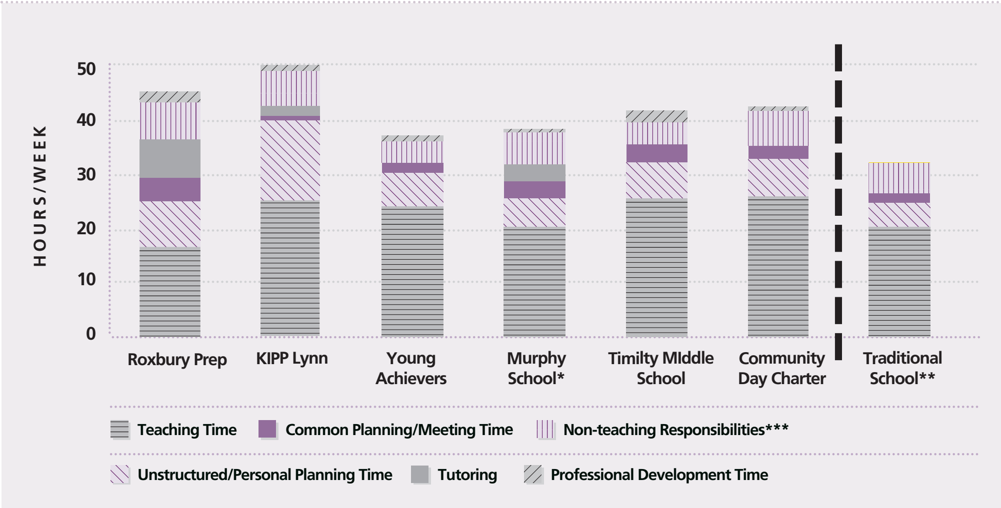
In order to operate for longer hours, extended-time schools must, of course, develop a staffing model that ensures staff coverage beyond the traditional six-and-a-half-hour day. For most schools this strategy involves:

- Paying teachers to work longer hours, and
- Integrating non-teaching staff into classrooms and forming partnerships with community organizations to offer enrichment activities

Teacher schedules

At most extended-time schools, teachers are required to work more hours than their peers in schools with conventional schedules. At the schools examined, teachers work between 6 and 18 extra hours per week, not including additional weeks in the summer at some schools. As shown in Figure 9, not all of this additional time is spent teaching in the classroom. Teachers spend, at most, five more hours in the classroom per week than teachers at schools with conventional schedules. In several cases, teachers spend the same or fewer hours teaching. Instead, teachers at profiled schools generally spend much of the extra time tutoring students, supervising enrichment activities, participating in professional development and group planning sessions, and planning their own classes.

FIGURE 9 **Teacher Schedules at Extended-Time Schools**



*Calculated for teachers who teach in the school-run extended-day program **Based on a sampling of districts in Massachusetts
***Includes supervision of arrival, dismissal, lunch, recess, and enrichment activities

As discussed in Chapter 2, the Timilty School, Young Achievers, and Roxbury Prep set aside roughly three hours every week on Friday afternoons for professional development, common planning, and staff meetings. This uninterrupted block of time is possible only because of the extended schedule. At four of the six schools presented in Figure 9, teachers are allotted almost twice the amount of personal planning time as teachers at traditional schools. Teachers treasure this time and consider it integral to their effectiveness in the classroom, as it allows them to prepare for classes, review and revise curricula to better address student needs, and plan special projects that can help reinforce learning.

Roxbury Prep caps the time teachers spend in the classroom at about four hours per day, even though students are in school for more than eight hours. Teachers explain that this manageable teaching load (four classes and a total of approximately 70-80 students) allows them to make sure all their students are progressing, and that it makes the job much less overwhelming. During this time teachers have other responsibilities. For example, they are expected to tutor individual students, work with other teachers to plan curricula, contact parents to discuss student performance, plan their own classes, grade papers, or, in some cases, teach an enrichment activity such as drama or chess.

Teacher compensation

In almost all cases, teachers receive additional compensation in the form of higher salaries or special stipends for these additional hours.

District schools generally compensate teachers based on a rate negotiated with the teacher unions. At the Timilty School, for example, teachers are paid the Boston Teachers' Union contracted hourly rate of $34.68 per hour. This rate is standardized, meaning that every teacher, regardless of seniority, is paid the same per hour. For Timilty teachers, the eight additional weekly hours accrue to an annual total of approximately $10,000 more. A similar stipend is calculated for those teachers at the Murphy School who opt to work in the extended-day program. Because some of these teachers choose to work only a few days per week, teacher stipends for the extended-day program at the Murphy School vary considerably. Stipends are roughly $10,000-$11,000 a year for an extra 12-15 hours per week.

Other schools simply increase teacher salaries by a set percentage to account for the additional time. KIPP Academy Lynn, for instance, calculates teacher compensation by using the Lynn School District's salary schedule to establish a base salary and then adding 20 percent. While teachers are required to work more than 20 percent more hours per week than teachers in the Lynn public school system, the school has found in its first year that a salary 20 percent higher than the comparable district salary, when combined with other benefits, is sufficient to recruit and hire talented teachers.

TABLE 4 Comparison of Teaching Requirements and Compensation across Extended-Time Schools

School	School Type	Hours Teachers Work per Week	Average Classroom Hours per Week	Average Years Teaching Experience	Additional Pay Above District Salary Schedule
Community Day Charter School	State Charter	42	26	8	0%
Roxbury Prep	State Charter	45 plus 3 wks in summer	17	5	0%
KIPP Academy Lynn	State Charter	50 plus 4 wks in summer	25	6	20%
Murphy K-8 School	District Public	45*	20	20	16%*
Timilty Middle School	District Public	42	25	8	14%
Young Achievers	District Pilot	35-38**	24	10	0%

**At the Murphy School work in the extended-day program is optional. The numbers shown refer only to teachers who choose to do so. **Because of different student schedules, Young Achievers elementary school teachers work 3 hours less per week than middle school teachers.*

The University Park Campus School also used this strategy to set teacher compensation when it opened as an extended-time school in 1999. Because University Park is a district public school, the Worcester public school system negotiated with the local union a higher rate of pay to reflect the extra hours worked. Ultimately, the union and the school system settled on a rate of 19 percent more than the standard Worcester public school salary schedule. This 19 percent increase was not proportional to the amount of additional time, as teachers at University Park were required to work approximately 30 percent more time, but teachers expressed satisfaction with the negotiated salary rate.

While most of the extended-time schools examined pay their teachers for the additional time they work, two charter schools do not. Roxbury Prep and Community Day Charter School try to offer competitive salaries for their teachers, but also claim to attract teachers to their schools through non-monetary benefits. Roxbury Prep believes it attracts teachers through its more manageable teaching load and its intense focus on professional development. Community Day Charter School offers a team teaching model that assigns both an experienced teacher and a new teacher to one class of 25-30 students. This team approach provides an opportunity for continuous professional development as teachers learn from and critique one another. Many teachers, particularly new teachers, feel less isolated than they would teaching on their own.

Supplemental staff, staggered schedules, and community partnerships

Another approach to staffing a longer school day is to hire supplemental staff to cover some of the extra hours, and to stagger staff schedules so that no teachers are required to work more than seven hours a day. One practitioner of this approach is the Young Achievers school. In its schedule, all elementary school students attend from 9:00 a.m. to 5:00 p.m. Monday through Thursday and 9:00 a.m. to noon on Friday; all middle school students attend from 8:00 a.m. to 5:00 p.m. Monday through Thursday and 8:00 a.m. to noon on Friday. In this school's approach, regular elementary school teachers are hired to teach from 9:00 a.m. to 4:00 p.m. Monday through Friday, and middle school teachers are hired to teach from 8:00 a.m. to 3:30 p.m. Monday through Friday. A second group of staff, who are either specialist teachers or paraprofessionals, begin work at 11:00 a.m. and stay until 5:00 p.m. when all students are dismissed. Between 11:00 a.m. and 3:00 p.m., paraprofessionals work alongside teachers and provide support in their classes; after 3:00 p.m., the paraprofessionals and specialists continue to work with students after the regular teachers leave the school. After 3:00 p.m., instruction in core academic classes ends but all students stay at the school to participate in homework help and enrichment activities or clubs. Paraprofessionals lead some of these activities, or help supervise if there is a specialist teacher in charge.

To lead enrichment activities, many schools also hire staff from the community who have special skills or expertise. In some cases, schools form partnerships with community organizations that provide these services at low or no cost to the school. Young Achievers, in particular, relies a great deal on community partnerships to augment its programming. Through a partnership with the Metropolitan Opera Guild's Urban Voice Choral Program, students in grades one through eight are able to participate in weekly choral classes. Last year, the National Foundation for Teaching Entrepreneurship led a weekly course in business concepts for 19 seventh graders, and helped students to start their own businesses. Another program called Young Naturalists is run by two parents, and offers second and third graders the opportunity to study agriculture and the natural environment. Students frequently take trips to the Arnold Arboretum and other local areas.

Most schools employ a combination of public and private funds, and are extraordinarily creative in forging partnerships with outside organizations, leveraging existing resources and identifying external funding sources.

5 | Financing A Longer School Day and Year: Opportunities and Challenges

The first questions school leaders and administrators pose when presented with the concept of extended-time schools are: how much does the extra time cost, and how does the school pay for it? The extended-time schools profiled for this project indicate that there are a number of strategies for financing the additional hours. Most schools rely on a combination of public and private funds, and are extraordinarily creative in forging partnerships with outside organizations, leveraging existing resources and identifying external funding sources in order to collect the extra money it inevitably costs to fund a longer school day and year.

How much more does an extended-time school cost?

Pinpointing the actual cost of operating an extended-time school is difficult because each school and school district operates differently. The extended-time schools profiled here have different program and staffing models, offer different amounts of time, and are subject to very different regulations about staffing and teacher pay (i.e., some are charters, some are pilot schools, and some are traditional district public schools). These are all factors in determining overall cost. Because they use very different budgeting processes, the costs of extra time at extended-time district schools and at extended-time charter schools are discussed separately below.

FIGURE 10
Increase in Cost vs. Increase in Time at Extended-Time Schools

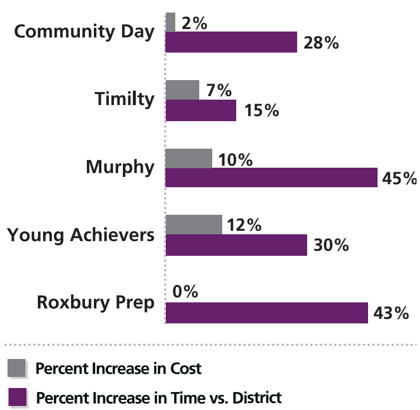
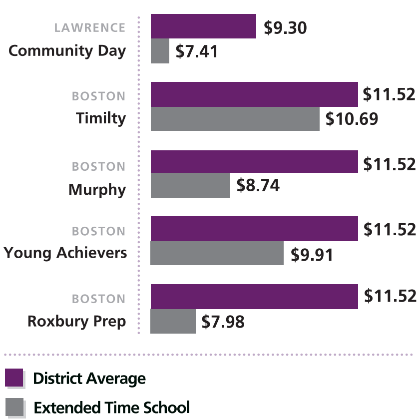


FIGURE 11
Cost per Student Hour Extended-Time Schools vs. District Schools



District schools

The cost of the expanded schedule at three of the district-run extended-time schools ranges between $900 and $1,500 per student, depending on the amount of additional time offered and the staffing strategy used to cover that time (Table 5).[18] These estimates are based on the school's own calculation of the expenses associated with operating for longer hours than other schools in the district.

As shown in Figure 10, even as these schools do cost more to operate than schools with shorter days, the increase in cost is not directly proportional to the time added. Even though these schools spend from 7 percent to 12 percent more per student, they are serving students for 15 percent to 45 percent more time. Analyzing the budgets of the extended-time schools by a "cost-per-student hour" metric (i.e., dividing the cost per student by the total number of hours the students attend school) confirms this point (Figure 11). Cost efficiencies in extended-time schools appear because what primarily drives the rise in cost is the increase in teacher pay (in accordance with the additional hours they work). Other school-related costs (facilities, administration, books, transportation, healthcare benefits, etc.) either do not increase, or do not increase as much. With only one budget element rising to any significant degree, the aggregate budget does not grow in direct proportion to the added time. Therefore, school leaders, superintendents, and policymakers who are considering lengthening the school day or year do not need to assume that their costs will rise in direct proportion to the time added. For example, it will almost certainly not cost 30 percent more to lengthen the school day by 30 percent.

TABLE 5 **Cost of Additional Time at District-Run Extended-Time Schools (FY 2004)**

	Young Achievers	Murphy*	Timilty
Total Additional Cost	$466,904	$381,000	$600,000
Number of Students	303	307	661
Additional Cost per Student	$1,541	$1,241	$908
Percent above District Average	12%	10%	7%

**Data for Murphy School reflect costs only for the 307 students participating in the extended-day program (with three additional hours per day for each student) **Percent above district average is the percent above FY04 per-pupil spending in Boston ($12,784), which is calculated using data from the Massachusetts Department of Education. District per-pupil expenditures include all federal, state, and municipal funding, but do not include capital expenditures.*

Charter schools

The difference in cost between the extended-time charter schools profiled in this report and traditional public schools in their district is more complicated to analyze because the charter schools do not operate under the budget standard set by a central administrative structure and do not break out the costs of operating for a longer school day. Rather, their costs are simply calculated as the costs of the whole school, not the costs of a standard six-and-a-half-hour day plus whatever it costs to operate the school beyond that standard. In addition, charter schools' cost structures are very different from those of district schools. The only method for approximating the cost of the additional time is to compare these schools' per-pupil expenditures (PPE) to those of schools in their districts. This method, as indicated in Table 5, was used for two of the charter schools profiled, Roxbury Prep and Community Day Charter School.[19] Here PPE seem to be roughly comparable to PPE at regular district schools, even though the charter schools offer a substantially expanded schedule (respectively, 43 percent and 28 percent more time than district schools in Boston and Lawrence).[20]

These charter schools are able to offset the costs of operating for longer hours with other cost savings that are not necessarily available to district schools, such as lower teacher salaries (resulting primarily from a teaching corps with fewer years of experience), and lower costs for transportation, and some administrative overhead.

TABLE 6 Difference in PPE at Charter Extended-Time Schools vs. District Schools (FY 2004)[21]

	Including Facility Costs		Excluding Facility Costs	
	Roxbury Prep	Community Day	Roxbury Prep	Community Day
Cost per student	$13,572	$11,377	$12,708	$10,960
District PPE	$13,926	$11,575	$12,784	$10,709
Difference	($354)	($198)	($76)	$251
Percent above or below district PPE	(2.5%)	(1.7%)	(.6%)	2.3%

How schools raise the additional funds

Extended-time schools use a variety of strategies to cover the cost of operating for additional time. Some strategies include:

- Securing special allocations from the district to supplement the budget
- Raising external public and private funds
- Building partnerships with outside organizations
- Implementing creative budgeting practices to leverage existing resources

Most schools need to use a combination of these strategies to fund their programs.

SECURING SPECIAL ALLOCATIONS FROM THE DISTRICT

Though this happens relatively rarely, some schools receive special allocations from their districts in order to operate on an extended schedule. When University Park was created in 1997 as a partnership between the Worcester Public Schools and Clark University, it was conceived as an extended-time school that would provide students in one of Worcester's poorest neighborhoods, Main South, with the best possible education. Worcester Public Schools committed additional funding to the school to cover the 19 percent increase in teacher salaries in order to staff an eight-hour school day. Unfortunately, despite the school's success—the Rennie Center named the school the "only high-performing non-selective urban public high school in Massachusetts," and the school was ranked 68th among top-performing high schools in the United States by *Newsweek* magazine[22]—University Park lost the additional funding beginning with the 2002-2003 school year when the Worcester School Committee voted to cut extended-time programs in all schools throughout the district. Without this funding, the school was forced to revert to a traditional six-and-a-half hour school day.

Similarly, when the Timilty Middle School became an extended-time school in 1987, it received a special budgetary allocation from the Boston Public Schools to cover the costs of the additional time. This allocation, approximately $600,000, funded stipends for teachers. In 2004, this funding was cut due to budget constraints. The school was able to remain an extended-time school by raising the additional $600,000 from private sources. Recently, Boston Public Schools has agreed to cover half the cost of the additional time; the Timilty School is continuing to raise the other half from private sources. Starting with the 2005-2006 school year, Young Achievers will also receive a special district allocation of $250,000 to help cover the costs of its extended schedule.

Because it does not require extensive fundraising, a special allocation from the school district may seem an ideal source of funding from a school's perspective. Special allocations can be particularly precarious funding sources, however. Because districts must maintain equity across the system, they are often forced to cut these funds during difficult budget years.

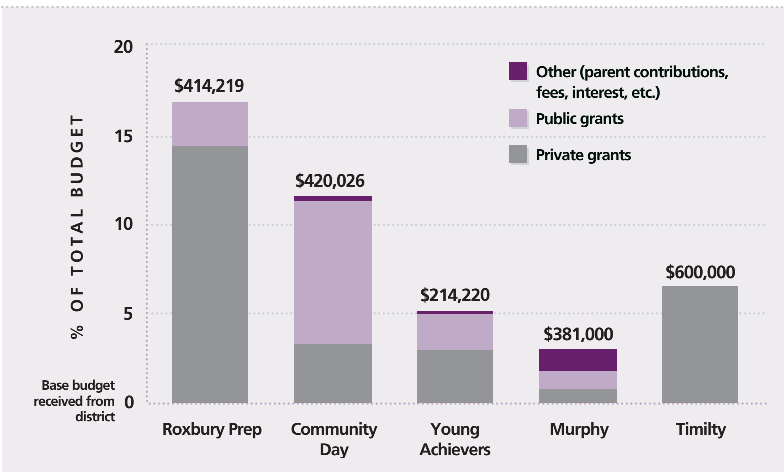
School leaders, superintendents, and policymakers who are considering lengthening the school day or year do not need to assume that their costs will rise in direct proportion to the time added. It will almost certainly not cost 30 percent more to lengthen the school day by 30 percent.

RAISING EXTERNAL PUBLIC AND PRIVATE FUNDS

Many of the extended-time schools studied for this report have sophisticated fund-raising operations, and raise anywhere from eight to 23 percent of their total budgets from external public and private sources. Public funds are generally accessed through competitive state or federal grants. The 21st Century Community Learning Center Grants, a competitive grant program of the Massachusetts Department of Education, provides $80,000 per year to individual schools to operate programming after the traditional school day ends. While schools usually utilize these grants to fund optional after-school programs, some schools, like Young Achievers, integrate the funding into the school budget to pay for a longer school day for all students. To support its extended-time program, the Murphy School has taken advantage of approximately $25,000 received through another competitive grant program operated by the U.S. Department of Education called the Safe and Drug Free Schools Program.

While charter schools traditionally rely on significant private fundraising to supplement the per-pupil allocation they receive from the state, district schools are also beginning to seek private funds to augment their program offerings. The three district schools studied for this project raise from $100,000 to $600,000 per year in private funds. Private funds come from local corporations, foundations, and individuals. Principals and supportive partners at these schools are adept at cultivating relationships with private funders and spend a significant amount of time on private fundraising. More and more funders are willing to fund innovative district public schools, if the school is able to show positive results. To accept private funds, these schools need to form affiliate 501(c)3 organizations or partner with community-based organizations that can serve as fiscal agents. Figure 12 shows that portion of the budget of each extended-time school which exceeds the budgets of conventional schools (based on per pupil allocation by the district or state) and how much of that portion comes from public and private sources.

FIGURE 12 **Sources of Additional Revenues FY 2004**



BUILDING PARTNERSHIPS WITH EXTERNAL ORGANIZATIONS

Some schools have forged partnerships with external organizations that provide special programming. None of these partnerships manages to cover a school's entire extended-time program, but the partnerships do broaden the types of activities and enrichment opportunities that schools can offer. For example, at no cost to the school or to students, the Murphy School is able to offer violin lessons (through a partnership with the Boston Arts Academy) and dance lessons (through a partnership with the TOPF Center for Dance Education). Through a similar partnership with Historic New England, a historic preservation organization that operates educational programs in schools, the Murphy School offers a photography course using the history of Boston as a theme of the curriculum. A program director at the Murphy School develops and manages these relationships and serves as the main line of communication between the partner organization and the school. Mary Russo, principal of the Murphy School, pointed out that many potential partners could operate such programming, bringing in resources at no cost to the school. The school principal or other staff usually needs to invest time in researching and courting these partners. In many cases, the partners approach the school first, but partners will look elsewhere if the school is unresponsive or does not demonstrate a genuine commitment to the partnership. Sometimes, Mary Russo noted, principals and other school staff can be too busy to respond to such opportunities.

The strong relationship formed almost a decade ago between University Park Campus School and Clark University in Worcester is an example of the tremendous benefits schools can reap from partnerships with higher education institutions. Clark University was a key partner in creating University Park. The university assisted in the planning of the school and provided expertise from Clark's Hiatt Center for Urban Education. During its first two years of operation, while it awaited its own school building, the school was even located on Clark's campus. Today, Clark graduates and undergraduates serve as student teachers and volunteer as tutors. University Park students have full use of Clark's gym and library, and juniors and seniors are even able to enroll in classes at Clark free of charge.

Clearly, such partnerships can be quite fruitful and contribute a great deal to a well-rounded education for the school's students, but they also require significant management and oversight. School leaders explained that it is best if a single individual manages all outside partnerships to avoid confusion and conflicts. At the Murphy School, a full-time program director manages partnerships; the principal maintained that the school's partnerships would not be possible without the organization and coordination of the program director. Administrators also explained that in order to stay focused on their educational missions, they need to carefully assess which partnerships to enter, taking into account the school's needs and capacity. Too many partnerships could be overwhelming to the school, diluting, rather than enriching, the curriculum.

IMPLEMENTING CREATIVE BUDGETING PRACTICES TO LEVERAGE EXISTING RESOURCES

While existing resources are not sufficient to lengthen the school day significantly, some schools have found ways to leverage funds in their current budget to cover some of the additional costs. In some cases, school budgets are flexible enough to allow principals to shift resources and use funds budgeted for other purposes. In Boston, for example, principals may use funds allocated in their annual budget for specialists (such as art, music, physical education teachers), and other specialized positions (such as student support coordinators, library aides, assistant principals, registrars at the high school level) to cover some of the costs associated with a longer school day. Most often these funds are directed toward teacher stipends for longer hours. Schools that receive Title I funding, a federal entitlement grant provided to schools based on the number of low-income students served, can sometimes leverage this funding to support a longer school day. Title I funds are relatively flexible in how they can be used; some schools use them to cover the cost of paying teachers for the extra hours worked.

Another strategy for leveraging existing resources is to arrange for a later start time for specialists and some paraprofessionals, so that these staff cover classes during the last part of the day, enabling regular teachers to work just their contracted hours. Using this strategy, Young Achievers estimates that nearly 60 percent of the cost of its longer school day is financed by the regular budget allocation received from the Boston Public Schools. This allocation is not significantly different from the allocations of other schools but because Young Achievers is a pilot school, it maintains the legal autonomy over staffing and budgeting required to leverage existing resources to fund an extended-time school model.

While existing resources are not sufficient to lengthen the school day significantly, some schools have found ways to leverage funds in their current budget to cover some of the additional costs.

"At first the idea of extended day was horrible but teachers brought material to life. Sometimes you didn't realize that it was a 90-minute class. You wished you had more time because you were having fun in class. With longer classes you could learn more material and learn the subject in depth."

— Student at University Park

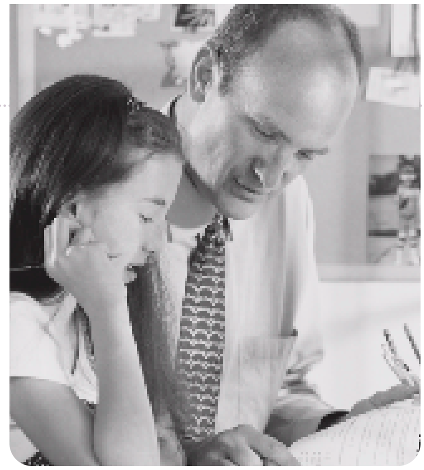
6 | Reactions Of Students, Parents, And Teachers To Extended-Time Schools

As part of its site visits to the profiled schools, Massachusetts 2020 conducted focus groups with students, teachers, and parents to better understand how these constituencies feel about their involvement in an extended-time school. The focus groups revealed that across all of the schools profiled, students, teachers, and parents are highly enthusiastic about the longer school day. Students generally value the additional academic support and the wide range of enrichment activities their schools offer. Teachers appreciate the additional class time, which allows them to ensure their students are learning, and the additional time they have for planning and professional development. Parents are grateful to have their children engaged in a safe, positive environment while they are working, and many note strong improvement in their children's attitude and performance in school. Each group warns however, that the extra time must be productive, organized, and thoughtfully planned. Despite this overwhelming support, information collected through these focus groups cannot be considered statistically significant data on student, teacher, and parent satisfaction, as Massachusetts 2020 conducted no large-scale survey of these groups.

Students

Perhaps most surprisingly, students themselves are strong proponents of an extended-time schedule. At University Park, students actively protested at school committee meetings when the school was forced to revert to a traditional schedule. Though it has been a few years since the existence of the extended-time schedule, current students in the eleventh and twelfth grades speak fondly of the extended-time program and argue passionately about its advantages. Dan, an eleventh grader at the school, explained, "At first the idea of extended day was horrible but teachers brought material to life. Sometimes you didn't realize that it was a 90-minute class. You wished you had more time because you were having fun in class. With longer classes you could learn more material and learn the subject in depth." Students at University Park are convinced that the extended day and longer classes provided better academic preparation. Jorge, a sophomore pointed out, "In every class all the teachers were focused on getting all the kids to the same place. Some kids fell behind after they took away the extra time. With something as important as MCAS, they shouldn't have taken away the extra time."

Even younger, less mature students are enthusiastic about the longer school day. As one Roxbury Prep seventh grader noted, "I thought it would be the worst thing ever but I got used to it. You just don't look at your watch. Having enrichment classes where you choose what you want to do helps a lot. It's not all work." When asked if it ever feels as if they have too much school, one eighth grader at Roxbury Prep responded: "No, I wouldn't be doing anything at home anyway. It keeps you out of trouble." Similarly, a fifth grader at KIPP Academy Lynn explained: "Before coming to KIPP, I mostly went home at 1:45 and watched TV. My parents weren't home. I was really bored. I don't miss that at all. Here we are having fun and being challenged." Students in all the focus groups also articulated the differences they had observed between their school and the schools some of their friends attended. Students often remarked with pride that they are far ahead of their peers in most subjects and that their friends at other schools often ask them for help with schoolwork. Students often feel "special" attending an extended-time school.



Teachers

Many teachers were equally enthusiastic about the benefits of an extended-time school because they believed their students truly needed the additional time. A teacher at the Murphy School, where only about one-third of the school's students participate in the extended-time program, explained that she wished all students had at least one more hour in the school day. "We feel guilty giving kids recess because we are losing time in class—but the kids need that time, too. With more time for everyone, the whole dynamic would be different. You wouldn't have to stop just when kids are getting into it. There is so much pressure to squeeze everything into a six-hour day, and it just doesn't fit."

In focus groups, many teachers also commented that when they had not been working at an extended-time school, they found that they often stayed late anyway to work with students, prepare classes, and grade student work. With the longer school day, their actual hours spent working did not necessarily change very much; their full hours were just integrated into the formal work schedule.

Another point made consistently across teacher focus groups was how important it was to teachers that they were working in schools that helped them to perform their jobs effectively. If that meant working in a school with longer hours, the additional time was not necessarily a concern, particularly if they were compensated for it. A teacher at Roxbury Prep commented, "At Roxbury Prep you work very hard, but it feels better than at other schools; you know you are getting somewhere." For teachers across many of the schools, the sense of accomplishment, the professionalism and administrative support, and the overall teaching environment were all part of the school culture, as much as the additional time.

These comments from teachers highlight how important other benefits are to attract qualified teachers to extended-time schools (or any schools for that matter). These benefits can include:

- A sense that their ideas and concerns are addressed
- The opportunity to team with other teachers to identify solutions, and a sense of camaraderie with other teachers
- Support and respect from the administration
- Strong instructional leadership and professional development
- A sense of success or efficacy in helping students learn and grow
- A strong discipline system so that teachers can focus on teaching rather than on classroom management

Teachers also emphasized that teaching in an extended-time school may not be for everyone because the additional hours can make a difficult job even more demanding.

For teachers across many of the schools, the sense of accomplishment, the professionalism and administrative support, and the overall teaching environment were all part of the school culture, as much as the additional time.

> "At other schools you don't always get the extras—music, gym, and art—because you don't have time. Here the kids get so much more than academics. They don't get bored—because of the extra-curricular activities."
>
> *— Parent of Student at Timilty Middle School*

Parents

In focus groups, many parents indicated that the schedule was one of the factors that first drew them to the extended-time school. As working parents, they appreciated the longer school day, and felt that the additional school hours used their children's time after school more productively than either sitting home alone or participating in a less structured after-school program. Some parents were also attracted by the additional academic assistance their children would receive at the extended-time school. Parents expressed excitement that teachers were spending the time needed to help children progress academically. Other parents found the enrichment activities to be of real value. "At other schools you don't always get the extras—music, gym, and art—because you don't have time. Here the kids get so much more than academics. They don't get bored—because of the extra-curricular activities," observed one Timilty Middle School parent. A parent at the Murphy School praised the extended-time program for its success in developing children's social skills. "With all the enrichment and extracurricular activities at the school, students have more opportunity to work together collaboratively and experience teamwork. These things are an important part of school, but they are always being cut out of the regular school day," she explained.

The overwhelming demand for these schools is another indicator of parents' willingness to embrace an extended-time school model. For example, the three Boston schools examined for this project—Young Achievers, the Murphy School, and the Timilty School—rank among the five most-requested schools in the city.[23] Each of the charter schools—Roxbury Prep, KIPP Academy Lynn, KIPP Academy New York, and Community Day—have long waiting lists. This year Roxbury Prep Charter School had 153 applicants for only 75 spots. Community Day Charter School had only 10 openings this year, yet maintains a waiting list of 832 students. While parents' interest in these schools may be sparked by other factors, clearly the extended-time schedule is not a deterrent to enrolling their children.

Of course, many parents conditioned their approval of extended-time schools on the overall quality of the school. Parents explained that they were pleased with the extended-time model at their children's school because their children were stimulated and the teachers were highly qualified. If this were not the case, most explained, they would not be in favor of a longer school day. Parents also emphasized the importance of choice in selecting an extended-time school. Parents explained that while they deliberately chose the longer school day, it might not be a good fit for all families.

7 | Time Alone Is Not Enough: Other Characteristics Of Successful Schools

Simply adding extra hours to the school day will not transform a failing school into a successful one. Most school leaders characterize extra time as necessary but not sufficient by itself to produce the results they expect from their students. As Josh Phillips, Co-Director of Roxbury Preparatory Charter School cautioned, "Before schools consider adding a seventh and eighth hour in the day they need to make sure they are making good use of the first six; otherwise it won't have much impact."

Therefore, it is important to highlight some of the other non-time-related characteristics that make many of the extended-time schools studied for this report successful. Trying to add extra hours without also taking into account these other elements of success would be unlikely to yield positive results.

Interviews, focus groups, and class observations at the extended-time schools revealed five key features—in addition to the extended schedule—that helped these schools to reach their professed goals and to produce strong student outcomes. These five features are:

- Strength of leadership
- Focus on professional development and teaching quality
- Use of data to drive continuous improvement
- Positive school culture
- Effective family engagement

Strength of leadership

It is no mystery to the business community that having a skilled and effective CEO is fundamental to the success of any company. Likewise, a strong, visionary principal stands at the center of every truly successful school. The challenge of leadership is particularly poignant in urban public schools that serve a high percentage of low-income and special needs students. In focus groups with teachers at two of the profiled schools, when teachers were asked what made that school most different from other schools where they may have worked, without hesitation, they answered, "the principal." Successful principals are able to set high expectations for teachers and students; convey a compelling vision for the school's success; create a work environment for teachers that is stimulating, supportive, and rewarding; and leverage and attract resources to support the school's needs. While effective school leaders need training and experience, they must also possess a number of more intrinsic qualities, such as a passion for learning and for children, a drive for excellence, strong communication skills, and the ability to motivate others. The principals who are most effective appear to derive their success from a complex blend of personality, experience, training, management style, and vision.[24]

Focus on professional development and teaching quality

Successful schools also place extraordinary emphasis on teaching quality.[25] From the initial hiring process to teacher evaluation and professional development, these schools have given much consideration to how they recruit, hire, and develop outstanding teachers. Mary Russo, principal of the Murphy School, 2004 Massachusetts Principal of the Year and a National Distinguished Principal, described how she tries to spend as much time as possible sitting in on classes and offering teachers her feedback. Teachers explained that they find this type of feedback incredibly helpful, as it gives them new ideas for how to approach material and manage their classrooms. It also sends them a clear message that their teaching improvement is central to the school's mission. Leaders at Community Day Charter School also observe classrooms frequently, a

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The leaders of these extended-time schools attribute their success in large part to a strong, positive school culture that they have spent considerable time and effort working to promote.

practice that is made possible by having three school heads, one for each of the three schools: the Early Learning Center (pre-K-1st grade), the Lower School (2nd-5th) and the Upper School (6th-8th grade.) Each of these three heads of school is able to devote a significant amount of time to professional development and instructional leadership, and works closely with teachers to plan curricula, monitor student performance and identify new teaching strategies to support struggling students. Teachers in focus groups spoke highly of the support and guidance received from the heads of school.

Similarly, Roxbury Prep operates with two co-directors, rather than one principal, to allow one co-director to focus primarily on instructional leadership, while the other handles many of the more administrative aspects of school management. Teachers at Roxbury Prep receive tremendous guidance and support from the instruction-oriented co-director as well as from other teachers at the school. The overall effect of this institutional focus on teaching and professional development is to create a culture of healthy critique and continuous improvement.

Young Achievers also places a heavy emphasis on professional development, particularly in place-based experiential education. Young Achievers' teachers are in the third year of a five-year plan to develop experiential education units of study embedded in the local environment. Teachers are working to develop multidisciplinary learning activities that integrate many academic subjects into long-term projects that include field trips, visits from outside experts, and hands-on activities. Young Achievers believes implementing project-based learning will boost student interest and engagement in core academic subjects. The school recognizes that professional development is necessary to help teachers develop the skills and expertise to implement this type of curriculum.

Use of data to drive continuous improvement

Another vital factor in school success is the use of data to drive continuous improvement in teaching and learning.[26] Extended-time schools in which students perform particularly well on MCAS set clear goals for student performance, actively measure student progress toward these goals, and hold themselves accountable for expected results. At the Murphy School, where students score well above the district average on MCAS, the principal and assistant principal carefully analyze student data to identify areas in which students may not be receiving sufficient instruction. They review all students' test results to highlight patterns in the types of questions students seem to answer incorrectly on MCAS. For example, if a significant percentage of students answered specific types of word problems incorrectly, school leadership together with teachers might conclude that students need more exposure to such problems or that new teaching strategies are needed to help students master them. In short, they incorporate MCAS as a dynamic diagnostic and measurement tool within their teaching structure to help ensure students are learning the required material.

At Community Day Charter School, where every sixth, seventh, and eighth grade student passed the math and ELA MCAS in 2004 (as much as three times the passing rate of other Lawrence public schools), the school hired a full-time data analysis manager to work with teachers to help them understand and interpret MCAS data. This manager has now developed a full system of analysis through which, in late summer, each teacher receives the MCAS performance history of the students they taught the previous year as well as that of students coming into their class new in the fall. Each student's test has been analyzed according to the type of question (e.g., essay, multiple choice, etc.) and by specific content standard (e.g., fractions, numeration, reading comprehension, etc.). The head of school also receives the same data for all the students in the school, along with an analysis of student trends for the previous three years. This data analysis system is so valuable that the school is now marketing it to other schools throughout the state.

At Roxbury Prep, in addition to taking MCAS, students undergo a diagnostic test in each subject—designed by the Roxbury Prep teachers—at both the beginning and the end of the year. The entire curriculum plan for each subject is then focused on helping students master the material to be covered on the year-end subject test. The tests are important tools that help to measure how well each teacher has covered the material.

Positive school culture

Many of these school leaders attribute the success of their extended-time schools in large part to a strong, positive school culture that they have spent considerable time and effort working to promote. While it is difficult to define or dissect "school culture," interviews with school leaders and teachers indicate that the term is used most frequently to describe a climate or environment that is consistently supportive, safe, and focused on learning at every level of the institution. This culture does not emerge magically from some accumulated sets of activities, but demands enormous effort to build and maintain. It is established through specific events (e.g., community meetings) and policies (e.g., consistently enforced rules of behavior), as well as through more subtle modes of behavior (e.g., teachers modeling good conduct, discussing values, and providing positive reinforcement.) All of these strategies blend together to send very clear and uniform messages about the expectations of the school.

At KIPP Academy Lynn, the core school values are no mystery, even to an outsider. Prominently posted on every wall of every hallway and in every classroom are the simple phrases "Work Hard" and "Be Nice." Students quickly see that these phrases are not hollow, but infect every minute of every day in the school: anything other than hard work and respecting other students is unacceptable. To help reinforce school values and expectations KIPP has developed a reward system that encourages specific behaviors such as hard work, kindness, cooperation, concentration, and leadership. At KIPP Academy Lynn students receive on Fridays a weekly "paycheck." The "paycheck" awards a specific number of points or "KIPP dollars" to each student based on his or her overall effort and behavior during the week. These points can then be traded in for various items at the school store (such as notebooks, pens, snacks, or small toys) or for special trips and privileges. The school maintains a running total of each student's total paycheck points. At the end of the year, only students who have accrued a certain minimum level of points are able to participate in special trips and activities. Teachers and administrators at the school have found the "paycheck" system enormously valuable for helping students understand what is expected of them and helping them gain a sense that, as one school slogan puts it, "good things happen when you do the right thing."

Roxbury Prep uses a similar system of "creed deeds" and "demerits." "Creed deeds" are points awarded for behavior that exemplifies the school creed—a set of core values that is posted prominently in the front hallway. Creed deeds can be traded in for supplies and special privileges. Each month the student with the most creed deeds gets to have one of the two school directors serve as his or her assistant for the day—carrying books between classes, getting lunch, holding doors, etc. "Demerits," by contrast, are assigned for negative behaviors and have clear consequences: three demerits result in one after-school detention, six demerits result in two after-school detentions, and nine or more demerits result in a three-hour detention on a Friday. Roxbury Prep Co-Director Dana Lehman explains that a tight discipline policy also keeps students more focused on learning and allows teachers to do their jobs.

Two schools, the Timilty Middle School and Roxbury Prep, have found that insisting that students pass silently in the hallways when they switch classes during the day helps to maintain a focus on learning and convey a sense of order and discipline. Teachers and administrators at both schools realized that when students were allowed to talk and roam freely in the halls, discipline problems were much more likely to erupt. With the silent transitions, teachers feel their students enter class more prepared to begin working and take much less time to settle down.

This culture does not emerge magically from some accumulated sets of activities, but demands enormous effort to build and maintain.

"My son doesn't act up here and I know it's because he doesn't want to disappoint his teachers. The teachers are so involved with the kids. He really respects them and wants their approval."

— Parent of Student at Community Day Charter School

With the perceived rise in school violence nationwide, cultivating a sense of safety among students seems essential to creating an effective learning environment and a positive school culture. Students in focus groups at several schools were quick to point out that there were no fights at their school. One seventh grader at Community Day Charter School explained, "My friends at other schools don't believe there are no fights here. At their schools, there is a fight every day." Several students at the Timilty School echoed this statement and explained that the sense of safety they felt at school was one of the school's most positive attributes. Student safety at these schools is often the result of a zero tolerance policy on fighting, disrespect, verbal abuse, and general rough play. At the Murphy School teachers work hard to send very consistent messages to students about expectations and standards of behavior. Because the Murphy School is a K-8 school, students learn the rules early and have already accepted them by the time they move into the older grades. Teachers and administrators explain that they have few behavior problems.

Students and parents also attribute the differences in student behavior at the school to the relationships that students develop with their teachers. One parent at Community Day Charter School explained, "My son doesn't act up here and I know it's because he doesn't want to disappoint his teachers. The teachers are so involved with the kids. He really respects them and wants their approval."

To be sure, "school culture" is an intangible concept that is hard to replicate from one school to the next. It is clear from interviews and school visits, however, that successful schools do not waver in their commitment to creating an atmosphere that promotes learning, cultivates respect for staff and students, and offers a supportive, safe, and nurturing environment.[27]

Effective family engagement

Successful schools also realize that their work will ultimately fall flat without the parents' or guardians' support of their efforts. The schools that are most successful at engaging parents consider family involvement a core part of their strategy and work hard to facilitate it. At KIPP Academy Lynn, prior to each student's entrance into the school, the principal makes a visit to each child's home. At this home visit, the principal explains specific school values, communicates clear expectations for parents and students, and helps the family to become comfortable with the school. Each parent actually signs a contract with the school, promising to ensure high student attendance, provide assistance with homework by checking homework that is completed each night, and help enforce the KIPP dress code and other rules of conduct. Teachers also focus on being highly accessible to parents. One parent at KIPP Academy Lynn explained, "The first time I called the school to set up a time to talk to my son's teacher, I was told I could come in that afternoon. I couldn't believe it. At his old school I had to make an appointment several weeks in advance. This doesn't work with kids—you need to address issues right when they are happening. I was so relieved that I found a place where I could actually talk to someone about my son."

Teachers at Roxbury Prep also communicate frequently with parents. Each teacher has a phone extension with voice mail and is required to return parent calls within 24 hours. Many teachers also distribute their cell phone numbers to students and parents, and encourage them to call if they have a question or concern. Teachers will also call home frequently to talk to their students' parents—not just when there is a problem, but also when the student is doing well. One parent explained his surprise at receiving a call from a teacher about the strong progress his son was making. "I was shocked. I couldn't believe she took the time to call me for that. I thought she was calling because he was in trouble."

Many of the extended-time schools profiled in this report are successful not just because they offer more time, but because they offer more of the right type of time and have built the school upon principles and behaviors that promote success. They have strong leaders and excellent teachers. They set high expectations for students and teachers and carefully monitor performance. They create an effective learning environment that is safe, supportive, and nurturing. They support students' overall development by teaching important values and social skills. They are clear that more time is important, but they also admit that it is not the only factor that determines success.

8 | Conclusion

The eight extended-time schools that Massachusetts 2020 examined for this project demonstrate that extending the time students spend in school is possible in a variety of settings, including district public schools, pilot schools, and charter schools, and through a range of funding and staffing innovations. Examination of these schools further reveals that there is no one correct model of an extended-time school. In fact, each school has a unique character that grows from its strong educational vision. But these schools do all share one core belief: that more learning time is the *sine qua non* upon which a successful school is built. Employing creativity and attention to detail, these educators then develop a school that deliberately departs from the standard calendar of 180 six-and-a-half-hour days. They expand upon this time for the express purpose of enhancing teaching and learning.

The positive effects of having more time are evident throughout each school. Through longer class periods, individual assistance, and tutoring sessions, students spend more time on task than do students in schools operating on a conventional schedule. These elements of the academic schedule also enable teachers to cover material in greater depth and to offer students greater opportunities for project work and experiential learning. The longer class times and individualized sessions enable teachers to consistently tailor their teaching to students' individual learning needs. Outside the core academic classes, all students are able to benefit from a wide array of enrichment activities that are intended to build new skills and interests and deepen their enthusiasm for learning. The longer day also provides teachers with more common planning time and additional opportunities for professional development, both of which help to generate noticeable camaraderie and professionalism among teachers.

Studying these schools also reveals that despite the benefits of having more time than the conventional schedule allows, there are hefty challenges to extending the school day. Clearly, one of the most significant is funding to pay for additional staff time. This compensation can be a sizeable cost. The schools profiled admit that raising additional funds or juggling existing resources to cover this cost can take considerable imagination and energy. Moreover, having each school raise the funds individually to pay for longer hours is not a sustainable or scalable strategy. Any effort to extend learning time beyond a few innovative but isolated models will require substantial public investment and a deliberate and predictable funding structure.

At the same time, the required public investment may not be as large as many anticipate. Because only a portion of the total school costs rise when the school day is extended (primarily a result of added teacher pay), overall costs do not rise in direct proportion to time added. Put another way, per-pupil costs *per hour* begin to drop off appreciably with the addition of each hour to the school schedule. These schools also exhibit a range of strategies for extending the school day, many of which come closer to being cost neutral. Staggering teachers' schedules, for instance, can mean that schools are able to provide full coverage of students' schedules without necessarily requiring all teachers to work more total hours. Forging partnerships with community-

A Strong Step Forward: Expanded Learning Time Planning Grants

In 2005 Massachusetts took a strong step toward helping schools and districts expand learning time for students. The state legislature approved funding for planning grants to support districts and schools as they identify ways to restructure their school days and/or years around a schedule with 30% more time. To assist districts with the complex planning required to redesign the school schedule to better meet student, school, and district goals, grants of at least $25,000 per district were made available through a competitive RFP process.

The sixteen districts awarded grants in 2005 will use the money to work with principals and school teams, collective bargaining units, and external partners of their choosing to develop an implementation plan for extending time and restructuring the school day. The grant program will allow each district to determine the staffing, schedule, budget, and program options that best fit its local context and goals. All districts that participate in the planning grant program will be eligible for state funding for implementation of these plans.

While long-term funding for implementation of extended-time schools is still uncertain, these planning grants are a pioneering step toward extending learning time for Massachusetts students.

If universal proficiency at high standards is to remain the goal of this state (and the nation), then we have no choice but to allot enough time to enable all students to reach that goal.

The schools profiled admit that raising additional funds or juggling existing resources to cover this cost can take considerable imagination and energy. Moreover, having each school raise the funds individually to pay for longer hours is not a sustainable or scalable strategy.

based organizations and/or higher education institutions can not only provide a wider range of programming for students, but can also mean that some of the cost burdens of the additional programming are shared by these institutions. From this relatively small sampling of schools, it is not at all clear which method of cost containment or cost coverage is the most effective for extending school hours.

Usually when we talk of the millions and billions of dollars spent in this state and nation to support public education, we are thinking in only one dimension: costs. But it is important to remember that those costs, like education itself, are distributed over time. Every existing educational hour already has an associated cost. So, instead it is much more accurate to consider educational spending across two dimensions: costs *per hour*. In other words, we must account for the quantity of what is purchased (i.e., the total amount of schooling) and the quality it does or does not deliver. Extended-time schools may cost more in absolute terms, but the education delivered costs less per hour.

Money is not the only facet of our education system that is distributed over time. The very *raison d'etre* of our schools—student learning—is also rooted in time. In fact, in 1963 educational psychologist John Carroll expressed the relationship of time and learning in a simple equation:

$$\text{Degree of Learning} = \frac{\text{Time Spent}}{\text{Time Needed}}$$

The closer individuals come to achieving equilibrium between the numerator ("time spent") and the denominator ("time needed"), the higher the degree of learning. In the ideal situation, the equation equals "1"; a learner spends exactly the amount of time he or she needs to learn any one particular fact or concept. Carroll believed that no learner always spends as much time as he or she needs to maximize the degree of learning on every point. But it is the duty of teachers, schools, and districts to fashion classrooms in which learners can approach that perfect equilibrium as often as possible.[29]

As educators and policymakers struggle to surmount the dogged achievement gap and the worrisome flattening of proficiency rates overall, they may be ignoring one of the most fundamental truths of all: human cognitive capacity (i.e., learning) is limited by time. The more content and skills there are to master, the more time is needed to master them.[30]

On a systems level, as students are held formally accountable for demonstrating proficiency on an increasing amount of material, the time allotted to master that material should also rise. This adjustment has not been made. State educational policy in Massachusetts and other states simply fails to recognize the value of time: of ensuring that teachers have enough time to teach, and students have enough time to learn. It is indeed wise to expand what's taught so that students can better meet the demands of our increasingly complex and information-based society, and to focus on building necessary skills such as oral and written communication, researching, problem solving, and teamwork. But such wisdom is completely undermined unless the amount of time allowed for learning is expanded simultaneously. Demanding that students learn more in the same amount of time is especially counterproductive for students who are behind grade level, have limited English proficiency, or have special needs. If universal proficiency at high standards is to remain the goal of this state (and the nation), then we have an obligation to allot enough time to enable all students to reach that goal.

Notes

[1] The policy group, Achieve, Inc., a Washington, D.C.-based bipartisan education analysis group made up of governors and business leaders, in 2001 rated Massachusetts' standards and its MCAS test as the best among the 10 states it has reviewed since 1996, both in terms of alignment to each other and in content and design. According to Robert Schwartz, Achieve's then-president, "Massachusetts is the first state we can confidently say has high-quality, rigorous, and fair but challenging academic standards, and a fair but rigorous assessment that is aligned with the standards…. The state is in a category by itself." (Rick Collins, "Education Reform In Massachusetts Is Tops Among Ten States Analyzed," *State House News Service*, Oct. 17, 2001.) For an online copy of the report, http://www.achieve.org/achieve.nsf/StatePro-Massachusetts?OpenForm. One education think tank has even gone so far as to identify Massachusetts as the "smartest state" for two consecutive years, based on student performance. (Education State Rankings, 2004-2005 (2004), Lawrence, KS: Morgan Quitno Press). For more information, see http://www.morganquinto.com/edpress.htm.

[2] Kevin Carey, "The Funding Gap 2004," Education Trust (Fall 2004). The full report can be downloaded at http://www2.edtrust.org/NR/rdonlyres/30B3C1B3-3DA6-4809AFB92DAACF11CF88/0/funding2004.pdf.

[3] Districts are categorized and ranked based on the Gaudet Index, a rating of community socioeconomic status based on five key indicators from the 2000 census. These indicators include percentage of college graduates and median income. A full explanation of the analysis is available online at www.mass2020.org/portraitofboston youth(final).ppt, p. 3.

[4] For an excellent summary of the research on how in-school performance is linked to children's background and use of time outside of school, see R. Rothstein, *Class and Schools: Using Social, Economic, and Educational Reform to Close the Black-White Achievement Gap* (Washington, DC: Economic Policy Institute, 2004). In Rothstein's words, "Although conventional opinion is that 'failing' schools contribute mightily to the achievement gap, evidence indicates that schools already do a great deal to combat it. Most of the social class difference in average academic potential exists by the time children are three years old. This difference is exacerbated during the years that children spend in school, but during these years the growth in the gap occurs mostly in the after-school hours and during the summertime, when children are not actually in classrooms."

[5] National Commission on Excellence in Education, *A Nation at Risk: The Imperative for Educational Reform: Report to The Nation and The U.S. Secretary of Education*, 1983. The report is available online at http://www.goalline.org/Goal%20Line/NatAtRisk.html#anchor809864.

[6] The Massachusetts Commission on Time and Learning, *Unlocking the Power of Time*, 1995, pp. 4-5.

[7] The most concise review of the literature appears in J. Zimmerman, *Improving Student Achievement by Extending School: Is it Just a Matter of Time?* (San Francisco, CA: WestEd, 1998).

[8] J.D. Bransford, et al., eds., *How People Learn: Brain, Mind, Experience and School* (Washington, DC: National Academy Press, 2000), pp. 58-62.

[9] On teacher impact on students, see H. Wenglinsky, "How Schools Matter: The Link Between Teacher Classroom Practices and Student Academic Performance," *Education Policy Analysis Archives,10:12, February* 2002.

[10] One example of this research is in arts education. See S.B. Heath, "Living the Arts through Language + Learning: A Report on Community-based Youth Organizations," *Americans for the Arts Monographs*, 2:7, November 1998.

[11] Many articles and books explore this relationship. For one example, see C. Muller, S. Katz, L. Dance, "Investing in Teaching and Learning: Dynamics of the Teacher-Student Relationship from Each Actor's Perspective," *Urban Education* 34:3, 1999, pp. 292-337.

[12] Massachusetts Commission on Time and Learning, p. 21.

[13] A pilot school in Boston operates essentially as an in-district charter school. The school can operate free of many of the central administrative rules of the district, though they are required to pay teachers according to the common collective bargaining agreement for Boston Public Schools. Any student from the district is eligible to attend a pilot school, dependent upon space availability.

[14] University Park Campus School was created as an extended-time school in 1997 but was forced to revert to a traditional schedule in 2003 when funding for extended-time programs was cut throughout the Worcester Public Schools.

[15] On average, Roxbury Prep students progress 2.5 grade equivalency levels in their first year in math, reading, and English grammar and usage, as measured through the Stanford 9.

[16] Department of Education, University of California at Irvine, *Evaluation of California's After School Learning and Safe Neighborhoods Partnerships Programs: 1999-2001, Preliminary Report* (Sacramento, CA: California Department of Education, 2002); B. Miller, *Critical Hours: Afterschool Programs and Educational Success* (Quincy, MA: Nellie Mae Education Foundation, 2003).

[17] R. Rothstein, *Class and Schools*, p. 57-58.

[18] University Park Campus School is not included in this analysis because it no longer offers a longer school day.

[19] Budget information is not shown for KIPP Academy Lynn because the school was not in operation during FY2004 and, therefore, a complete year of audited financial information is not available. KIPP Academy New York is not included because the process used for financing and managing charter schools in New York is very different from that used in Massachusetts.

[20] Per-pupil expenditures are calculated based on 2004 annual reports from the two schools and Massachusetts Department of Education 2004 Year End Pupil and Financial Reports for Boston and Lawrence. Total district expenses include spending from state and federal grants as well as municipal contributions. Tuition paid to non-district schools and payments for retired teacher benefits are excluded from total district expenses.

[21] Cost per student is shown with both the inclusion and exclusion of facilities costs because districts and charter schools have very different cost structures for facilities. These two charter schools spend less on facilities on a per student basis than the district public schools. Facilities costs excluded for the district schools include all capital expenditures and rent. Because the charter schools do not have capital expenditures, their spending on rent is excluded. General maintenance of facilities is included for both district and charter schools.

[22] Rennie Center for Education Research and Policy, *Head of the Class: Characteristics of Higher Performing Urban High Schools in Massachusetts*, 2003, and "The 100 Best High Schools in America," Newsweek, May 16, 2005.

[23] In Boston, students are admitted to schools through a lottery system. Parents request the schools they most want their children to attend. Source: Boston Public Schools Student Assignment Office.

[24] M. Fullan, *The New Meaning of Educational Change* (New York: Teachers College Press, 1991). C. Glickman, *Leadership for Learning: How to Help Teachers Succeed* (Alexandria, VA: Association for Supervision and Curriculum Development, 2003). M. Wheatley, *Leadership and the New Science: Learning About Organization from an Orderly Universe* (San Francisco: Berett-Koehler, 1994).

[25] L. Darling-Hammond and G. Sykes, eds., *Teaching as the Learning Profession* (San Francisco, CA: Jossey-Bass, 2003). J.W. Warren Little, et al, "Looking at Student Work for Teacher Learning, Teacher Community, and School Reform," *Phi Delta Kappan*, 85:3, November 2003, pp.184-92. A. Lieberman and L. Miller, *Teachers Caught in the Action: Professional Development That Matters* (New York: Teachers College Press, 2001).

[26] S. Rallis and M. MacMullen "Inquiry-Minded Schools: Opening Doors for Accountability," *Phi Delta Kappan*, 81:10, June 2000, pp. 766-73.

[27] R. Barth, *School Culture: Learning by Heart* (San Francisco, CA: Jossey-Bass, 2001).

[28] J. Epstein, et al., *School, Family, and Community Partnerships: Your Handbook for Action* (Thousand Oaks, CA: Corwin Press, 2002).

[29] J. B. Carroll, "A Model of School Learning," *Teachers College Record*, 64:8, 1963, 723-33.

[30] On this concept of trying to quantify the amount of time needed to learn a particular task, see M. Gettinger, "Time Allocated and Time Spent Relative to Time Needed for Learning as Determinants of Achievement," *Journal of Educational Psychology*, 77:1, 1985, pp. 3-11.

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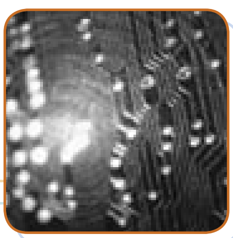
The STEM Workforce Challenge:

the Role of the Public Workforce System in a National Solution for a Competitive Science, Technology, Engineering, and Mathematics (STEM) Workforce



April 2007

The STEM Workforce Challenge:

the Role of the Public Workforce System in a National Solution for a Competitive Science, Technology, Engineering, and Mathematics (STEM) Workforce

April 2007

This report was prepared for the U.S. Department of Labor, Employment and Training Administration by Jobs for the Future.

The STEM Workforce Challenge and the Role of the U.S. Department of Labor in a National Solution

Executive Summary

Science, Technology, Engineering, and Mathematics (STEM) fields have become increasingly central to U.S. economic competitiveness and growth. Long-term strategies to maintain and increase living standards and promote opportunity will require coordinated efforts among public, private, and not-for-profit entities to promote innovation and to prepare an adequate supply of qualified workers for employment in STEM fields.

American pre-eminence in STEM will not be secured or extended without concerted effort and investment. Trends in K-12 and higher education science and math preparation, coupled with demographic and labor supply trends, point to a serious challenge: our nation needs to increase the supply and quality of "knowledge workers" whose specialized skills enable them to work productively within the STEM industries and occupations. It will not be sufficient to target baccalaureate and advanced degree holders in STEM fields. Our nation's economic future depends upon improving the pipeline into the STEM fields for sub-baccalaureate students as well as BA and advanced degree holders, for youth moving toward employment and adults already in the workforce, for those already employed in STEM fields and those who would like to change careers to secure better employment and earnings.

The seriousness of this challenge has penetrated public and opinion-makers' consciousness—and government, industry, and education and training providers have begun to respond. NIH, NSF, and the Department of Education have been leading the federal effort. Industry associations, individual firms, foundations, and other organizations have identified and tried to fill gaps. State governments, too, are working to strengthen the STEM workforce pipeline. Much remains to be done, though, within government and across diverse sectors, to ensure that U.S. education, workforce, and economic systems rise to the STEM challenge.

The U.S. Department of Labor is already an important partner in federal efforts to strengthen the science, technology, engineering and math (STEM) pipeline. The U.S. Department of Labor invests about $14 billion a year in the nation's workforce system and in increasing the skills and education of our current workforce. In addition, the Department of Labor has begun investing regionally in ways that overcome typical fragmentation in planning and action among industry, government, non-governmental organizations, and education and training institutions.

The Department of Labor has the potential to play an even more important role in addressing gaps in the nation's approach to strengthening the STEM pipeline in three areas: 1) building the gateway to STEM careers; 2) enhancing the capacity of talent development institutions to produce more and better skilled STEM workers; and 3) catalyzing and supporting innovation, entrepreneurship, and economic growth. The leadership of the Employment and Training Administration is committed to—and stands ready to—contribute and collaborate to develop an overall national strategy around the STEM workforce pipeline and to improve coordination across federal agencies.

The STEM Challenge to U.S. Competitiveness and Growth

There is broad consensus that the long-term key to continued U.S. competitiveness in an increasingly global economic environment is the adequacy of supply and the quality of the workforce in the STEM fields. Scientific innovation has produced roughly half of all U.S. economic growth in the last 50 years (National Science Foundation 2004). The STEM fields and those who work in them are critical engines of innovation and growth: according to one recent estimate, while only about five percent of the U.S. workforce is employed in STEM fields, the STEM workforce accounts for more than fifty percent of the nation's sustained economic growth (Babco 2004). Opinion leaders and the public broadly agree that education in math and science is critical to the nation's future success. According to a recent Educational Testing Service survey, 61 percent of opinion leaders and 40 percent of the general public identify math, science and technology skills as the most important ingredients in the nation's strategy to compete in the global economy (Zinth 2006).

This engine of growth is increasingly precarious in today's global economy. The Business Roundtable (2005) warns that, if current trends continue, more than 90 percent of all scientists and engineers in the world will live in Asia. The Business-Higher Education Forum (2005) concludes: "Increased global competition, lackluster performance in mathematics and science education, and a lack of national focus on renewing its science and technology infrastructure have created a new economic and technological vulnerability as serious as any military or terrorist threat." The seminal National Academy of Sciences study, *Rising Above the Gathering Storm* (2006), argues that, absent a serious and rapid response, the U.S. will lose quality jobs to other nations, lowering our standard of living, reducing tax revenues, and weakening the domestic market for goods and services. Once this cycle accelerates, it will be difficult to regain lost preeminence in technology-driven innovation and its economic benefits.

The STEM education and workforce challenge is multi-faceted.

- *Many students never make it into the STEM pipeline, because of inadequate preparation in math and science or poor teacher quality in their K-12 systems.* Of the 2005 high school graduates who took the ACT test, for example, only 41 percent achieved the College Readiness Benchmark in mathematics and 26 percent achieved that benchmark in science (ACT 2006).
- *Many who are academically qualified for postsecondary studies in science and math fields at both the two- and four-year levels, don't pursue those programs: They might be dissuaded by disappointing postsecondary experiences, high tuition or demanding curricula and courses of study, relatively low salaries in STEM fields compared to other professions, or the lack of role models with whom they can identify (American Association of State Colleges and Universities 2005).* Whatever the reasons, trends in undergraduate and graduate enrollment in the biological, engineering, and physical sciences are troubling, as modest growth in STEM field degree graduates is being eclipsed by more dramatic growth in graduates from non-STEM programs (U.S. Government Accountability Office 2005).

- *The low engagement with STEM-related learning is particularly acute among minority, female, and lower-income students, who comprise a growing proportion of the total college-going public.* In the 2000 National Assessment of Educational Progress for twelfth grade students, about three out of four white and Asian students scored at or above basic level (which is far below proficient) on the math assessment, while fewer than half of Hispanics and under a third of African American students attained that level (National Science Foundation 2005).

Preparation for STEM success is one concern. Equally important are trends in the overall supply and employment of STEM field workers.

- *A large segment of the existing STEM workforce is approaching retirement age with the rest of the baby boomers.*
- *Women appear to be choosing non-STEM employment opportunities with increasing frequency.* According to industry data, for example, the percentage of women in the IT workforce declined from a high of 41 percent in 1996 to 32 percent in 2004, even as the percentage of women in the workforce as a whole remained steady at around 46 percent during that period (Information Technology Association of America 2005).
- *In addition, the reliance on immigrants for meeting employer demand for skilled STEM workers has become increasingly problematic.* In the wake of September 11, foreign immigration has become more complicated and visa processes have been tightened. In addition, as other countries expand their STEM-related economic growth, some who might have sought employment opportunity in the U.S. are able to find good jobs closer to home.

The STEM workforce pipeline challenge is not just about the supply and quality of baccalaureate and advanced degree earners. A large percentage of the workforce in industries and occupations that rely on STEM knowledge and skills are technicians and others who enter and advance in their field through sub-baccalaureate degrees and certificates or through workplace training. Competitiveness in STEM fields requires a focus on the skills and the supply of those involved in STEM fields from the most complex research and development and leadership positions to production, repair, marketing, sales and other jobs that require competencies built upon math, science, engineering, and technology knowledge. Getting more Americans ready for, interested in, and sufficiently skilled to be productive in STEM-related jobs will require attention to segments of the workforce that are often overlooked in STEM discussions: incumbent workers who need skill upgrading, dislocated workers who are trying to find new jobs in industries with a future, and individuals from groups traditionally underrepresented in STEM fields. The Department of Labor has an important role to play in this arena.

Responding to the STEM challenge will require a concerted and multi-faceted approach. No single agency can respond effectively. Tax, immigration, and innovation policies need to be reviewed through the lens of the STEM pipeline. Perhaps most important, education and workforce preparation policies need to be carefully reassessed.

This will require changes in: K-12 students' foundational preparation in math and science; improvements in access to and success in science, math and technology education and training both in our elite research universities and in the thousands of two- and four-year educational institutions that prepare most Americans for employment; stronger teacher and faculty training in the STEM disciplines; more effective linkages and economic signals between the education/talent development sectors and the employers who depend upon their graduates; better assessments of the quality of STEM-related education and programming; and strategies that expand and deepen workplace-based training and retraining for STEM workers at all levels.

No single sector of society can respond adequately in isolation from others. Much greater collaboration is called for: within the federal government; across different levels of government; and among the key business, government, and non-governmental institutions whose policies and practices shape the quality and quantity of the STEM workforce.

The STEM Fields and the STEM Workforce Pipeline

Science, Technology, Engineering, and Mathematics (STEM) related fields are many and diverse. About 150 different college majors have been identified by the National Science Foundation as STEM majors. Equally diverse are the industries in which STEM jobs are critically important to growth and competitive success. Some of these industries are obvious: advanced manufacturing, biotechnology, chemical engineering, energy, actuarial science and health care all rely on high-level skills and education in the STEM fields in their workforce. Other industries may seem less obvious for their reliance on STEM knowledge and skills, such as construction, retail, transportation, and hospitality. But changing technology and expectations of the workforce in these industries make STEM knowledge important even in these industries. For example, mechanics in the trucking industry must deal with sophisticated computer technology in both diagnostics and repair procedures. In construction, the increased importance of math and technical knowledge on the construction site and in construction business offices has become an obstacle to entry into apprenticeship and other training programs for individuals who fifteen years ago would have easily found their way into those programs.

According to the U.S. GAO (2005), employment in STEM fields rose from an estimated 7.2 million to around 8.9 million in the years between 1994 and 2003—an increase of about 23 percent during a time when non-STEM employment rose by only 17 percent. The Bureau of Labor Statistics (2006) projects significant growth in the overall STEM workforce between now and 2014; of the 20 fastest-growing occupations over the coming decade, 17 will be in health care and computer fields.

The overwhelming majority of the last decade's expansion in STEM employment was in computer and math fields (78 percent) as opposed to science (only 20 percent growth) or engineering fields (no apparent growth). Getting sufficient numbers of individuals qualified for advanced education in STEM is one challenge; but connecting qualified and skilled workers to jobs in their fields is also problematic, particularly in science and engineering. A recent NSF report found that two-thirds of workers with science and engineering degrees are employed in positions that are only somewhat or not at all related to their educational expertise.

Current Responses to the STEM Challenge

The steady drumbeat of industry, government, and educators' warnings about the future of technology-based growth has led to important action by various stakeholders to address weaknesses in the pipeline into STEM occupations and fields in the United States.

Federal government: The federal government has taken a hard look at its own activities to support STEM and made efforts to coordinate and expand them. In October 2005, the U.S. GAO issued a report cataloguing and assessing the impact of federal programs designed to increase the number of students and graduates or to improve educational programs in the STEM fields. The agency found 13 different federal civilian agencies spent about $2.8 billion in fiscal year 2004 for over 200 different programs, mostly within the National Institutes of Health and the National Science Foundation. Although about half of the programs had evaluations as part of their investment, agencies reported little about the effectiveness of these investments. More recently, the National Science and Technology Council (2006) catalogued and issued recommendations for improving the impact of the federal investment in STEM education research, with particular focus on the Department of Education, NIH, and NSF, noting several ways that federal agencies can work together to ensure that gaps in STEM education research will be adequately funded and that research will be effectively disseminated to policymakers.

In his 2006 State of the Union Address, President George W. Bush announced the American Competitiveness Initiative. The Initiative promotes American innovation, emphasizes the need to increase the nation's ability to compete in the global economy, and promotes growth of the workforce's knowledge base, skill level, and use of technology. A week later, the budget act signed into law included an Academic Competitiveness Council chaired by the Secretary of Education and consisting of members of the federal government whose agencies have education programs in science, technology, engineering and mathematics. In FY 2007, Congress committed $5.9 billion to increase investments in research and development, strengthen education, and encourage entrepreneurship.

Industry: Industries and firms dependent upon a strong science and math workforce pipeline have launched a variety of programs that target K-12 students and undergraduate and graduate students in STEM fields. Industry associations that include the Society for Manufacturing Engineers, the American Chemical Society, the American Physical Society, the National Association of Manufacturers, and the National Science and Technology Education Partnership invest in STEM education initiatives that involve curricular improvements, career-focused websites, mentoring programs, scholarships, and other incentives and supports. Individual firms and their corporate foundations, including Raytheon, Bayer, and General Electric, have created outreach efforts of their own (Delaware Valley Industrial Resource Center and National Council for Advanced Manufacturing 2006).

Foundations: Foundations, too, are investing in efforts to promote expanded enrollments and success in STEM education, particularly among groups traditionally underrepresented in these programs. Project Lead the Way operates in more than 1000 schools in almost all the nation's states, promoting pre-engineering courses for middle and high school students. The Alfred Sloan

Foundation has invested in a career information website targeted to pre-college, college, and early career professionals regarding STEM occupations and opportunities. The Bill and Melinda Gates and the Michael and Susan Dell Foundations have collaborated with the State of Texas on an ambitious new Texas Science, Technology, Engineering and Math (T-STEM) Initiative to create new T-STEM Academies across the state, establish a best practice network, and support other efforts to increase the number of young people who enter STEM postsecondary programs.

State government: According to a recent Education Commission of the States report, state governments are also beginning to respond. Some are raising graduation requirements in mathematics and science. Others have developed or imported pre-engineering curricula for high schools. Other areas for state action have included teacher training and recruitment, dual enrollment in STEM courses, real-world learning opportunities for students in science and technology courses, and grants to students who pursue STEM postsecondary programs and employment (Zinth 2006).

The entrepreneurial spirit that motivates these varied and vibrant efforts is impressive. But much more can and must be done. To date, these critical efforts at the national, state, and local levels have focused primarily on students at four-year universities and traditional high schools. If the pipeline for a qualified and flexible STEM workforce is to expand to meet the growing need, the nation must look to attracting and educating additional, less traditional pools of potential STEM workers: incumbent workers, dislocated workers, students working toward community college technical credentials, even students in alternative education settings who are trying to find their way back into the economic and educational mainstream. To tap these potential sources of new STEM employees, all the nation's talent development systems need to work in concert.

The Department of Labor, which coordinates a national public workforce development system and $14 billion of investments in workforce skills, is an important stakeholder and potential contributor to a robust national strategy for tackling the STEM workforce pipeline challenge. The Department's Employment and Training Administration is already deeply involved in supporting efforts to prepare more STEM workers. Its experience, capacity, and training and education assets puts the Department in a position to help the nation address this critical economic and security challenge—and to integrate its efforts to support innovation and growth with those of others in government, industry, and the education community.

The Department of Labor's Current Contributions to a Stronger STEM Pipeline

In seeking to help fill gaps in the nation's response to the STEM workforce challenge, the Department of Labor's Employment and Training Administration seeks ways to employ its infrastructure, capacity, investments, and initiatives for maximum impact. The Department's $14 billion of activities and investments in talent development is a significant asset. Moreover, the Department's unique commitment to regional workforce quality and economic growth strategies provides a powerful structure for collaboration and alignment across funding streams and public and private stakeholders.

Specifically, in collaboration with multiple agencies across the federal government, the state and local workforce investment system, and a wide array of strategic partners in the public and private sectors, ETA is committed to:

- **Building the gateway to STEM careers** by helping to prepare an educated, skilled STEM workforce in the context of its investments in preparing talent for economic development in regional economies;
- **Enhancing the capacity of talent development institutions** to produce more and better skilled STEM workers through investment of Department resources and through greater integration and alignment of existing public and private resources, so that more workers have access to postsecondary opportunities;
- **Catalyzing and supporting innovation, entrepreneurship, and economic growth** that can expand STEM employment opportunities.

Many of the Department's major initiatives are directly relevant to national strategies to improve STEM workforce pipeline outcomes. These include:

- *President's High Growth Job Training Initiative:* This initiative is ETA's foundation effort for engaging business, education, and the workforce investment system to work together to develop solutions to the workforce challenges facing high growth industries, including those industries with significant STEM-related employment. ETA identified fourteen sectors that are projected to add substantial numbers of new jobs to the economy or affect the growth of other industries or are being transformed by technology and innovation requiring new sets of skills for workers. The fourteen sectors are:
  - Advanced Manufacturing
  - Automotive
  - Construction
  - Financial Services
  - Geospatial Technology
  - Homeland Security
  - Information Technology
  - Transportation
  - Aerospace
  - Biotechnology
  - Energy
  - Financial Services
  - Health care
  - Hospitality
  - Retail

The initiative invests in national models and demonstrations in these sectors, many of which have high and growing concentrations of employment that is STEM-based. Initial investments have targeted the health care, biotechnology, advanced manufacturing, and construction sectors, among others.

Here are a few examples of the Department's STEM-related investments through this initiative: In the geospatial industry, for example, the University of Southern Mississippi is working with community colleges and industry partners to develop career ladders and apprenticeship training programs. In the advanced manufacturing industry, the Arkansas Department of Workforce Services focuses on training for technicians in such STEM-reliant fields as programmable logic controllers, plastics engineering, and robotics. The program includes a college, community colleges, the state WIB, and the state departments of Workforce Education, Economic Development, and Higher Education. In health care, the CVS Regional Learning Center is implementing pharmacy technician training programs for incumbent workers as well as people looking to enter the industry for the first time.

Community-based Job Training Grants: This relatively new competitive grants program, which builds upon the High Growth Job Training Initiative, is designed to improve the capacity of community colleges to train workers in skills needed by regional employers. It recognizes that many job opportunities of today and tomorrow require postsecondary education and training and that our community colleges will play an increasingly important role in developing the skills and talent of American workers. In 2005, $125 million in grants were made to 70 community colleges in 40 states. A second competition was conducted in 2006. Because the grants are targeted to the fourteen sectors defined above as having either high growth or high demand, many of these grants promote community college programs that prepare individuals for work in these sectors.

Northwest Iowa Community College is developing a biotech initiative that will combine a high school science curriculum component, an Associates Degree Lab Technician program for biotechnology careers, and a skills enhancement component for incumbent workers. Tanaka Valley College of the University of Alaska in Fairbanks is developing a set of curricula in technical skills needed in the state's energy industry that can be delivered in industry-based instructional sites with industry instructors. These funded programs involve multiple workforce partners including community colleges, local and/or state WIBs, businesses, trade associations, and K-12 education.

Workforce Innovation in Regional Economic Development (WIRED) is ETA's flagship initiative that focuses on the role of talent development in driving regional economic competitiveness, increased job growth, and new opportunities for American workers. The WIRED initiative is a regional initiative; it focuses on labor market areas that are comprised of multiple jurisdictions within state or across state borders, enabling Governors a unique opportunity to design and implement strategic approaches to regional economic development and job growth. Designed particularly for regions hard hit by global trade, dependent upon a single industry, or recovering from natural disasters, WIRED emphasizes strategic partnerships to accelerate and support regional transformation linking economic development, workforce, and education systems. To date, twenty-six regions have been selected for participation. In many of these efforts, collaboration to catalyze talent development for STEM-related fields is at the core of the regional strategy.

The Northwest Florida Initiative is designed to create high wage high skill jobs in the target industries of aerospace and defense, life sciences, information technology, electronics engineering, and construction. The Denver regional strategy will focus on partnerships to address the "Colorado Paradox" of high in-migration of skilled and educated workers coupled with comparatively poorly-performing K-12 and higher education institutions in-state. The initiative will focus on raising standards in local educational institutions and reversing the current pattern. The California Innovation Corridor noted that it has the greatest concentration of potential innovation assets in the world; however it continues to seek to "Grow its Own" in order to meet the challenges of competing in the regional and global market as well as educating enough qualified technical workers to fill sectors of California's high-tech economy. This WIRED grant has a three-tiered approach: Innovation Support, Industrial Rejuvenation, and Talent Development.

National Emergency Grants and Dislocated Worker funds: An important component of the Department of Labor's portfolio is its responsibility to minimize the negative economic and employment impacts of dislocation from plant closings, regional employment shifts, and global competition. The Department provides funds that are spent for training and retraining services for dislocated workers, through the local and state public workforce system. The Department also makes available to local workforce investment boards National Emergency Grant funds for large group layoffs. While these resources are available for employees in all industries, the importance of STEM fields for American competitiveness and economic growth has led to increased allocation of these funds for STEM-related training and skill development. Funds have been used to train workers on new technologies, to enable them to earn industry certifications, and to provide entrepreneurial training and skills for workers interested in opening their own small businesses. An example of how these funds can support STEM pipeline activities: in the Merrimack Valley of Massachusetts, when Lucent Technologies laid off a large number of workers, dislocated worker and NEG funds were used to retrain STEM workers for employment in the defense and homeland security industries (Lazonick and Quimby 2006).

Interagency Aerospace Revitalization Task Force: In the last session of the 109th Congress, H.R. 758 was passed and signed by the President. This new legislation, which originated in the House Committee on Commerce, Science and Transportation, establishes a new Federal Interagency Aerospace Revitalization Task Force intended to develop a strategy for the federal government for aerospace workforce development. The legislation appoints the Assistant Secretary of Labor for Employment and Training as the Chairperson of the Task Force. This is further evidence that Congress has identified the critical role workforce development plays, and therefore the Department of Labor, in ensuring that one of the nation's most important STEM related industries has a stable, high-skilled job pipeline necessary to compete globally in this highly competitive industry.

InDemand Magazine: InDemand Magazine is a quarterly publication that the Employment & Training Administration produces to connect today's students with the careers of tomorrow. It is available on CareerVoyages.gov and each issue explores careers in a different high growth industry. It provides students, as well as guidance counselors, parents and teachers, with interesting and relevant information and tips about career opportunities; education and the skills needed for various jobs; and how to help students build successful futures. There are opportunities for young people in fields ranging from art to math, from sports to science, and from design occupations to the trades.

These and other Departmental efforts—including youth employment funding under WIA, WIA adult worker programs, the longstanding registered apprenticeship system, and faith and community-based organization programs funded by ETA—give the Department an opportunity to address serious gaps in the nation's STEM workforce pipeline strategy and to augment and help integrate investments available through other federal and other public and private sources.

A Call to Action: Toward a Pro-Active Response to the STEM Challenge

The Department has embraced the beginnings of an action agenda that, in collaboration with other stakeholders and investors, should help to: expand the pool of potential STEM workers; strengthen the gateway for non-traditional populations into STEM careers; ease the transition for dislocated or transitioning workers into STEM fields; and integrate national, state, regional, and local efforts into a more powerful set of partnerships and coordinated strategies.

Some specific contributions that the Department can—and does—make to this agenda include the following:

> *Building the Gateway to STEM Careers:* Labor Department programs can promote alternative learning models in STEM education; support the development of career awareness materials highlighting employment in high growth, high demand STEM industries; establish a framework for defining competencies and skills essential for 21st century STEM workers; and explore the use of technology-based learning for STEM competencies.
>
> *Enhancing the Capacity of Talent Development Institutions:* Labor Department investments can support community college efforts to train workers for STEM occupations; develop competency-based apprenticeship and internship models in STEM fields; promote the professional development of teachers, recognizing education as a high growth industry; and strengthen the public workforce system's capacity to support employer commitment to developing a skilled STEM workforce.
>
> *Catalyzing and Supporting Innovation, Entrepreneurship, and Growth:* The Department's activities can accelerate the development and success of emerging and leading growth companies through access to resources, expertise, and private sector networks; invest in entrepreneurship and intrapreneurship talent development strategies; and assist entrepreneurs in finding and strengthening the skills of their workforce as their firms grow.

These kinds of investment priorities can provide important leadership and address gaps and opportunities that currently constrain the nation's ability to generate sufficient qualified and prepared workers for the STEM fields—from the most skilled research and technical scholars to the production, service, and technician-level employees who are so critical to industry health and growth. These investments will have even greater impact if they can be linked effectively with the investments of other stakeholders, starting with other federal agencies (particularly the Department of Education, NIH, and NSF) and extending to industry, foundations, and state governments across the nation.

The time is now for coordinated efforts to seed innovative new ideas, incubate the most promising of these initiatives, and scale demonstrably successful programs to strengthen the STEM pipeline. The Department of Labor's Employment and Training Administration is committed to partnering with others in the public, private, and not-for-profit sectors to achieve this critically important goal. The future well-being, security, and prosperity of the nation depend upon our collective success.

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U.S. Chamber of Commerce
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PRE-K – 12 EDUCATION
Policy Declaration

Introduction

To keep America competitive and strong, the business community must be actively engaged on issues related to our nation's educational system as a means to ensure an educated citizenry of self-sufficient, lifelong learners who have the skills needed to thrive in the global workplace, today and in the future. The coordination of community resources, school support systems, family engagement programs, and classroom teachers' efforts can diminish the barriers to learning. Employer engagement must be significant and have the ability to address some of the greatest challenges facing education in this country. These challenges include the lack of preparation of early learners who enter school for the first time, the significant learning and education gaps among groups of students, as well as the unacceptable number of students who never complete a secondary education or have the skills necessary to enter the world of work or continue on with higher education.

I. Building the Foundation - Early Childhood and Pre-K

Studies by the Federal Reserve Bank of Minnesota reveal that the capacity for developmental skills begins in the first five years of life. This is the beginning point for a person's creativity, communication, team working, problem solving, and critical thinking skills. These studies reflect that there is a great need for children to enter kindergarten prepared to learn. Unfortunately, too few young children today are in fact prepared with these tools. The U.S. Chamber of Commerce believes that to begin to address this issue of maximizing educational effectiveness, while remaining fiscally responsible, there must be far greater coordination among the existing patchwork of federal, state, local, and private early childhood programs. Through these efforts, states and localities should strive to provide access to high quality programs for all children. These programs should include a strong family engagement component to facilitate early literacy development; should focus on academic preparation; and be held accountable for their performance. Research shows that lasting benefits of Pre-K programs only persist when staff is professionally prepared and high quality standards are maintained.

II. Identifying Elements of a Successful K-12 System

The toughest, most important competitive race in the 21st Century worldwide economy will be the global race for talent and workers. For the American Dream to thrive, it will require economic prosperity and opportunity for every American—and that requires a quality, rigorous, well-rounded education that prepares our youth for the challenges of today and tomorrow. To ensure every child receives a quality education, the Chamber believes there needs to be a focus on human talent, effective systems, innovation, and measurement.

A. Human Talent

States and districts must ensure that teachers are effective. Study after study has shown that teacher quality has the biggest impact on student achievement of all school-related factors. Not only does the research show that effective teachers do the most to help students learn, it also shows the negative impact of inexperienced and out-of-subject teachers on student performance. With 40% of teachers and principals approaching eligibility for retirement, efforts to raise the bar for educators have taken on added urgency. Dramatic increases in student learning will require better teacher preparation programs, well-designed professional development opportunities, good working conditions, and the creation of nontraditional teaching paths. The business community believes that starting pay for teachers must be improved while avoiding lock-step salary increases. Providing career advancement opportunities and financial rewards are proven methods of motivating employees in every profession, and the same is true of teaching.

States and districts must:

- Align preparation, recruitment, induction, retention, and professional development with the knowledge and skills needed to improve student performance.
- Evaluate schools of education and other organizations that train educators by measuring the impact of their graduates on students' academic achievement.
- Reform pay and performance structures to improve starting salaries; reward teachers whose performance contributes to substantial growth in student achievement; attract and retain effective instructors in subjects experiencing teacher shortages, notably math and science; draw effective educators to high-need schools; and fairly and efficiently remove ineffective educators.

Successful businesses use well-documented management and leadership practices that result in lean, accountable, flexible, high-achieving organizations. Yet these practices are often absent in school management. States and districts are not held accountable for their academic outcomes relative to their expenditures. Nor are principals consistently given the authority to make the decisions for which they are held accountable, from allocating school budgets to hiring new teachers.

States and districts must:

- Hold state education officials and district superintendents accountable for their spending relative to the academic outcomes of students in their districts.
- Increase the authority principals have over budgets and personnel decisions.
- Insist that education leaders implement policies that create greater transparency surrounding spending, staffing, student achievement, and other aspects of school management.

B. Effective Systems

The Chamber believes the existing accountability framework reflected under the Elementary and Secondary Education Act must be strengthened. Specifically, States must have standards and assessments in place to measure student achievement in core academic subjects for all students, and sanctions and rewards for schools based upon their performance towards moving all students toward proficiency.

1. Standards and Rigor

While all States currently have education standards in place at the elementary and secondary levels, too often these standards lack the rigor necessary to ensure that students meeting the standards throughout their school career will have the skills necessary to succeed in postsecondary education or the workplace.

Throughout the States, there should be clear and measurable standards for core academic subjects that are set by the state with input from the business community and institutions of higher education and which reflect what it means to be ready for a postsecondary education and the workplace. These standards and assessments should be benchmarked to the best in the world.

2. Curriculum

To achieve the U.S. Chamber's goal to maintain a competitive business environment in America and to ensure that future generations are fully prepared to compete on a global playing field, students should graduate from high school with a strong grounding in reading and mathematics, advanced problem-solving skills and critical thinking capacities needed to succeed in both postsecondary education and the workplace. An effective academically demanding curriculum should include:

- Expanded learning time.
- Expanding Advanced Placement and International Baccalaureate programs.
- Focusing on science and math education through state and federal funding, improved teacher training and development in these fields and strengthening standards and accountability measures.
- Ensuring that business people cooperate with schools, boards of education, and institutions of higher education to assist them in developing more relevant career and technical education programs.
- Encouraging the use of rigorous, relevant, contextualized, and problem-based learning opportunities.

- Literacy across the curriculum as well as differentiated instruction for struggling older readers in order to accelerate adolescent literacy development and get middle and high school students on track for achievement and academic success.
- Utilizing distance education in such situations as when States and school districts are confronted with issues of reaching students in remote areas; reducing costs of new facilities; and enabling highly qualified educators to "virtually" teach in schools where there are shortages of such teachers.

3. **Alignment**
For students to graduate high schools with the skills and knowledge needed to succeed in postsecondary education and the workplace, there must be alignment among the state standards, curriculum, instruction, professional development, and assessments. In addition, the K-12 system must align its standards with the credit-bearing course requirements of colleges and universities as well as the employer's skill and knowledge demands to succeed in the workplace.

4. **Assessments**
While ensuring that States have rigorous standards is important, it is equally important that States accurately measure student achievement in meeting these standards through valid and reliable assessments. These assessments should be provided on an annual basis and be required of all students attending public schools within the State in order to identify students making progress toward proficiency. To help assure consistent and appropriate levels of rigor, States should produce annual benchmark reports that compare state standards and assessment systems to national benchmarks, like the National Assessment of Educational Progress (NAEP), and to other national and international benchmarks.

5. **Rewards and Sanctions**
The results of assessments must be used to identify schools that are successfully raising the achievement level of their students. In addition, assessments results must be used to identify those schools in need of improvement. These schools must create and implement real and accountable plans on how they will improve academic achievement. If the plans do not lead to school improvement, these schools must be subject to corrective action.

C. Innovation
The economic environment of the 21st century is rapidly changing. New technologies emerge constantly, bringing with them the demand for new skills, and our education system needs to keep up with the rapid pace of change. The nation needs to experiment more with new approaches to help schools and

students dramatically improve academic performance. Innovation is especially needed when it comes to tackling seemingly intractable problems like the high school dropout crisis, which requires immediate and intensive intervention in the most heavily affected communities. And our openness to new approaches must include efforts to keep students engaged and improve their achievement by expanding learning time.

Education policymakers must:

- Embrace a choice of educational options that will provide greater flexibility to parents and encourage schools to be more responsive to community needs and accountable for academic achievement.
- Implement innovative education models such as contracting with independent organizations to manage and operate schools, early enrollment in college-level courses for credit, youth apprenticeships, charter schools, small learning communities, and online learning. So long as these new institutions and programs are held accountable for academic results, giving them maximum flexibility to try new ideas would most likely yield groundbreaking approaches that, when successful, could be replicated elsewhere.
- Research and develop promising instructional practices and school models aimed at students who are not on track to graduate. A prime target for reform: the large number of high school "dropout factories" across the country that regularly post graduation rates below 50%.
- Encourage schools to expand learning time. Extra learning time provides an opportunity to reinforce the relevance of the subjects students are studying and to keep them engaged and in school. It does not necessarily mean more classroom time, however. Expanded learning time could take forms such as tutoring, differentiated instruction, after-school programs, and experiential learning offered by accountable and highly-effective public and private providers. These enrichment opportunities can be especially important for disadvantaged students.

D. Measuring Success

State and local policymakers must improve data collection and quality dramatically—then use that data to make better educational decisions. In some cases, crucial data are simply unavailable. No state, for example, can provide systematic figures on how many teachers are receiving performance-based rewards—or how many have been terminated for poor performance. In other cases, data are not used in a timely and effective manner. Too often, teachers do not receive the results of student assessments until it is too late to identify student needs and to create and implement individualized improvement plans. Finally, data are not always reliable and consistent. This data is also critical for parents, the public as well as the business community—as a means to hold our education system accountable.

States must:

- Develop statewide data systems that offer timely and accurate collection, analysis, and use of high-quality longitudinal data to track student achievement and teacher effectiveness. These data systems should include unique and privacy-protected student identifiers to track individual students or teachers across classrooms and schools.
- Adopt the common definition of graduation rate agreed to by the nation's governors.
- Provide funding to districts to train teachers on the use of data to differentiate instruction for students who are not yet proficient and for those who are more advanced.
- Collect, process, and return data to educators and administrators in time for them to use it to benefit their students, schools, and parents.

Conclusion

The Chamber is committed to the success and well-being of every child in America. We believe that our policy proposals will contribute to building an education system deserving of our nation's democratic heritage and capable of enhancing its economic competitiveness.

APPENDIX W – REFERENCES FOR DIRECT INSTRUCTION

Direct Instruction:
Its Contributions to High School Achievement

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Abstract

This paper describes the design principles, instructional practices, and specific curricula of Direct Instruction--one example of focused, systematic, explicit instruction. At a time when public schools are increasingly held accountable for students' achievement and for closing and preventing the achievement gap between minority/disadvantaged and white/advantaged students, Direct Instruction provides highly effective programs whose implementation fosters beneficial change in students' engagement and achievement, in teachers' skill at instruction and evaluation, and in the social organization of schools (e.g., strong shared mission and teacher teaming). Information in this paper will assist high school teachers and administrators to: (1) integrate Direct Instruction programs (e.g., in math, science, history, reading, and writing) in high school curricula; (2) use features of Direct Instruction (if not commercial programs) in virtually any high school classes to ensure strong student involvement and content mastery; and (3) make important contributions to district-wide school reform that involves the introduction of Direct Instruction beginning in early elementary grades and continuing through high school.

1. Introduction

For several decades the field of education has been strongly influenced by an orientation called constructivism--which includes so-called progressive, child-centered, holistic, and developmentally appropriate philosophies and practices. Constructivist principles inform the curricular and licensure standards promulgated by organizations such as the National Council for Teachers of English, the National Council for Teachers of Mathematics, and the National Council for the Accreditation of Teacher Education. In addition, constructivist principles engender and legitimize curricula in reading (e.g., whole language; Goodman, 1986), math (Davis, Maher, & Noddings, 1990), science (Brookes & Brookes, 1996), early childhood education (DeVries & Zan, 1994), and schools of education. However, public schools are increasingly criticized because: (1) a large percentage of students (from elementary schools through high schools) are not proficient in reading, writing, and math; and (2) there are unacceptable discrepancies in achievement between white/affluent students and minority/disadvantaged students. In addition, schools of education are cited for failing to produce teachers skilled at effective instruction in literacy and math (Ingersoll, 1999; National Center for Educational Statistics, 1999).

The critique of public schools and schools of education has led scholars, state legislatures, and consumer groups to examine constructivism itself. Examples of the critique of constructivism can be found in Bianchini, 1997; Chall, 2000; Grossen, 1998; Hirsch, 1996; Johnson and Immerwahr, 1994; Nola, 1997; Ravitch, 2000; Stone, 1996; Suchting, 1992; Zevenbergen, 1996; and Zolkower, 1995). The major criticisms of constructivism include the following.

1. The design principles underlying constructivist "inquiry" curricula and "developmentally appropriate" "best practices" are at odds with the large body of experimental research on learning (Anderson, Reder, & Simon, 1998; Brophy & Good, 1986; Catania, 1998; Rosenshine, 1986; Rosenshine & Stevens, 1986).

2. Constructivist "inquiry" instruction relies heavily on students "discovering" concepts, rules, and cognitive strategies in the absence of carefully tested sequences of instructional units and explicit instruction from teachers; with minimal teacher correction of errors; and without an emphasis on distributed (planned) practice to the point of mastery--to ensure fluency, retention, and independence. Therefore, constructivist "best practices" fail to foster in students strong and broad sets of competencies; favor affluent children entering school well-prepared by literate parents; and (ironically) instead of yielding equality and social justice, exacerbate the unequal distribution of knowledge and life-chances (Delpit, 1988).

3. Constructivist beliefs--that all truth is relative, that knowledge cannot be transmitted, and that students should guide their own education (beliefs whose validation rests on little more than repetition)--lead to social and individual anomie; i.e., the absence of individual and shared standards for reasoning, interpreting, and evaluating (Nola, 1997).

4. Weak skills acquired in early grades result in "cumulative dysfluency" (Binder, 1996). Students not taught to communicate, read, and reason skillfully in elementary school are unable later to learn other subjects (math, science, history) that depend on skillful communication, reading, and reasoning. Therefore, these students enter high school many years below grade level, are a source of discipline problems, and are more likely to drop out of school (Montgomery & Rossi, 1994).

The critique of contemporary education in general and constructivism/progressivism in particular--combined with efforts of state legislatures and consumer groups to hold public schools and schools of education accountable for what students learn and do not learn--appears to have fostered the increasing adoption (in public schools) of focused, explicit, direct forms of instruction validated by extensive field tests, and whose aims are high student involvement and mastery of content. The purpose of this paper is to introduce high school administrators and teachers to the major features of Direct Instruction. This introduction will help high school administrators and teachers to:

1. Increase student proficency with a variety of Direct Instruction programs for initial and remedial instruction in literacy, math, history, and science, and/or by integrating certain features of Direct Instruction in classrooms even when commercial programs are not used.

2 Participate in district wide school reform that involves integration of Direct Instruction beginning in early elementary grades--so that students enter high school well prepared.

The paper is divided into the following sections: (1) a definition of the instructivist approach (which includes Direct Instruction); (2) the mission of instructivist educators; (3) varieties of instructivist education; (4) a discussion of the implications of Direct Instruction for high school teachers and administrators; and (5) correction of myths about Direct Instruction--myths that decrease students' access to effective education.

II. A Definition of the Instructivist Approach in Education

To educate means to lead forth--to bring a person into a culture of ideas (e.g., bodies of knowledge), moral principles, and skills (e.g., reading) so the person may competently participate in and contribute to the culture--and at the same time develop his or her potentials. Systematic education (e.g., schooling) requires a curriculum (a sequence of ideas, moral principles, and skills to teach) and instruction (communication between teachers and students). This raises two questions. What generates and guides the curriculum and instruction? How does one determine how well the curriculum and instruction are educating students (and teachers)? Different approaches are defined by their answers. The instructivist approach draws on two principles and two concepts to answer these questions.

Instructivist Principles: Reality and Knowledge

In contrast to advocates of constructivism (Cobb, Wood, & Yackel, 1990; Noddings, 1990; von Glasersfeld, 1984, 1995), instructivists (Finn & Ravitch, 1996) believe that:

1. There is surely a reality that exists independently of what we may think of it. It is difficult to prove that this proposition is true. However, it is easy to show that any other proposition (e.g., that reality is all an interpretation--all in your head) leads to painful consequences (Peirce, 1877).

2. Our human species has worked for thousands of years to better understand reality, and has organized knowledge into systems called "mathematics," "science," "literature," and "history," among others. The historical role of teachers is to help students acquire this knowledge (and then to generate their own knowledge), in the form of concepts ("knowledge that"), principles or rules ("knowledge why"), cognitive strategies ("knowledge how"), and physical operations ("knowledge how to"). This is best done by teaching with clear and focused knowledge objectives in mind; teaching concepts, principles, strategies, and operations explicitly and systematically; and paying careful and continual attention to students' learning. This brings us to the concepts that guide the instructivist approach.

Instructivist Concepts: Behavior and Learning

Instructivist educators are guided by the concepts behavior and learning. Behavior is anything students do. Generally, behavior that is grist for development in education is behavior that is observable. However, inner behaviors, such as thoughts and feelings, though not directly observable except by the individual, are affected by the same environmental events and arrangements as observable behavior. Therefore, the instructivist approach in education certainly addresses how students: (1) feel (e.g., pleasure at achievement); (2) think (e.g., wonder, plan, decide, solve, mentally rehearse); and (3) act (talk, read, write, discuss). The second main concept is learning. Learning is change in behavior (feeling, thinking, acting) that results from interaction with the environment. Of course, learning is affected by health, sleep, prior learning, and maturation. It is also affected by the nature of the environment; e.g., opportunities to interact with objects and persons.

In light of the concepts behavior and learning, the instructivist approach in education simply means that an educator (college professor, school principal, classroom teacher, student intern):

1. Draws on the enormous literature on how human beings learn, to design curricula and forms of communication (instruction) that are congruent with students' competencies, preferences, needs, and capacities. And

2. Focuses on changes in students' behavior (learning) as a way of keeping track of students' progress and the adequacy of their education.

III. The Mission of Instructivist Educators

The mission of instructivist educators is to create environments with students that will foster students' (and teachers'): (1) investment in the educational process; (2) prosocial participation in the class as a community; (3) conceptual knowledge (e.g., concepts and propositions in reading, science, social studies, math, and higher-order thinking, or reasoning); (4) practical knowledge (e.g., cognitive strategies and physical operations for skillful problem solving); and (5) an increasing ability to direct their own learning. Instructivist educators believe that virtually all students can succeed, and when they do not succeed, something is wrong with instruction.

> ...we begin with the obvious fact that the children we work with are perfectly capable of learning anything that we can teach... We know that the intellectual crippling of children is caused by faulty instruction--not by faulty children. (Engelmann & Carnine, 1991, p. 376)

From as long ago as the 1950's, instructivist educators have been guided by an ethic of social justice--i.e., equal access of all individuals and groups to effective education and to the opportunities for self-development, jobs, and social contributions that depend on effective education. Instructivist educators were among the first to create programs to improve education for disadvantaged children and their families (Bereiter & Engelmann, 1966); to prevent or replace antisocial behavior in children; to humanize large, custodial training schools that warehoused persons with disabilities; and to develop effective treatments for persons with a variety of illnesses or conditions, including depression, schizophrenia, anxiety disorders, stroke, and cancer. This early and more recent work is described in Gardner et al. (1994), Ullmann and Krasner (1966), and Ulrich, Stachnick, and Mabry (1970).

Because of its distinctive methods of instruction and effectiveness, instructivist education has been successful where curricula based on other philosophies have failed with challenged individuals. This has led some educators to assume that instructivist education is suitable only for these populations. This unfortunate inference is as illogical as providing supernutritious food only to the most malnourished. In fact, instructivist education is field tested with all sorts of populations, including challenged, average and gifted learners, and is highly effective with all (Gardner et al, 1994).

Finally, instructivist educators feel a moral imperative to design and participate with students in effective educational environments.

> We function as advocates for the children, with the understanding that if we fail the children will be seriously pre-empted from doing things with their lives, such as having career options and achieving some potential values for society. We should respond to inadequate teaching as we would to problems of physical abuse... We should be intolerant because we know what can be accomplished if children are taught appropriately. (Engelmann & Carnine, 1991, p. 376)

IV. Varieties of Instructivist Education

The instructivist approach has three prominent, related, but distinct branches--applied behavior analysis, Precision Teaching, and Direct Instruction. When these are combined, the educational environment gives students the maximum chance of learning all of the curriculum at their own pace, while fostering creativity, community, and independence (Binder & Watkins, 1990).

Applied Behavior Analysis

Applied behavior analysis is not one distinct curriculum (Schloss & Smith, 1998). It is a loosely coupled set of practices derived from decades of experimental research on how environmental events and arrangements affect "operant" learning; i.e., learning in more or less voluntary behavior (Skinner, 1938, 1953). The major contributions of applied behavior analysis include: (1) methods for discovering functional relationships between features of students' environments (e.g., difficulty of tasks, pacing of instruction) and students' participation and achievement; (2) using knowledge of functional relationships to design instruction consistent with students' individual skills, preferences, and requirements; e.g., for less noise or more frequent feedback; and (3) methods for evaluating the adequacy of curriculum and instruction by keeping careful track of each student's (and the whole class's) learning, and revising curriculum and instruction accordingly.

Precision Teaching

The second branch of the instructivist approach is Precision Teaching. Precision teaching was developed by Ogden Lindsey and his associates, who have kept records on over 500,000 precision teaching programs conducted through the years (Binder, Haughton, & Van Eyk, 1990; Haughton, 1980; Johnson & Layng, 1996; Lindsley, 1993; Potts, Eshleman, & Cooper, 1993). Lindsley based Precision Teaching on Skinner's discovery that the rate of a behavior (the number of occurrences per unit of time) is a dimension of the behavior, and not just a measure of the behavior. This implies that fluent (automatic, effortless, fast, and accurate) behavior differs fundamentally from behavior that is not fluent. Following are features of Precision Teaching.

1. Teachers identify and teach "tool skills" (component skills or knowledge) needed to learn complex (composite) skills and knowledge. For example, (a) skill at listening to a teacher, following her argument and taking notes, combined with (b) fluency with math facts, the concept of ratio, and simple arithmetic operations, facilitate students' learning algebra. When students are not fluent with tool skills (e.g., reading and writing), they are unable to learn complex skills (e.g., comprehending text, solving math problems) in which the tool skills are embedded. In other words, early dysfluencies are compounded. This "cumulative dysfluency" (Binder, 1996) yields low expectations of success, disruptive or withdrawn behavior, diagnosis of learning disability, and/or dropping out (McDermott, 1993; Montgomery & Rossi, 1994). For instructivist educators, this is a failure of instructional design, not of students.

2. Teachers provide carefully planned, short practice sessions on older and new skills to strengthen fluency, retention, and independence. These sessions have the spirit of team (e.g., basketball) practice.

3. Teachers help students assemble component skills into complex activities; for example, using elemental knowledge of biology and experimental procedure to conduct projects.

4. Teachers help students evaluate progress; e.g., counting and charting math problems solved per minute per day, or misspelled words caught and corrected. Counting and charting (as weightlifters count repetitions), enables students to become more independent learners; they know what to look for and how to improve their skills. It is also a powerful source of self-motivation to excel and pride in achievement.

Direct Instruction

Direct Instruction is a third branch of the instructivist approach. Direct Instruction grew out of the work of Siegfried Englemann, Carl Bereiter, and Wes Becker with disadvantaged children (Becker & Carnine, 1981; Bereiter & Engelmann, 1966). Over the past 30 years, it has been developed for teaching elementary through secondary language, reading, math, history, higher-order thinking (reasoning), writing, science, social studies, and legal concepts (Adams & Engelmann, 1996; Kameenui & Carnine, 1998). The methods and materials have been rigorously tested in numerous experiments and field trials. This field testing of all curricula distinguishes Direct Instruction from other curricula and textbooks, which ordinarily receive no testing before they are adopted by schools and "tested" on children.

Moreover, Direct Instruction was compared with 12 other models of instruction in the largest education evaluation ever conducted, called Follow Through, sponsored by the U.S. Department of Education and conducted by the Stanford Research Institute (Bock, Stebbins, and Proper, 1977; Watkins, 1997). Follow Through ran from 1967 to 1995. In its early years, 75,000 children per year in 120 communities participated. The other models included the Behavior Analysis Model, the Florida Parent Education Model, and several constructivist/progressivist models that were language-oriented, "student-centered," and cognitive-developmental--including the High/Scope cognitive curriculum, the Bank Street College Model, Open Education, Responsive Education, and the Tucson Early Education Model. Scores on the Metropolitan Achievement Test, the Coopersmith Self-Esteem Inventory, and the Intellectual Achievement Responsibility Scale, showed that Direct Instruction was superior both to controls schools and to every other model in fostering basic reading and math skills, higher-order cognitive-conceptual skills, and even self-esteem (Adams & Engelmann, 1996; Becker & Carnine, 1981).

Finally, follow-up studies have been conducted with students taught with Direct Instruction. For example, Meyer (1984) followed children (predominantly Black or Hispanic) in the Ocean Hill-Brownsville section of Brooklyn who had been taught reading and math using Direct Instruction in elementary school. At the end of the 9th grade, these students were still one year ahead of children who had been in control (nonDirect Instruction) schools in reading, and 7 months ahead of control children in math. Similar results were found by Gersten, Keating and Becker (1988). Former Direct Instruction students continued to out-perform children who had received traditional instruction. In addition, in contrast to comparison groups who had not received Direct Instruction in earlier years, former Direct Instruction students have higher rates of graduating high school on time, lower rates of dropping out, and higher rates of applying and being accepted into college (Darch, Gersten, & Taylor, 1987; Meyer, Gersten, & Gutkin, 1983).

The major features of Direct Instruction are as follows (Engelmann & Carnine, 1991; Gersten, Woodward, & Darch, 1986; Stein, Carnine, & Dixon, 1998).

1. A guiding principle of Direct Instruction is that students can learn what the teacher can teach, and that if students aren't learning, the teacher isn't teaching. In other words, neither race, family background, social class, nor other factors are used to explain low achievement. Either the curriculum is ill-designed (which is unlikely because Direct Instruction curricula are extensively field tested); or the teacher is not following the curriculum exactly (generally because she has not received sufficient prior training or is not receiving timely coaching), or the teacher has not adapted the curriculum (e.g., provided extra practice) based on students' needs revealed by periodic curriculum-based measures ("mastery tests").

2. Direct Instruction focuses on cognitive learning--concepts, rules, cognitive strategies, and problem solving. It is not rote learning.

3. Curriculum development involves three analyses: the analysis of knowledge, the analysis of teacher-student communication, and the analysis of (student) behavior.

a. The curriculum developer first analyzes a knowledge system (e.g., mathematics, literacy) into logical classes and relationships.

b. These are transformed into strand sequences representing the major concepts and skills in the knowledge system. For example, literacy strands might be increasingly complex units on decoding, spelling, comprehension, and writing.

c. Each unit of knowledge is transformed into lessons with precise wording of teacher presentations (instructional communication) and specification of examples (e.g., algebra problems that require one vs. another solution strategy), so that communication is logically faultless. This enables students readily to induce ("construct") the proper generalizations and discriminations and correctly use the concepts, propositions, and strategies.

d. The curriculum developer specifies activities (e.g., answers to questions, responses to history texts) that indicate whether students have learned what the teacher was trying to teach.

In summary, Direct Instruction curricula consist of carefully crafted teacher-student communications during exercises (e.g., how to derive the slope of a line) ordered into lessons (e.g., on linear relationships), arranged into skill sequences (e.g., on functions) within levels (e.g., Algebra I).

4. The aim of instruction on any lesson is mastery. Every student should be able to perform the skill independently and without mistakes--firm and fluent. Direct Instruction teaches concepts, rules, strategies, and operations to greater mastery than typically is the case. As Binder points out:

> (E)ducational programs will be more effective in the long run if they produce a more focused, but truly mastered, repertoire rather than a broad but fragile repertoire. The latter might be said to characterize the usual educational approach in America, which introduces but never ensures mastery of a broad range of skills and knowledge. (Binder, 1996, p. 179)

Therefore, Direct Instruction curricula are organized around big ideas (Kameenui & Carnine, 1998).

> Big ideas are those concepts, principles, or heuristics that facilitate the most efficient and broadest acquisition of knowledge. They are the keys that unlock a content area for a broad range of diverse learners... (S)tudents, from the brightest to the most challenged, are likely to benefit from thorough knowledge of the most important aspects of a given content area. (Kameenui & Carnine, 1998: p. 8)

For example, big ideas in a Direct Instruction science curriculum might include "the nature of science, energy transformations, forces of nature, flow of matter and energy in ecosystems, and the interdependence of life" (Kameenui & Carnine, 1998, p. 119). These concepts "are essential in building a level of scientific literacy among all students that is necessary for understanding and problem-solving within the natural and created world" (Kameenui & Carnine, 1998, pp. 121-

122). In addition, big ideas provide for the generalization of knowledge to other areas, and serve as a context of prior knowledge to which students can assimilate new learning.

5. Concepts, rules, and cognitive strategies are not taught in isolation from each other. Instead, instruction involves *strategic integration* (Kameenui & Carenine, 1998) within and across subjects. For example, the concepts density, heat, and pressure overlap in a science curriculum. Instruction on each concept is part of a strand leading to a larger concept (e.g., convection cell) that integrates the strands. As a big idea, convection is illustrated with air circulating in a room, liquid boiling in a pot, and mantle, ocean, and ocean-land convection (Kameenui & Carnine, 1998, p. 121). In other words, the aim is to help students acquire knowledge that is rich in detail, integrated (e.g., synthesizing math, science, writing and reasoning), and generative of new questions and activities.

6. Brief (5 minute) placement tests are given for most Direct Instruction curricula to ensure that each student begins at the level and lessons for which he or she is prepared. This means that students are immediately able to learn very quickly what the teacher is teaching, and therefore learn more in less time. For example, high school students who have had prior years of ineffective reading instruction might begin the Corrective Reading curriculum on level A, where they are taught elemental strategies for decoding words. Other remedial reading students might be placed on more advanced levels of Corrective Reading, where they would be learning strategies for analyzing different forms of text.

7. The teacher closely monitors and coaches students' learning during lessons and when students are working independently or in groups. The point is to make sure students are getting the concepts, rules, cognitive strategies, and physical routines being taught. This can be done only if the teacher closely supervises and works with students.

8. Generally, students are taught in small groups of about eight to twelve so that the teacher can more easily monitor progress and provide individual help. Students in a group are equally prepared for the beginning lesson and have the same degree of need for teacher guidance. It's important to emphasize that these temporary skill groups are not tracks. Temporary skill grouping is in stark contrast to the "invisible tracking" that occurs despite teachers' apparent commitment to egalitarianism. Invisible tracking is the systematic, differential treatment of students in the usual "mixed-ability groups," in which teachers pay more instructional attention and give more approval to higher performing students, which leads to the self-fulfilling prophesy of achievement for a few students and underachievement for the many (Grossen, 1996). Direct Instruction confronts head-on the fact of real differences in students' background preparation and the right of all students to achieve. It does this by providing instruction tailored to the identified strengths and needs of the students, as determined by short placement exams. Therefore, all students have a maximum chance of learning all the material. All can succeed. Moreover, skill groupings are frequently re-evaluated. The continuous data yielded by Direct Instruction lessons and mastery tests enable teachers to alter group membership; e.g., to move some students to a faster group.

9. Lessons move at a brisk pace. This sustains attention and results in a high rate of learning opportunities--15 per minute is common.

10. Instruction is organized in a logical-developmental sequence. All the concepts, rules, strategies, and operations that students need in any lesson have already been taught. In addition, what students learn in any lesson is used in later lessons. There is no inert knowledge.

11. Lessons are scripted in the sense that the teacher knows exactly what to say to provide faultless communication, and what to ask that enables students to reveal their understanding and/or the help they need. Scripts (which teachers in time generally memorize) ensure that teachers present exercises in the most logical-developmental order and use the exact wording that most clearly communicates the knowledge task at hand.

12. The strategy the teacher uses to help students get concepts or solve problems (e.g., to conjugate French verbs) is at first explicit, or conspicuous. For example, the teacher states the steps and the rules she is using at the same time she demonstrates how to find the first differential in a calculus class. After another teacher demonstration, students are closer to solving the problem on their own; they are internalizing the explicitly presented cognitive strategy. In other words, Direct Instruction teaches students to use higher-order thinking.

13. Lessons are about 30-45 minutes long. Each lesson consists of short exercises from different strands. For example, an early lesson from the *Corrective Reading* curriculum might have three minutes (one exercise) on pronouncing new sounds; another three minutes on reading new sounds; another five minutes on reading words "the slow way"--sounding out; another five minutes on reading old words "the fast way"--blending; and five minutes of review.

The teacher-directed (verbal) part of a lesson (e.g., on multiplying parentheses in algebra) might be followed by independent and small group activity (e.g., cooperative groups or students working in pairs) to give students practice and to generalize skills to new problems. Exercises in subsequent lessons address many of the same strands but add more concepts or address harder problems or examples. This organization of strands and lessons in a logical-developmental sequence holds attention and helps students retain knowledge from one day, week, and month to the next.

14. The group and each student is always "firm" on one exercise (for example, calculating the slope of a line with the teacher) before the teacher moves to the next exercise (e.g., students calculate the slope of the same line independently). This ensures that students master more complex materials presented later, because they are firm on the concepts and rules needed to understand the teacher's subsequent communication.

Teachers are alert to mistakes and teach students immediately to identify and correct them. This is because uncorrected errors will be learned, which makes it harder and harder for students to learn new material and requires much time to remedy later. However, helping students to correct errors does not make students dependent on the teacher. In fact, correction procedures teach students to observe and improve their own behavior. This builds patience, persistence, and confidence. "If you try hard, you get it."

15. Teacher-student communication has a common format from lesson to lesson. Therefore, students need to attend only to the content of the communication, and do not have to figure out how the teacher is communicating. The general format is Model-Lead-Test-Delayed test:

a. Model: For example, in an algebra class the teacher says, "I'll show you how to use the FOIL strategy to multiply (x + y)(a - b). First, I multiply x and a, to get ax. Outside, I multiply x and -b to get -bx. Inside, I multiply a and y to get ay..."

b. Lead: This step is guided practice; teacher and students work the same problem together. For example, the teacher says, "Okay, let's use the FOIL strategy together. Get ready. First we..." This step is repeated once more if needed until all students are firm.

c. Test: Students now do the exercise on their own. "Your turn to use FOIL. Get ready..." Once students are firm with the first problem, the teacher adds a second and third, gradually fading out the model and the lead steps as students become more skillful.

d. Delayed test: The teacher provides many opportunities later in the lesson and in subsequent lessons to give extra practice and to assess mastery. If she discovers errors of definitions, rules, or strategies, these are, again, corrected immediately. Repeated errors of the same kind suggest that students were not prepared for the new material and/or that instruction must be adapted to meet individual or group needs (e.g., certain steps of a strategy may have to be taught in smaller steps).

Following is a portion of a script from lesson 45, level C of the remedial reading curriculum *Corrective Reading* (described in the next section). The exercise is on relevant vs. irrelevant evidence, which is part of the strand on deductive reasoning, which is part of the large objective of teaching students to analyze and evaluate arguments in a variety of materials. Students' answers are in italics. Note that: (1) this exercise builds on many earlier exercises (e.g., students have already learned about premisses and conclusions); (2) the evidence-testing strategy is taught explicitly (the students do not have to try to "construct" how to do it; they are taught how to do it); (3) the teacher first models the strategy; (4) the teacher "tests" whether she has in fact taught the rules and strategy; and (5) the teacher provides sufficient practice until students are firm--can do the strategy independently and without errors. The teacher says,

When we draw a conclusion from a rule, we start with the rule. Then we add some other evidence. Here's a rule. The more you exercise, the healthier you are. Here's some additional evidence. Sharon exercises more than she did a year ago. What's the conclusion? Say it.

Sharon is healthier.

Sometimes, we can't draw a conclusion from a rule. This happens when the additional evidence is irrelevant. Here's a rule: The more you exercise, the healthier you are. Here's the additional evidence: Olivia takes a lot of vitamins. What's the conclusion? There is none. We can't draw a conclusion because the additional evidence is irrelevant to the rule.

Here's another rule: The more you drive, the more you pollute the air. Tell if each piece of evidence is relevant or irrelevant to the rule. Remember, if it is irrelevant, we can't draw a conclusion. Here are the pieces of evidence:

1. This year's cars are more expensive than last year's. Is this evidence relevant or irrelevant? What's the answer?

Irrelevant.

So what's the conclusion? Say it.

There is none.

2. Carla uses the family car twice as much as Amanda does.
Is this evidence relevant or irrelevant? What's the answer?

Relevant.

So, what's the conclusion? Say it.

Carla pollutes the air more.

3. Now that Frieda has a bike, she doesn't drive as much as she used to.
Is this evidence relevant or irrelevant? What's the answer?

Relevant.

So, what's the conclusion? Say it.

Frieda doesn't pollute the air as much.

4. Many English words have roots that are thousands of years old.
Is this evidence relevant or irrelevant? What's the answer?

Irrelevant.

So, what's the conclusion? Say it.

There is none.

This exercise (and others) prepares students for later lessons in which students learn to analyze the logical adequacy of complex arguments.

16. The general format of the highly focused portion of lessons is model-lead-test-delayed test. However, there are specific formats for teaching each form of knowledge; i.e., concepts, rules, cognitive strategies, and physical operations (routines).

a. Concepts (e.g., granite, in an earth science course) are taught by providing students with a definition, which students learn via model- lead-test-delayed test. "Granite is an igneous rock consisting of quartz, feldspar, and mica....Say that definition with me....Great! Your turn to say the definition of granite..."

Then the teacher carefully juxtaposes examples and nonexamples of granite, and labels each one, reminding students of the definition.

Finally, the teacher helps students to apply the definition by presenting examples and nonexamples of a concept; asking students to label each item; and then asking students to state their reason. "Is this granite?... How do you know?" It is essential that the teacher juxtapose some examples that appear very different, but still share the defining features of the concept (e.g., red vs. gray granite), so that students learn to see "sameness" (quartz, mica, and feldspar). In addition, the teacher juxtaposes examples that appear to be the same, but have features that require categorizing differently, so that students learn "difference."

b. Propositions, or rules, are taught be telling students the rule ("When pressure increases, temperature increases."); teaching students to say the rule; and then teaching students to apply the rule to examples. "So, if pressure is 150 pounds per square inch, and temperature is 120 degrees, and pressure is increased to 190 pounds per square inch, what will happen to temperature?...*It will increase*...How do you know? (Students give the rule.)

c. Cognitive strategies and physical operations are taught by having students enact the steps in a sequence (e.g., calculating the first derivative) at the same time the teacher states the rules that govern actions in the steps. If a task is short enough, the whole routine would be taught at one time. If the task is lengthy, the teacher might teach the central step first, and then add the remaining steps.

17. Teachers provide timely and genuine praise for new learning, for reading and solving problems without errors, and for persistence. Following are examples from Becker, Engelmann, and Thomas (1971).

a. (To the group, while a student is trying) "Gill is working hard. Just watch. He's going to figure it out. If you work hard, you'll get it."

b. (To the group, while a student is trying) "Betty will learn this. It is tough, but she's a smart person." (Later, as Betty continues working) "She's working hard. She's going to show you."

c. (To the group, when the student has gotten it) "What did I tell you? She kept working hard and she got it. She knows that if you work hard you'll get it."

18. Gradually, the teacher moves from a teacher-guided to a more student-guided format. This is called *mediated scaffolding* (Kameenui & Carnine, 1998). The move from more to less scaffolding is accomplished by first ensuring student mastery of the knowledge tasks at hand; teaching students problem-solving strategies; fading assistance; and introducing more complex

contexts (which helps students distinguish between essential and inessential details) (Becker & Carnine, 1981). In other words, Direct Instruction fosters independence and retention.

19. Short proficiency (mastery) tests are used periodically (e.g., about every ten lessons) to ensure that all students have mastered the material and to determine which concepts, rules, or cognitive strategies require additional instruction. This helps to sustain the quality of teachers' instruction and students' education; it prevents the drift towards mediocrity or failure.

20. A school that uses Direct Instruction does not use it all day. Rather, Direct Instruction would most likely be for 30-45 minutes at the beginning of some class periods, to review previous concepts and to give instruction that builds on previous learning. The rest of a class period would be individual or small group work to practice, generalize, or adapt what was learned. For example, a class period might begin with Direct Instruction on atmospheric convection. This might be followed by students searching the internet for websites with data on weather patterns illustrating convection. This might be followed by students' writing papers (stretched over a week or so) that describe their computer search. In writing papers, students use big ideas and strategies learned in earlier classes on spelling, reasoning, and writing (strategic integration). The essential thing is that students get the main concepts, principles, strategies, and operations before they are asked to use them in complex tasks.

In summary, Direct Instruction has nothing to do with training meaningless bits of behavior or training students to be compliant. Indeed, the conversational format of Direct Instruction approximates a Socratic dialogue with students learning both the subject matter and the rules of the dialogue (reasoning). It is a sophisticated way of: (1) determining what students need to succeed with meaningful material; (2) arranging the learning environment so students receive what they need; and (3) helping teachers and students keep track of progress and difficulties so curriculum and instruction can be improved (accountability). Section V shows suggests some of the implications of Direct Instruction for high school teachers, supervisors, and administrators.

V. Some Implications of Direct Instruction for High Schools

There are three major implications of Direct Instruction for high school teachers, supervisors, and administrators. These are: (1) using Direct Instruction curricula either for initial instruction or remedial instruction in various subjects; (2) using the main features of Direct Instruction to organize and improve classroom instruction even if commerical Direct Instruction curricula are not used; and (3) knowing enough about Direct Instruction to initiate (if needed) and to play a guiding role in district-wide school reform that involves the implementation of Direct Instruction (or other focused) curricula.

High School Level Direct Instruction Curricula

A number of extensively field tested and highly effective Direct Instruction curricula are available for initial teaching and remedial teaching in high school content areas.

Initial Teaching Curricula. Following are Direct Instruction curricula for teaching students who do not require remediation or who are not in an at-risk status.

1. *Understanding U.S. History I and II.* (Carnine, et al., 1994). This field tested program teaches students a general strategy for analyzing historical events, processes, and periods--Problem-Solution-Effect. The strategy is then applied to U.S. history using original materials. The program contains concept maps and interspersed questions (to foster higher-order thinking) and a variety of writing projects.

2. *Expressive Writing* (Engelmann & Silbert, 1983). This curriculum teaches the elements of composing and writing (punctuation, sentence and paragraph construction, quotations, editing), and for writing and editing in different formats.

3. *Basic Writing Skills* (Gleason & Stults, 1983). This curriculum addresses elemental rules for composing sentences and paragraphs, and more advanced strategies for writing papers.

4. A Mathematics Series, on videodisc, for teaching geometry, equations, roots, exponents, graphs, and statistics (BFA Education Media, 1991)

5. *Understanding Chemistry and Energy* (BFA Educational Media, 1991). This videodisc program focuses on atomic and molecular structure, energy forms, organic compounds, energy activiation and catalysis.

6. *Earth Science* (BFA Education Associates, 1991). This videodisc program explores phases of matter, density and mass, and geologic processes.

7. *Advanced Skills for School Success* (Archer, 1992). This program teaches students to plan objectives, budget time, evaluate progress, and solve problems.

Remedial Teaching Curricula. Several Direct Instruction curricula are useful for students entering high school unprepared for the difficult work or who later reveal learning difficulties in a particular area. These remedial curricula are as follows.

1. *Corrective Reading.* The *Corrective Reading* program (Engelmann et al., 1998) is for students who have not learned to read proficiently and do not learn well on their own. This fast-paced program allows students to work in a comprehension strand, a decoding strand, or both. Each of these strands has four levels--A, B1, B2, and C. The Decoding strand progresses from teaching letter sounds and blending skills to reading expository passages characteristic of textbook material. The Comprehension strand helps develop reasoning strategies used by successful readers; e.g., applying prior knowledge, making inferences, and analyzing evidence. Both strands include teacher presentation books, teacher guides, student books, and workbooks. Ongoing assessment is built into the program to provide immediate feedback. Corrective Reading is also an excellent program for students with learning disabilities.

2. *Corrective Spelling Through Morphographs* (Dixon & Engelmann, 1979). This program teaches a variety of morphographs (e.g., prefixes, suffixes, and word bases) and rules for combining them into general strategies for students to use with thousands of words--familiar and unfamiliar.

3. *Corrective Mathematics* (Engelmann & Steely, 1997). This curriculum contains placement tests that identify students' needs precisely, and then materials for instruction on basic operations, fractions, decimals, percents, and equations.

4. *Rewards: Reading Excellence, Word Attack, and Rate Development Strategies* (Archer, Gleason, & Vachon, 2000). This program teaches multi-syllabic decoding strategies and vocabulary to mastery in a short time (20 lessons). It also contains correlated literature in history and science to foster fluency and generalization. It is an excellent program for use in classs, after school, or in summer programs.

<u>Using Some of the Main Features of Direct Instruction to Organize and Improve Classroom Instruction</u>

When schools do not use commercial Direct Instruction programs, teachers can still increase student
involvement and achievement by employing some of the main features of Direct Instruction. These features include the following.

1. *The curriculum for a course is logically coherent and explicit.* It is important for teachers to examine their state standard course of study, textbooks, their own subject matter knowledge, and resource materials, and then to create a concept/proposition map that depicts logical and sequential relationships among the knowledge units to be covered. These maps (provided to students and demonstrably followed by the class) are a visual support during instruction (e.g., showing how the study of cell division is logically part of the study of life cycles); a framework for assessment (e.g., whether the class has mastered the entire knowledge system on the map); and a source of motivation to learn the later units (Vitale & Romance, 1999).

2. *Daily lessons are a sequence of short, quick-paced exercises*; e.g., (a) review of items from previous days to ensure students are firm before adding new examples; (b) work on new material from an earlier curriculum strand (e.g., vocabulary regarding historical events); (c) work on new material from another earlier curriculum strand (e.g., further examination of documents from an historical period); (d) independent, peer, or cooperative activities to practice vocabulary, solve problems, or write papers; (e) review of the day's lesson. In other words, a teacher rarely lectures (with students in a passive role). Instead, new material is virtually always worked on in a highly interactive format.

3. *Teacher and students have clear and explictly stated knowledge objectives for every exercise.* "Now I'll show you how to find the missing premiss in a syllogism." "Our goal is five or less errors reading this story passage" (review). Objectives are defined by what students will be able to do.

4. *Teacher wording is unambiguous and focuses precisely on the point to be made.* New words, concepts, and rules are taught before students need to know them understand the teacher's communication.

5. *The most general and generalizable problem solving strategies are taught.*

6. The teacher's models or demonstrations make explicit the definitions, rules, and strategies he or she is using. Students' knowledge of these is "tested," practiced, and firmed by the teacher, who frequently follows students' answers with the question, "How do you know?" If students have not gotten the rule or definition, the teacher uses the common error correct format: model-test-retest. The example, below, is from lesson 53 of *Corrective Reading Level C.* Student responses are in italics. The teacher says,

Here's an argument. Senator Flopp was convicted on criminal charges both before and after he was in the Senate. There can be no question about the character of people in the Senate. The argument concludes something about all the people in the Senate. What is that conclusion?

They're all criminals.

The conclusion is based on information about part of the people in the Senate. Which part is that?

Senator Flopp.

Say the rule the argument breaks. (Taught in an earlier lesson)

I (can't remember, forgot, don't know).

(Error correction) The rule is, just because you know about a part doesn't mean you know about the whole thing. (Model)

Say the rule the argument breaks. Say it. (Test)

Just because you know about a part doesn't mean you know about the whole thing.

Excellent. The conclusion was that all senators are criminals.
Say the rule the argument breaks." (Re-test)

Just because you know about a part doesn't mean you know about the whole thing.

Great job saying that rule!

7. Examples are selected and juxtaposed to reveal sameness ("These look different, but they are all examples of democracy.") and difference ("These problems look the same, but they require different strategies."). The teacher makes sure that students identify the essential features that make sameness and difference.

8. Student are firm on an exercise before going on to next exercises. Firmness is checked by questions and problems addressed to the whole group and to individuals. These "tests" enable teachers to determine whether the class is moving too quickly or to slowly, whether re-teaching is needed, and whether certain students need extra and/or more individualized assistance.

9. As said, every error is corrected immediately--generally with the model-test-retest format. The teacher might back up a few steps in strategy instruction or back up a few words (e.g., in translating word lists), and then repeat the sequence (including the previous error spot) to ensure that students are firm. Chronic errors suggest the need for re-teaching.

10. Initial instruction (e.g., exercises spread over several lessons until students are firm on a cognitive strategy for finding the slope of a straight line) is highly structured and teacher directed, and generally uses the model-lead-test-delayed test format. Later ("expanded") instruction, as students master a knowledge unit, is less structured and more student directed; e.g., projects to foster generalization and synthesis from different curricular strands. Note: at this point Direct instruction "expansion" activities resemble constructivist "inquiry" methods. The difference is that Direct Instruction first ensures that students are firm on background knowledge needed to inquire effectively.

Direct Instruction and District-wide School Reform

Using Direct Instruction programs and/or teaching methods will increase the effectiveness of high school instruction--and therefore student engagement and achievement. However, it will not affect the rate at which ill-prepared students enter high school. For this, there must be district-wide curriculum reform beginning in kindergarten--or even pre-kindergarten, to prepare children from disadvantaged homes (Hart & Risley, 1994). The following information and suggestions are offered so that high school administrators and teachers can initiate and/or participate effectively in district-wide reform involving the integration of Direct Instruction or other forms of focused instruction.

The Benefits of District-wide Reform Plans. In contrast to piece-meal changes in curriculum and instruction, district-wide planning can: (1) provide for the coherent and cumulative development of students' knowledge from grade to grade; (2) ease students' transition from elementary, to middle, to high school; (3) assist in planning and coordinating student assessment and teacher training; (4) facilitate communication across grade levels; (5) help to align a district's curriculum with a state's standard course of study; and (6) increase the likelihood that students will pass "gateway" examinations required for entry to the next grade levels or for graduation.

Common Mission. A shared mission is likely to facilitate the development and implementation of district-wide reform plans. An example of a district's mission might be as follows.

1. To raise the achievement of all children.

2. Especially to raise the achievement of minority and economically disadvantaged children.

3. To intervene early and proactively with powerful curricula in language and school skills for children in pre-k and grade 1 at risk of failure academically and behaviorally.

4. To increase teachers' skills in instruction, evaluation, collaboration, and school reform.

It is hard to imagine that there would be much disagreement in a district over these aims.

Direct Instruction Programs in Elementary Grades. Four powerful Direct Instruction programs that can be integrated with other programs in elementary school are *Language for Learning*, *Reading Mastery*, *Connecting Math Concepts*, and *Corrective Reading*. All have been extensively field tested and revised, and are published by SRA/Mc-Graw Hill.

1. *Language for Learning* is for grades pre-k-2. This curriculum teaches concepts, language rules, forms of communication, and classroom skills needed for oral and written expression, and participation in school activities. It can be used as part of a regular pre-school or kindergarten curriculum; to give a head start to children developmentally delayed or at-risk; or for children in first or second grade who have not yet acquired essential language and social skills.

2. *Reading Mastery* is a complete program, integrating decoding and comprehension, for students in grades k or 1-6. Complex skills are taught in sequences of sub-skills learned to 100% mastery. Lessons (taught in small groups) involve brisk pace, a high rate of student opportunities to respond, group and individual turns, and immediate error correction to prevent students developing gaps in knowledge. Student books contain fiction (classical and modern), history, poetry, geography, meterology, and oceanography. Generally, students complete six years of reading instruction in five years.

3. *Connecting Math Concepts* is a six-level program (generally grades 1-6) organized around big ideas, that covers basic math concepts, rules, and operations; fractions, ratios, and proportions; probability; coordinate systems and functions; and data analysis.

4. *Corrective Reading* (described in an earlier section) is an effective and relatively inexpensive remedial reading program that can be used beginning in grade 3 to ensure than children at least one grade behind in reading will be proficient before entering middle school.

Some Guidelines for Reform. School reform can be threatening. Teachers and principals may feel coerced to use new methods, concerned that they will lose their jobs, and overly stressed by the rapidity of change. The following suggestions may reduce the stress of school reform.

1. New curricula (e.g., Direct Instruction *Reading Mastery*, *Language for Learning*, or *Corrective Reading*), are not presented as replacing existing curricula and materials (e.g., Houghton Mifflin, *Accelerated Reader*, or whole language activities). Instead, principals and teachers examine (a) school-level achievement; (b) achievement by subgroups; and (c) achievement by individual students, and then decide how different curricula contribute to student success. For example, 30-45 minutes a day of Direct Instruction in language and reading is seen as providing focused instruction that complements other activities, so that all children master essential skills.

2. Curricular change must be driven by data. Data are of two sorts:

a. Achievement data (e.g., state end-of-grade tests) suggesting that the existing mix of curricula in a school (e.g., in math and reading) do not appear effective in helping all students master all the skills (e.g., as specified by the state standard course of study).

b. The research base for a new candidate curriculum (e.g., Direct Instruction) provides strong evidence that the candidate curriculum is effective in fostering student achievement, is developmentally appropropriate, and complements existing curricula.

3. Principals and teachers, meeting within schools and across school levels, themselves decide to adopt new curricula based on their own rational decision-making process and in light of the disctrict's mission and the data.

4. Changes in curricula and in school organization (e.g., within-school coaching and supervision) are best made at a comfortable pace that allows next steps to be planned on the basis of evaluation of the last step. For example, a high school might want to pilot test Corrective Reading in a few classes before deciding to use it school-wide.

5. It is a good idea to have one or more persons in each school serve as the curriculum coordinator of new programs (e.g., *Reading Mastery*) because successful implementation involves several integrated tasks--placement testing, cross-class and cross-grade grouping, ordering materials, providing initial training and ongoing supervision and coaching.

6. The district should have a plan for ongoing evaluation of the implementation of the school reform plans (e.g., faithfulness of implementation), summative (e.g., end-of-year) evaluation that includes teachers' and principals perceptions as well as achievement data, and decision rules about actions to take in light of the data.

The next section examines and corrects several myths about the instructivist approach in general and Direct Instruction in particular.

VI. Correcting Negative Myths About Direct Instruction

There are several myths about Direct Instruction. These myths are easy to correct by: (1) reading books and articles that report research on Direct Instruction; and(2) visiting schools and classrooms where Direct Instruction is used. Important authors include Adams and Engelmann (1996); Engelmann and Carnine (1991); and Stein, Silbert and Carnine (1997). Important journals are *The Behavior Analyst*, *Effective School Practices*, the *Journal of Applied Behavior Analysis*, the *Journal of Precision Teaching*. Let us now examine and correct various myths.

"Direct Instruction Reduces Students to Stimulus-Response Relationships."

The few technical terms in Direct Instruction ("signals," "firming," "error correction") lead some persons to believe that Direct Instruction teachers and curriculum developers regard students as akin to pigeons and rats trained by experimental psychologists. Nothing could be further from the truth. The purpose of technical terms (words with precise meaning) is to enable teachers to communicate effectively. The word "signal," for example, directs attention to events that come before students' actions. Therefore, if one teacher says, "I think my signals are ambiguous," the other teacher knows what to look for.

Second, technical terms themselves do not depersonalize. Direct Instruction teachers know that a few words do not capture all there is to a person. The words merely point to certain aspects of the environment and students' actions. This is the same as in medicine, where physicians speak of cells, tissues, organs, symptoms, and illnesses. This does not mean physicians see clients as nothing more. If a physican sees her clients that way, it suggests she is inclined to do so; the terms do not make her do so.

Finally, consider the words pistel, petiole, and petal to describe a rose. The words do not make a rose ugly, or reduce it to nothing but parts. In fact, these concepts make the flower more wondrous by drawing attention to how it is beautiful and how it works. Likewise, the terms "component skills," "response adduction" (bringing together) and "composite skill" do not degrade children; the concepts make it possible to see how amazing it all is.

"Direct Instruction Destroys Creativity By 'Drill and Kill' Teaching."

Direct Instruction teachers and curriculum developers are more disgusted than other persons by mindless drill. However, they do not throw out useful practice. The creative, skillful and life-long art of dancers, martial artists, painters, writers, musicians, good cooks, and athletes show the necessity of practice, practice, and more practice for accuracy, fluency, endurance, momentum, retention, and maintenance (i.e., independence). Instead of "drill and kill," Direct Instruction employs "perfect practice"--practice carefully scheduled to help students "iron out the bugs," discover and improve gaps in skill or knowledge, and foster fluency.

"Direct Instruction Scripted Presentations Dehumanize Teachers."

Some teachers may not like certain features of Direct Instruction; e.g., brisk pacing, close attention to students' learning, error correction, and scripted presentations. However, it is an exaggeration to call these dehumanizing. It is doubtful that actors are dehumanized by saying the lines Shakespeare wrote (because the lines are beautiful), that chess players feel dehumanized by moving pieces according to rules, or that dancers feel dehumanized by performing moves scripted by a choreographer. Indeed, a careful reading of Direct Instruction teacher presentations reveals the genius and logical elegance in the wording and in the sequencing of concepts. Moreover, as with dancers, painters, poets, athletes, surgeons, and anyone following a protocol, individuality is manifested in personal style and competence.

In addition, as teachers learn the formats, the formats become invisible. The teacher "owns" what she says, just as actors live their parts. The teacher expresses individuality and creativity in how she arranges practice sessions, modifies lessons, and creates projects for students' independent and small group activity (Adams & Engelmann, 1996). Finally, because the most focused portion of lessons is prepared (is in the script) teachers do not have to spend valuable time creating lesson plans. Instead, they can devote that time to preparing "expansion" (more student-directed) activities, and adapting instruction for students having a harder time.

"Direct Instruction is All Teacher Centered."

Teachers are more directive during the early phase when students are trying to get the concepts, rules, strategies, and operations. However, as students' skills increase (e.g., graphing data and interpreting the slope of a line), students work on less structured activities to generalize and adapt knowledge to practical problems (e.g., graphing data on water pollution). At this point, the teacher gives help ("direction") as needed.

"Direct Instruction Only Teaches Rote Responses or Basic Skills and Knowledge."

This statement reflects a misunderstanding of skillful activity and Direct Instruction. The dichotomy between "lower-order" behavior (memorization [rote] and basic concepts) and "higher-order" behavior (problem solving, reflection) is misleading. All human activity involves both kinds of behavior. During a chemistry experiment, for example, students assemble the apparatus (rote), label chemicals (rote), solve equations (higher-order), and inspect their work (higher-order). Second, aside from introductory lessons on reading sounds or on math facts, virtually all of Direct Instruction on reading, reasoning, writing, science, history, and math is higher-order thinking--classifying, inducing rules, making inferences, testing generalizations, analyzing arguments, and solving problems.

Summary

This paper examined the main features and outcomes of Direct Instruction. It argued that Direct Instruction's design features and programs are consistent with the research on learning, are highly effective, and will enable high school teachers and administrators to meet the challenges of increasing school accountability. Finally, the paper describes Direct Instruction programs and methods that are relevant to initital and remedial high school instruction, and it suggests things to consider when high school teachers and administrators are involved in district-wide reform.

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APPENDIX X – EVIDENCE FOR DIRECT INSTRUCTION ON MATH CURRICULUM

Research Regarding Direct Instruction

One of the biggest problems in teaching phonics is that a substantial amount of drill is required. In poorly designed phonics programs, young children are expected to sit through hours of dull repetition. This is unfortunate, since it is possible to turn drill into a highly engaging, exciting group activity through the use of Direct Instruction (DI). Direct Instruction is a specific teaching style originally developed at the University of Illinois and later at the University of Oregon. It has the following attributes:

- *Homogeneous Skill Grouping*: Children are grouped according to their levels of ability, rather than according to age or other factors. If you are going to teach the same material to a group of children, they clearly benefit most if they are all able to follow the material.
- *Scripted Class Sessions*: Teachers use pre-designed scripts when teaching. The scripts are based on extensive research regarding student retention, and every aspect of every script is based upon results that were demonstrated through research. The great advantage of this approach is that every teacher using the script becomes the beneficiary of that research and will probably teach much more effectively than if left to his or her own devices.
- *Intense, Constant Student Interaction*: The scripted sessions consist primarily of sequences of stimulus/response pairings, wherein the teacher stimulates the class with a description of a concept, an illustration of the concept through an example, and finally a request that the class repeat the example. The class responds orally, usually as a group.
- *Teaching to Mastery*: The group does not move on until everyone in the group understands the material.

There is a substantial body of research supporting the use of DI for early childhood instruction, although it is not nearly as voluminous as the research supporting phonics since DI is relatively new. If you are interested in more information about DI research, you can visit the web site of the Association for Direct Instruction. This web site and its associated University of Oregon ADI site together contain samples of DI materials, including a sample DI script, samples of the *SRA Reading Mastery* curriculum, an extensive bibliography of research supporting the use of both phonics and DI, and a summary of the results of the largest and longest educational research study ever conducted - the U.S. Department of Education's "Project Follow Through".

Project Follow-Through

Project Follow-Through began in 1967 under president Lyndon Johnson. Its express purpose was to study instructional methods that would lead to a reduction in the disparity between low- and high-performing students by improving the performance of low-performing students. It was ultimately concluded in 1995 after consuming $1 billion and conducting research on over 20,000 students nationwide. The reading portion of this study involved over 15,000 students and was designed to test the effectiveness of three major models of reading instruction. Three specific reading programs were studied under each of the three major models. The major models (and their associated specific programs) are:

1. Basic Skills Model
This model holds that the objective of education is to induce certain behaviors, all behaviors are learned, and that carefully designed instruction must be employed in order to induce those behaviors. The specific programs for this group were:

- ***Behavior Reinforcement*:** Social praise and tokens are given to children for correct responses and tokens are traded for desired activities. Teachers use scripts, and instruction is provided incrementally. Sponsored by the University of Kansas.

- ***Direct Instruction*:** This program emphasizes the teaching of phonemic awareness and phonics, using the DI techniques described above. The reading curriculum here is essentially the same *SRA Reading Mastery* curriculum that we are using. Sponsored by the University of Oregon.

- ***Language Development*:** is an eclectic approach emphasizing language development rather than explicit reading skills. Sponsored by the Southwest Educational Developmental Laboratory.

2. Cognitive/Conceptual Skills Model
This model holds that cognitive growth should be emphasized over the learning of specific content. A variety of instructional techniques are supported, with the common thread being an emphasis on self-guided activity and interaction with the environment. The specific programs for this group were:

- ***Cognitively-Oriented Curriculum*:** Based on Piaget's theories of underlying cognitive processes, this curriculum encourages children to schedule their own activities. Teaching emphasizes "labeling and explaining causal relationships". Sponsored by the High Scope Foundation.

- ***Parent Education*:** Parents of disadvantaged children are taught to teach their own children. Teaching emphasizes language instruction (precise nature not specified) and development of motor and cognitive skills. Sponsored by the University of Florida.

- ***Self Directed Literature*:** Students are exposed to literature relating to their own experiences and interest. Child-directed choices are emphasized, based in part on the assumption that student choice would enhance enjoyment and facilitate learning through each child's individual learning style. The specific curriculum here was the Tucson Early Education Model (TEEM), sponsored by the University of Arizona.

3. Affective Skills Model
The "psychodynamic approach" considers social and emotional goals to be essential for optimal development of the whole child. Learning presupposes the development of a healthy individual possessing a positive self-image, trust, emotional stability, and constructive peer relationships. Instruction emphasizes the quality of interpersonal relations and an environment which supports self-actualization, assuming that each child knows what is best for his personal growth. The specific programs for this group were:

- ***Learning Center*:** is based on the "Head Start" nursery school approach, extended into elementary school. Children select their own learning options at learning centers where they select their own options in a classroom structured to provide maximal learning opportunities. Sponsored by the Bank Street College of Education.

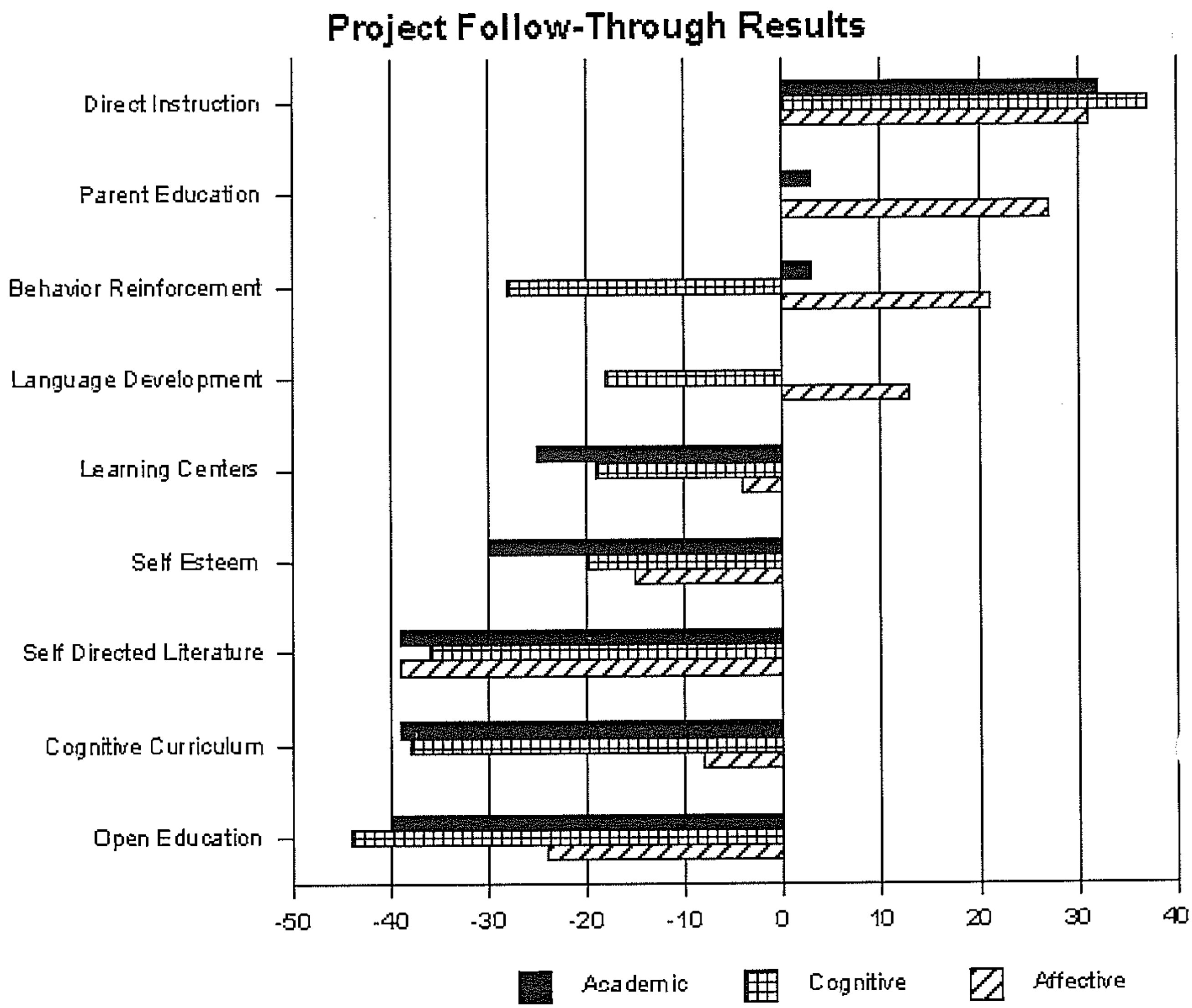
- ***Open Education*:** is based on the British Infant School model, extended into elementary school. Learning centers were used here also, and children were further assumed to be entirely responsible for their own learning, with no teacher-directed instruction provided. Sponsored by the Education Development Center.

- ***Self Esteem***: is another program utilizing learning centers, but here the curriculum emphasis was on the development of self-esteem. The central philosophy is that the curriculum must respond dynamically to the individual needs of each child. The specific curriculum here was the Responsive Education Model, sponsored by the Far West Laboratory.

Evaluation
Each program had four to eight sites, with children starting in either kindergarten or first grade. Each Follow-Through (FT) school district identified a non-Follow-Through (NFT) district to act as a control group. A total of 9,255 FT and 6,485 NFT children were in the final analysis group. Students in each school district were tested at entry and then each spring until third grade. Three types of assessments were conducted covering academic performance, cognitive development, and affective behavior. All FT program sponsors agreed in advance upon the assessments. The following five tests were used:

- ***Metropolitan Achievement Test***: an achievement test that assess basic skills and cognitive and conceptual skills, including reading comprehension and math problem solving;
- ***Wide Range Achievement Test***: measures number recognition, spelling, word reading, and oral and written math problems;
- ***Raven's Colored Progressive Matrices***: measures cognitive skills through the use of visually oriented problems;
- ***Intellectual Achievement Responsibility Scale***: measured affective skills by assessing whether children attribute their successes and failures to themselves or to external forces;
- ***Coopersmith Self-Esteem Inventory***: assesses how children feel about themselves, the way they think other people feel about them, and their feelings about school.

The Department of Education hired two independent agencies to collect and analyze the data. Each model was compared to both its local control group and to the pooled control groups of the entire project. Each test variable was scored according to whether there was a statistically significant (0.25 standard deviation) difference between the FT and NFT scores. If there was such a difference between the FT group and either the pooled or local NFT group, the program received either a positive or a negative point, depending upon whether the difference was positive or negative. All scores were then normalized to fit on a scale of -100 to +100; i.e. an FT group scoring a statistically significant improvement over either the local or pooled NFT group on all test variables would have scored "+100". The chart here summarizes the results.



Note: A missing bar denotes a value of zero.

One of the reviewers of Project Follow Through (Gary Adams) summarized it this way:

"... increased amounts of money, people, materials, health and dental care, and hot lunches did not cause gains in achievement. Becker (1978) observed that most Follow-Through classrooms had two aides and an additional $350 per student, but most models did not show significant achievement gains.

Popular educational theories of Piaget and others suggest that children should interact with their environment in a self-directed manner. The teacher's role is to be a facilitator and to provide a responsive environment. In contrast, the Direct Instruction model used thoroughly field-tested curricula that teachers should follow for maximum success.

The Follow Through models that were based on a self-directed learner model approach were at the bottom of academic and affective achievement. The cognitively-oriented approaches produced students *who were relatively poor in higher-order thinking skills, and models that emphasized improving students' self-esteem produced students with the poorest self-esteem.*

Educational reformers search for programs that produce superior outcomes with at-risk children, that are replicable and can therefore be implemented reliably in given settings, and that can be used as a basis for a whole school implementation that involves all students in a single program sequence, and that result in students feeling good about themselves. The Follow Through data confirm that Direct Instruction has these features. The program works across various sites and types of children (urban blacks, rural populations, and non-English speaking students). It produces positive achievement benefits in all subject areas - reading, language, math, and spelling. It produces superior results for basic skills and for higher-order cognitive skills in reading and math. It produces the strongest positive self-esteem of the Follow Through programs."

For an extensive analysis of the data from Project Follow Through, call the Association for Direct Instruction in Eugene, Oregon at 800-995-2464 and order a copy of their journal, Effective School Practices, Volume 15 Number 1 (Winter 1996) or simply click on the link in this sentence to view it on the web. If you have limited time then we recommend that you read the article, " Overview: The Story Behind Project Follow Through" by Bonnie Grossen, which provides an overview of the program and its aftermath. If you intend to read the whole journal, including the research results, then the paper copy is definitely worth the cost and the wait because the graphs shown in the web version are almost illegibly small (they are quite readable in the paper version).

American Institutes for Research Study

The National Education Association (NEA) is the largest teacher's union in the world, with approximately 2.4 million dues-paying members. The American Association of School Administrators (AASA) is the nation's largest association of school superintendents and administrators. These two organizations commissioned a comprehensive review of all of the research regarding curricula that are commonly used in school-reform efforts, including Direct Instruction, which is the curriculum we use here at *I Can Read!* To ensure the credibility of the study, the two organizations hired an independent research organization (the American Institutes for Research). The results of the study were published in 1999. Here is an excerpt from the NEA's summary of the results:

What's in the guide?
The guide first provides a ratings snapshot of 25 approaches in a single table that's similar to comparisons readers find in Consumer Reports magazine. The ratings, compiled by the American Institutes for Research, are based on a review of studies, articles, books, and other published material about each approach. Additional information appears in profiles that explain the ratings each approach received, provide details on its key features, and include the name and address of its developer.

So which reform approach is "the best"?
That depends, in part, on what characteristics you're looking for. "This guide is about separating real solutions--or at least programs with a track record for improving student achievement--from solutions that might work," says Marcie Dianda of NEA's Teaching and Learning staff. Only three of the approaches examined--Direct Instruction, High Schools That Work, and Success for All--provide strong evidence that they positively impact student achievement. For many of the approaches, surprisingly, there's little evidence one way or another on whether they help students achieve. Some approaches are new and haven't yet conducted studies to establish a track record. Others haven't done so even though they've been used by schools for years.

You can check out the summary for yourself by visiting the NEA Today Online, or you can read the the entire report, which has been published online by the AASA. Finally, you can read an article regarding this study in *Education Week* magazine.

Simply put. Direct Instruction has these properties:

- it uses a systematic, phonics-based approach in its reading curriculum
- it is one of only three methods that the AASA and NEA describe as showing clear evidence of producing higher student achievement, and it is one of only two that are applicable in primary school (K-8), where reading instruction is generally assumed to take place.

APPENDIX Y – MATH TEXTS

Algebra and Trigonometry ©2006
Paul Foerster
In this text, algebra and trigonometry are presented as a study of special classes of functions. In the process, relationships between theory and real-world applications are thoroughly explored, bringing the material to life. Critical thinking is developed by a strong emphasis on graphing and creative problem solving. Applications problems challenge students to use many mathematical concepts to solve one problem. The 2006 *Classics* edition also includes a new feature, the Skills Handbook. This handbook provides the tools to help students review problem-solving strategies and other math basics to get the on track and keep them progressing.

Teacher's Edition
Like the Algebra 1 teacher's edition, this edition features the same valuable teaching tools such as Chalkboard Examples, Assignment Suggestions, and Problem Notes in the margin with the student edition in the center for easy reference.

APPENDIX Z – VOLUNTEER NETWORK RECRUITMENT FORM

Volunteer Network Recruitment Form

Southmetro STEM High
Parent/Community Volunteer Form

Jent Name ______________________ (Last name, first name) Year Entering 9th Grade ______________ Which School Attending Now ______________

Address ______________________ City ______________ Zip ______________

Family Phone Number ______________________ Cell Phone Number ______________

E-mail Address ______________________ Mom ______________________ Dad

Parent/Guardian or Community Volunteer Name ______________________

Mom: Profession ______________________ Company Name ______________________

Father: Profession ______________________ Company Name ______________________

Parent/Community Committee Volunteer

1. _____ Fundraising Committee
2. _____ Letters of Intent/Support Committee
3. _____ Publicity Committee/ Advertising and Public Relations
4. _____ Instruction/Curriculum
5. _____ Charter School Application
6. _____ Data Base Management Support/Secretarial
7. _____ Web Site Support

_____ Architecture and Design

Parent Support Volunteer

9. _____ Liaison to Your Elementary/Middle School Which School: ______________________
10. _____ Collect Student Letters of Intent From Your School
11. _____ Collect Letters of Support from Businesses
12. _____ Interior Design and Furnishings
13. _____ Office Support – Stuff mailings/answer phones/secretarial

High Tech Skill or Project Suggestions

14. _____ Aerospace Tech
15. _____ Bioscience Tech
16. _____ Energy Tech
17. _____ Information Tech

Contracting Skills for the School Building

18. _____ Painting
19. _____ Other Help What? ______________________

Financial Donation

20. _____ If you would like to be a donor to help open the school. We will contact you.

Furnishings and Equipment Donation

21. _____ What would you like to donate? ______________________

Comments or Ideas:

____

ıtact Information:

Southmetro STEM High, Judy Brannberg, Project Manager
P.O. Box 631086
Highlands Ranch, CO 80163
303.522.2158, judy.brannberg@comcast.net

APPENDIX AA – TEXTBOOKS FROM DSST

Math Textbooks from DSST		
Algebra 1	Burger, Chard, etc...	Holt, Rinehart and Winston
Algebra 2	Burger, Chard, etc...	Holt, Rinehart, and Winston
Geometry	Burger, Chard, etc...	Holt, Rinehart, and Winston
Calculus	Paul A Foerster	Key Curriculum Press
Pre Calculus	Robert Blitzer	Prentice Hall
BSCS Biology	BSCS, Blue Version	McGraw Hill/Glencoe
Giancoli Physics	Douglas C. Giancoli	Prentice Hall
Conceptual Physics	Paul G. Hewitt	Prentice Hall
Modern Chemistry	Davis, Frey, etc...	Holt, Rinehart and Winston

Book Name	Department
Animal Farm	English
Antwone Fisher	English
Catcher in the Rye	English
Chronicle of a Death Foretold	English
Dawn	English
Fires in the Mirror	English
Gilgamesh	English
In the Time of the Butterflies	English
Kite Runner	English
Life of Pi	English
Little Brown Handbooks	English
Lord of the Flies	English

Night	English
Oedipus	English
Othello	English
Siddhartha	English
The Alchemist	English
The House of the Scorpion	English
The House on Mango St.	English
The Odyssey	English
The Sound of Waves	English
Their Eyes Were Watching God	English
Things Fall Apart	English
Writers INC.	English
World History	History
Entre Mundos	Language
Spanish-English Dictionary	Language
Ven Commigo 1	Language
Ven Commigo 1	Language
Ven Commigo 2	Language
Ven Commigo 2	Language
Ven Commigo 3	Language
Nuevas Vistas	Language
Algebra 1	Math
Algebra 2	Math
Calculus	Math
Geometry	Math
Pre Calculus	Math
BSCS Biology	Science
Conceptual Physics	Science
Giancoli Physics	Science

Glencoe Chemistry	Science
Success with Words	ACT Prep
Great Gatsby	English
Bless Me Ultima	English

APPENDIX AB – DCSD END STATEMENTS

Goals and DCSD Vision for the Future

DCSD Board of Education Key End Statements

1.0 Douglas County School District students acquire the knowledge and abilities to be responsible citizens who contribute to our society.

1.1 Students are able to think critically, using reason and logic when facing decision about what to believe or do.

1.2 Students embrace universal ethical principles such as honesty, integrity and justice.

1.3 Students demonstrate the self-motivation and resourcefulness to continue their learning.

1.4 Students apply what they have learned. They go beyond merely knowing to using their knowledge and skills productively.

1.5 Students develop and demonstrate Leadership skills. They are influential in creating a vision of what the future can be.

1.6 Students take ownership and accept responsibility for their wellbeing. Students have the knowledge, skills, and ability to make educated choices concerning their social, emotional, and physical health.

1.7 Students demonstrate essential skills of reading, writing, listening, speaking, numeracy and reasoning.

1.8 Students have an understanding of a core body of knowledge in Science, Application of Technology, Social Studies, World Languages, Literature and "Great Works", Physical Education and Health, Personal Business and Finance, Ethics and Philosophy.

1.9 Students are exposed to the fine arts

1.10 Students explore chosen areas beyond the liberal arts foundation that may expand future opportunities.

APPENDIX AC – THOMAS JEFFERSON HIGH SCHOOL EVIDENCE

Best High Schools

Home > Education > Best High Schools

http://www.usnews.com/listings/high-schools/virginia/thomas_jefferson_high_school_for_science_and_technology

School for Science and Technology (Top 100, #1)

Fairfax County Public Schools School District
Fairfax County

6560 Braddock Rd
Alexandria, VA 22312
Telephone: (703) 750-8300

College Readiness Index	100.0
Poverty-Adjusted Performance Index	4.04
Disadvantaged Students Performance Gap	Not Available

For more information, visit this school on the SchoolMatters website.

Detailed Information (methodology) School Data

Grades Served	9-12
Magnet School	No
Charter School	No
Admissions Type	Application - Merit-Based Selection
NCES Locale Type	Suburb, Large Territory
	No
Receives Title I Funding	

Demographic Data

Enrollment	1,802
Minority Enrollment (% of total)	3.9%

Disadvantaged Student Enrollment (% of total)	1.4%

Overall Student Performance

State Test Performance Index	144.3
Poverty-Adjusted Performance Index	4.04

Disadvantaged Student Performance

Disadvantaged Students' State Test Proficiency Rate	Not Available
Disadvantaged Students Performance Gap	Not Available
Non-disadvantaged Students' State Test Proficiency Rate	100.0
Current State Test Achievement Gap	Not Available

College-Ready Student Performance

College Readiness Index	100.0
Quality-Adjusted Exams Per Test Taker	6.8
Participation Rate	100.0%
Quality-Adjusted Participation rate	100.0%
Participant Passing Rate	100.0%
Exams Per Test Taker	6.9
Exam Passing Rate	97.9%

Advanced Placement Student Performance

Quality-Adjusted AP Exams Per Test Taker	6.8
AP Participation Rate	100.0%
Quality-Adjusted AP Participation Rate	100.0%
AP Participant Passing Rate	100.0 %
AP Exams Per Test Taker	6.9
AP Exam Pass Rate	97.9%

International Baccalaureate Student Performance

Quality-Adjusted IB Exams Per Test Taker	Not Available
IB Participation Rate	Not Available
Quality-Adjusted IB Participation Rate	Not Available
IB Participant Passing Rate	Not Available
IB Exams Per Test Taker	Not Available
IB Exam Pass Rate	Not Available
IB Diploma Per IB Test Taker	Not Available
IB Diploma Per Grade 12 Enrollment	Not Available

Criteria for Medals

Gold Medal: Top 100 schools nationally based on the College Readiness Index

Silver Medal: all other schools with a college readiness index of at least 20 but that are not ranked in the top 100 nationally

Bronze Medal: either do not offer AP or IB or do not achieve a college readiness index of at least 20 but successfully meet the other two key performance indicator criteria

Honorable Mention: schools that achieved very high levels of college readiness but only partially met state test performance criteria

College-ready student performance data derived from data provided by the College Board and/or International Baccalaureate of North America.

APPENDIX AD — STEM HIGH / MIDDLE SCHOOL HONOR CODE

As members of the STEM High / Middle School community, we honor academic and personal integrity. We uphold the values of honesty, integrity, respect, and responsibility.

Name (please print): ______________________________ Grade: __________

Signature: ______________________________ Date: __________

The above signature indicates that the individual has fully read and understood the Honor Code as the accepted standard for all academic work related to STEM High / Middle School.

Honesty is a value that holds each person to the truth, to tell the truth, and to defend the truth. Honesty results in fairness for each member of the STEM High community. Integrity is firm adherence to our values with and without the presence of others. Respect is treating others as we would like to be treated. In an environment of respect, work we turn in as our own is our own. Responsibility is the quality of being accountable for our actions and accepting the consequences of our actions.

The Honor Code is a physical representation of the values that STEM High / Middle School should encompass. At any educational institution, a code of conduct must be established so that people, teachers and students alike, know the proper way to behave. The behavior students acquire through their actions is the most valuable gift they can carry with them after graduation, and it is the most valuable gift any educational institution can give. Formulas and facts can carry students only so far in life. True success lies in one's desire to be good for the sake of being good ¾ doing the right thing, even when no one is looking. The Honor Code is not meant as an imposition, but rather as a standard to which all students and faculty should be held. At STEM, we push each other to higher academic achievement; this code asks that we hold each other, with the same rigor and passion in academics, to a standard of integrity and of personal achievement.

STEM Principles Regarding Academic Integrity

Enrollment at STEM High and Middle requires adherence to a certain set of standards. Our standards include the expectation that no student will engage in the following unacceptable behaviors as defined by the course teacher *:

- Cheating
- Plagiarism
- Fabrication
- Obtaining an Unfair Advantage
- Aiding and Abetting Dishonesty
- Falsification of Records and Official Documents
- Unauthorized Access to Academic or Administrative Records or Systems
-

*If a student is unclear as to whether or not his or her action(s) are in violation of the Honor Code, thenit is that student's responsibility to clarify any ambiguities with the appropriate administrator or instructor.

Teacher Responsibilities

- Clearly outline and define unacceptable academic behaviors within the teacher's course
- Address the degree to which students may collaborate on the completion of assignments, making distinctions where necessary as to assignment types
- Clearly outline the responsibility each group member must bear for a collaborative project
- Address the use of study aids (e.g. Cliffs Notes, etc.) in course work
-

Student Rights

In all cases regarding a suspected violation of the above stated principles, the student will be granted the rights delineated in the Fairfax County Public Schools' Student Responsibilities and Rights Regulation 2601.14P.

Procedures

The course of action taken for each suspected infraction of the Honor Code will follow the Douglas County School Districts' Student Responsibilities and Rights regarding due process and parent notification.

Sanctions

All cases of academic dishonesty will result in consequences as deemed appropriate by the teacher and/or school principal, or principal designee, under the circumstances. The school principal, or principal designee, may impose sanctions more serious than teacher reprimands.

APPENDIX AE – TEXTBOOK SELECTION POLICY

1. The Administrator (s) meets to discuss need and selection process. If the Administrator has not been hired, the Curriculum Committee Chair meets with the STEM High and Middle Board of Directors and the Curriculum Committee.

2. The Curriculum Committee researches various textbooks (with the assistance from parents, community members and experts), that meet STEM High / Middle School's standards and fulfill curriculum requirements.

3. The Curriculum Committee presents his/her findings in writing to the Board of Directors.

4. Other experts in the field are asked to review the favored text (s) and respond in writing.

5. Administration and Curriculum Chair contacts interested Board Members to review the text.

6. The teacher presents the text(s), his/her findings, and the other experts' responses at a scheduled STEM High / Middle School Board meetings.

7. The Board determines whether immediate approval or rejection is in order or it it should be delayed until the next board meeting in order to allow time for further review and discussion.

8. The final decision requires majority approval by the Board.

APPENDIX AF – POSSIBLE CURRICULUM REVIEW PROCESS

The Curriculum Chair discusses the process the Principal identifying focus area. If the Principal has not been hired, the Curriculum Chair discusses the process with the Curriculum Committee or the Board of Directors.

Curriculum Chair meets with teachers and gives an overview of the process, need, and focus areas.

Curriculum Committee is formed within the department of teachers who will be the primary participants in the process, although the entire team will be involved to some extent. The Curriculum Chair will either lead this team, or co-lead the team with ā lead teacher.

The Curriculum Committee meets for at least six times. Topics and tasks include:

- Discussing current textbooks and curriculum and noting apparent weaknesses or concerns.
- Comparing current courses to instructional philosophy and STEM High / Middle School's mission, noting where improvements need to occur for better alignment.
- Searching for new curriculum and texts to include internet searches, publisher contacts, teacher contacts from other schools, curriculum fairs, etc.
- Assigning team members tasks in the search process as well as then reviewing and reporting back to the committee on the materials (completing Textbook Evaluator form for any texts reviewed.)
- Advertising for parents to become involved int eh text review process. After they have completed a Textbook Evaluator form, they should attend committee meetings where new materials are being discussed.
- Completing textbook review documents on all considered materials.
- Recommending new texts/curriculum to the Curriculum Specialist.
-

The Curriculum Chair will take the recommendations to the principal(s) and then to the STEM High / Middle School and Middle Board for approval.

By special delivery, STEM High / Middle School and Middle parents are invited to review the recommended materials between the Board's first reading and the final vote.

APPENDIX AG – TEXTBOOK EVALUATION

Textbook Evaluation

Evaluator ______________________________ **Date**____________

Name of Course and Grade Level(s) ______________________________

Textbook Title ______________________________

Publisher ______________________________**Author**____________

ISBN ______________________________**Copyright Date**____________

Directions: Carefully examine the contents of each textbook. Using the following rating scale, circle the number that identified your evaluation of each item. Please feel free to identify page numbers to illustrate your ratings.

5 – Excellent
4 – Above Average
3 – Average
2 – Below Average
1 – Unsatisfactory
n/a – Not Applicable

A. Content and Organization Criteria

1. The subject matter and presentation support and encourage STEM High / Middle School's mission statement, philosophy, and instructional strategies. 5 4 3 2 1 n/a

2. The content of the text is consistent with Colorado State Standards 5 4 3 2 1 n/a

3. The reading level, concepts, picture, charts, maps, illustrations, and recommended activities are appropriate to the ability, aptitude and interest of the student at this level. 5 4 3 2 1 n/a

4. Illustrations, examples, and descriptions are accurate And well integrated into the text. 5 4 3 2 1 n/a

5. The text presents topics in a manner that will introduce Significant facts and promote an understanding of basic concepts. 5 4 3 2 1 n/a

6. The credentials and/or experience of the authors Qualify them to write this text — 5 4 3 2 1 n/a

7. The content is accurate when covering factual material. — 5 4 3 2 1 n/a

8. The book provides a balanced foundation. — 5 4 3 2 1 n/a

Comments: ____

____

____

B. General Format Criteria:

1. Texbook is durable and attractive — 5 4 3 2 1 n/a

2. The maps, charts, pictures, and illustrations are attractive, Accurate, useful, and appropriate for the intended grade level. — 5 4 3 2 1 n/a

3. The print is clear and of appropriate size. — 5 4 3 2 1 n/a

Comments: ____

____

____

C. Teacher Support Criteria:

1. Teacher's edition is comprehensive, organized, and easy to use — 5 4 3 2 1 n/a

2. "Big ideas" are clearly shown and stated for the year, units, and lessons. — 5 4 3 2 1 n/a

3. Activities apply to a diversity of student abilities, interests, and learning styles. — 5 4 3 2 1 n/a

4. Activities include questioning that encourages the development of analytical thinking skills. — 5 4 3 2 1 n/a

5. The activities recommended for students extend learning beyond The text and the classroom. — 5 4 3 2 1 n/a

6. Teaching strategies are varied to:

a.	Promote skill maintenance and development	5 4 3 2 1 n/a
b.	Stress the development of concepts	5 4 3 2 1 n/a
c.	Encourage varied actions and activities	5 4 3 2 1 n/a

D. Assessment Criteria

1. Assessments support student achievement as well as examine the extent to which students are able to link the instruction to the curriculum. 5 4 3 2 1 n/a

2. Multiple means of assessment are used, informal (formative), as well as formal (summative). Suggestions provided for assessing students, individually or in small groups, through observation, oral and written work, and student presentations. 5 4 3 2 1 n/a

Comments: ____

____

____

E. Specific criteria applicable to this particular class or subject area.

1.

2.

3.

4.

Comments: ____

____

____

F. Overall Evaluation

When applicable, not any character examples or teachable moments: ______________________

When applicable, note any content concerns: ____

____

Note below any particularly outstanding characteristics: _________________________________

____

Considering all the preceding features of this textbook, my overall recommendation is:

____

____

Additional Comments: ____

____

APPENDIX AH – TEXTBOOK EVALUATOR APPLICATION

Evaluator____ **Date**________________

Address ____ **Phone**_______________

Please list the subject areas and grade levels and/or the specific courses for which you have expertise: ____

Directions: Please answer the statements below using the rating scale:

5 – Excellent
4 – Above Average
3 – Average
2 – Below Average
1 – Unsatisfactory
n/a – Not Applicable

1. I understand STEM High / Middle School's Mission Statement and Philosophy of Instruction. 5 4 3 2 1 n/a

2. I understand Colorado State Standards for this discipline. 5 4 3 2 1 n/a

3. My expertise (BA, MA, PhD, Life Experiences) qualify me to Evaluate this textbook. 5 4 3 2 1 n/a

   Please describe your qualifications and experiences:

   ____

   ____

   ____

   ____

4. I will endeavor to complete my evaluation within 48 hours after receiving the textbook as I understand there may be limited copies for evaluation purposes. 5 4 3 2 1 n/a

5. I understand that all evaluations will be taken into consideration when determining a textbook. 5 4 3 2 1 n/a

Additional Comments: ____

____

APPENDIX AI – TEXTBOOK OPTIONS

Class	Book Title	Edition	Publisher	ISBN
STUDIO RECORDING	PRO TOOLS 101 OFFICIAL...VERS.8.0-W/DVD	09	CENGAGE L	1598638661
STUDIO RECORDING	PRO TOOLS 101 OFFICIAL...VERS.8.0-W/DVD	09	CENGAGE L	1598638661
THEATRE 1	MATERIALS AVAILABLE FROM THE INSTRUCTOR	LATEST	MBS	
THEATRE 2	MATERIALS AVAILABLE FROM THE INSTRUCTOR	LATEST	MBS	
INTRODUCTIO N TO BUSINESS	MATERIALS AVAILABLE FROM THE INSTRUCTOR	LATEST	MBS	
ACCOUNTING	MATERIALS AVAILABLE FROM THE INSTRUCTOR	LATEST	MBS	
BUSINESS LAW AND ETHICS	MATERIALS AVAILABLE FROM THE INSTRUCTOR	LATEST	MBS	
MARKETING	MATERIALS AVAILABLE FROM THE INSTRUCTOR	LATEST	MBS	
ENGLISH 9	TWELVE ANGRY MEN	06	PENG USA	0143104403
ENGLISH 9	ROMEO+JULIET	85	BARRON	0812035720
ENGLISH 9	ODYSSEY	96	PENG USA	0140268863
ENGLISH 9	OF MICE+MEN (RACKSIZE)	37	PENG USA	0140177396
ENGLISH 9	TO KILL A MOCKINGBIRD (376 PAGES)	60	HACHETTE B	0446310786
HONORS ENGLISH 9	TO KILL A MOCKINGBIRD (376 PAGES)	60	HACHETTE B	0446310786
HONORS ENGLISH 9	TWELVE ANGRY MEN	06	PENG USA	0143104403
HONORS ENGLISH 9	ROMEO+JULIET	85	BARRON	0812035720
HONORS ENGLISH 9	ODYSSEY	96	PENG USA	0140268863
HONORS ENGLISH 9	OF MICE+MEN (RACKSIZE)	37	PENG USA	0140177396
HONORS ENGLISH 9	OLD MAN+THE SEA	52	S+S	0684801221
ENGLISH 10	INTO THE WILD	97	RANDOM	0385486804
ENGLISH 10	OTHELLO	02	BARRON	0764120581
ENGLISH 10	CASE FOR FAITH	00	ZONDERVAN	0310234697
ENGLISH 10	THINGS FALL APART	59	RANDOM	0385474547
ENGLISH 10	NIGHT	06	MPS	0374500010
ENGLISH 10	SEPARATE PEACE	59	S+S	0743253973
ENGLISH 10	SIDDHARTHA	98	DOVER	0486406539
ENGLISH 10	CRY,THE BELOVED COUNTRY	87	S+S	0684818949
HONORS ENGLISH 10	CRAZY LOVE	08	D COOK	1434768511
HONORS ENGLISH 10	NIGHT	06	MPS	0374500010
HONORS	CASE FOR FAITH	00	ZONDERVAN	0310234697

ENGLISH 10				
HONORS ENGLISH 10	THINGS FALL APART	59	RANDOM	0385474547
HONORS ENGLISH 10	INTO THE WILD	97	RANDOM	0385486804
HONORS ENGLISH 10	JOY LUCK CLUB	89	PENG USA	0143038095
HONORS ENGLISH 10	UNDER THE BANNER OF HEAVEN	03	RANDOM	1400032806
HONORS ENGLISH 10	OTHELLO	02	BARRON	0764120581
HONORS ENGLISH 10	SIDDHARTHA	98	DOVER	0486406539
HONORS ENGLISH 10	SEPARATE PEACE	59	S+S	0743253973
HONORS ENGLISH 10	FRANKENSTEIN	94	DOVER	0486282112
ENGLISH 11	RAISIN IN THE SUN	88	RANDOM	0679755330
ENGLISH 11	GREAT GATSBY	25	S+S	0743273567
ENGLISH 11	ADVENTURES OF HUCKLEBERRY FINN	65	RANDOM	0553210793
ENGLISH 11	CRUCIBLE:TEXT+CRIT.	71	PENG USA	0140247726
ENGLISH 11	OUR TOWN:PLAY IN THREE ACTS	03	HARP PUB	0060512636
ENGLISH 11	ENRIQUE'S JOURNEY	06	RANDOM	0812971787
ENGLISH 11	NORTON ANTHOL.OF AMER.LIT,SHORTER	7TH 08	NORTON	0393930572
ENGLISH 11 AP LITERATURE	SCARLET LETTER	65	RANDOM	0553210092
ENGLISH 11 AP LITERATURE	GREAT GATSBY	25	S+S	0743273567
ENGLISH 11 AP LITERATURE	HEART OF DARKNESS	4TH 06	NORTON	0393926362
ENGLISH 11 AP LITERATURE	PRIDE+PREJUDICE	81	RANDOM	0553213105
ENGLISH 11 AP LITERATURE	ADVENTURES OF HUCKLEBERRY FINN	65	RANDOM	0553210793
ENGLISH 11 AP LITERATURE	HAMLET-NEW FOLGER ED.	92	S+S	074347712X
ENGLISH 11 AP LITERATURE	THEBAN PLAYS	47	PENG USA	0140440038
ENGLISH 11 AP LITERATURE	SEAGULL READER:POEMS	2ND 08	NORTON	0393930939
ENGLISH 11 AP LITERATURE	AP ADVANTAGE:ENGLISH LITERATURE	06	PEOPLES ED	1413813461
ENGLISH 12 (BRITISH LIT)	TALE OF TWO CITIES	04	B+N PUB	1593081383
ENGLISH 12 (BRITISH LIT)	MACBETH-FOLGER ED.	92	S+S	0743477103
ENGLISH 12 (BRITISH LIT)	SCREWTAPE LETTERS	82	HARP PUB	0060652934
ENGLISH 12 (BRITISH LIT)	ANIMAL FARM (50TH ANNIV.) W/NEW PREFACE	96	PENG USA	0451526341
ENGLISH 12 AP	IMPORTANCE OF BEING	06	NORTON	0393927539

LANGUAGE	EARNEST			
ENGLISH 12 AP LANGUAGE	NINETEEN EIGHTY-FOUR	92	RANDOM	0679417397
ENGLISH 12 AP LANGUAGE	FRANKENSTEIN	96	NORTON	0393964582
ENGLISH 12 AP LANGUAGE	CANDIDE	2ND 91	NORTON	0393960587
ENGLISH 12 AP LANGUAGE	LANGUAGE OF COMPOSITION-TEXT	08	MPS	031245094X
ENGLISH 12 AP LANGUAGE	FREAKONOMICS	05	HARP PUB	006073132X
ATHLETIC TRAINING	MATERIALS AVAILABLE AT LATER DATE	NONE	MBS	0000000000
ATHLETIC TRAINING	FUND.OF ATHLETIC TRAINING-W/CD	2ND 05	HUMAN KIN	0736052585
ATHLETIC TRAINING II	MATERIALS AVAILABLE AT LATER DATE	NONE	MBS	0000000000
ATHLETIC TRAINING II	ARNHEIM'S PRIN.OF ATHLETIC TRAINING	12TH 06	MCG	0073138908
HONORS SPEECH AND DEBATE	LOGICAL SELF-DEFENCE	06	BOOKS INTL	1932716181
THE WORLD AND THE WEST: T	WORLD HISTORY:PATTERNS OF INTERACTION	07	HM HS	0618690085
HONORS THE WORLD AND THE WEST	WORLD HISTORY:PATTERNS OF INTERACTION	07	HM HS	0618690085
AP EUROPEAN HISTORY	MODERN EUROPEAN HISTORY	90	MCG	0070674531
AP EUROPEAN HISTORY	WESTERN CIVILIZATION:FROM RENAISSANCE..	7TH 08	MCG	0073513245
AP EUROPEAN HISTORY	HIST.OF WEST.SOC.:SINCE 1300 (NASTA ED)	8TH 06	MPS	0312683707
UNITED STATES HISTORY	AMERICA:PATHWAYS TO...STUD.ED.SURVEY	5TH 07	PH SCHOOL	0131335081
AP UNITED STATES HISTORY	AMERICAN PAGEANT-F/ADV.PLACEMENT ED.	13TH 06	CENGAGE L	0618479406
AP UNITED STATES HISTORY	AMERICAN PAGEANT,COMPLETE-GDE.BOOK (HS)	13TH 06	CENGAGE L	0618574263
UNITED STATES GOVERNMENT	UNITED STATES CONSTITUTION:WHAT IT SAYS	05	OXF	0195304438
ECONOMICS	ECONOMICS:PRINCIPLES+PRACTICES	05	MCG	0078606934
ECONOMICS	SECRETS OF ECONOMIC INDICATORS	2ND 08	PEARSON	0132447290
CONTROVERSIAL AMERICA: RI	BETTER DAY COMING:BLACKS+EQUALITY...	01	PENG USA	0142001295
CONTROVERSIAL AMERICA:	FOUR HOURS IN MY LAI	92	PENG USA	0140177094

RI				
CONTROVERSIAL AMERICA: RI	EYES ON THE PRIZE	87	PENG USA	0140096531
CONTROVERSIAL AMERICA: RI	AMERICA DIVIDED	3RD O7	OXF	0195319869
AP UNITED STATES GOVERNME	CONSTITUTION OF THE U.S.,REV.+UPDATED	84	PENG USA	0451627245
AP UNITED STATES GOVERNME	AMER.GOVT. (HIGH SCHOOL)	9TH 04	HM HS	0618299823
ALGEBRA I HONORS	ALGEBRA 1	07	HM HS	0618594027
ALGEBRA I	ALGEBRA 1	07	HM HS	0618594027
GEOMETRY HONORS	GEOMETRY	07	HM HS	0618595406
GEOMETRY	GEOMETRY	07	HM HS	0618595406
ALGEBRAI/TRIGONOMETRY HONOS	ALGEBRA 2	07	HM HS	0618595414
ALGEBRA II/TRIGONOM	ALGEBRA 2	07	HM HS	0618595414
COLLEGE ALGEBRA	Teacher will provide Text materials	NONE	MBS	0000000000
PROBABILITY AND STATISTIC	ELEMENTARY STATISTICS-W/CD (NASTA ED.)	4TH 09	PEARSON	0136007201
PRE CALCULUS	PRECALCULUS WITH LIMITS	07	CENGAGE L	0618660895
HONORS PRE CALCULUS	PRECALCULUS WITH LIMITS	07	CENGAGE L	0618660895
AP STATISTICS	INTRO.TO STAT.+DATA ANALYSIS	3RD 08	CENGAGE L	0495118737
BIOLOGY I	LAST BREATH:LIMITS OF ADVENTURE	01	RANDOM	0345441516
BIOLOGY I	LABORATORY INVESTIG.IN ANAT.+PHYS.,CAT	07	PEARSON	0805353224
HONORS BIOLOGY I	BIOLOGY	08	PH SCHOOL	0132013495
CHEMISTRY	HOLT CHEMISTRY	06	HRW SCHOOL	0030391075
HONORS CHEMISTRY	HOLT CHEMISTRY	06	HRW SCHOOL	0030391075
ANATOMY AND EXTREME PHYSI	LAST BREATH:LIMITS OF ADVENTURE	01	RANDOM	0345441516
ANATOMY AND EXTREME PHYSI	LABORATORY INVESTIG.IN ANAT.+PHYS.,CAT	07	PEARSON	0805353224
ANATOMY AND EXTREME PHYSI	ESSEN.OF ANATOMY+PHYSIOLOGY-STD.GDE.	4TH 07	PEARSON	0805375201
ANATOMY AND EXTREME PHYSI	ESSEN.OF ANATOMY+PHYS.(NASTA ED.)-W/CD	4TH 07	PEARSON	013173296X

ASTRONOMY	ESSENTIAL COSMIC PERSPECTIVE-W/CD	4TH 07	PEARSON	0805393927
AP BIOLOGY	BIOLOGY -W/CD (AP EDITION) (HS)	8TH 08	PEARSON	0131356917
AP BIOLOGY	AP BIOLOGY LAB MANUAL F/STUDENTS	REV 01	COLLEGE B	0000000000
AP BIOLOGY	BIOLOGY -STUD.STD.GDE.	8TH 08	PEARSON	032150156X
AP CHEMISTRY	CHEMISTRY:CENT.SCIENCE,AP ED.-EXAM WKBK	11TH 09	PEARSON	0136002846
AP CHEMISTRY	CHEMISTRY:CENTRAL SCIENCE	11TH 09	PEARSON	0136006175
FRENCH I	DISC.FRENCH NOUVEAU!,BLEU 1	07	HM HS	0618656510
FRENCH I	DISC.FRENCH NOUV.!,BLEU 1-WKBK PKG.	04	HM HS	0618661786
FRENCH II	DISC.FRENCH NOUV.!,BLANC 2-WKBK-PKG.	04	HM HS	0618661743
FRENCH II	DISC.FRENCH NOUVEAU!,BLANC 2	07	HM HS	0618656529
FRENCH III	DISC.FRENCH NOUVEAU!,ROUGE 3	07	HM HS	0618656537
FRENCH III	DISC.FRENCH NOUV.!,ROUGE 3-WKBK PKG.	04	HM HS	0618661859
FRENCH IV	DISC.FRENCH NOUVEAU!,ROUGE 3	07	HM HS	0618656537
FRENCH IV	DISC.FRENCH NOUV.,ROUGE 3-PKG.	04	HM HS	0618661778
SPANISH I	501 SPANISH VERBS-W/CD	6TH 07	BARRON	0764179845
SPANISH I	POBRE ANA,NIVEL 1-LIBRO A	00	COMMAND P	092972447X
SPANISH I	PATRICIA VA A CALIFORNIA	01	COMMAND P	092972450X
SPANISH II	501 SPANISH VERBS-W/CD	6TH 07	BARRON	0764179845
SPANISH II	EL VIAJE DE SU VIDA	00	COMMAND P	0929724496
SPANISH II	POBRE ANA BAILO TANGO	05	COMMAND P	0929724453
SPANISH III	501 SPANISH VERBS-W/CD	6TH 07	BARRON	0764179845
SPANISH III	CONVERSACION Y CONTROVERSIA	5TH 04	PEARSON	0131838210
AP SPANISH LANGUAGE	501 SPANISH VERBS-W/CD	6TH 07	BARRON	0764179845
AP SPANISH LANGUAGE	AP SPANISH:PREP.F/LANGUAGE EXAMINATION	3RD 07	PH SCHOOL	0131660942

Correlation of *Core Knowledge®* *Sequence* & Colorado Grade Level Expectations

Core Knowledge® Content (English-Grade 6)	**Colorado Grade Level Expectations** (Grade 6-Reading & Writing)
I. Writing, Grammar, and Usage	
Teachers: Students should be given many opportunities for writing, both imaginative and expository, with teacher guidance that strikes a balance between encouraging creativity and requiring correct use of conventions. In sixth grade, it is appropriate to emphasize revision, with the expectation that students will revise and edit to produce (in some cases) a finished product that is thoughtful, well-organized, and reasonably correct in grammar, mechanics, and spelling. Continue imaginative writing, but place a stronger emphasis than in previous grades on expository writing, including, for example, summaries, book reports, essays that explain a process, and descriptive essays. Note also the requirement below for writing persuasive essays, a research essay, and a standard business letter.	
A. Writing and Research	
▪	6.2.A generate topics and develop ideas for a variety of writing and speaking purposes (for example, telling a story, publishing a class newsletter, writing a letter to an adult, writing or orally presenting a book report, creating and producing a play, introducing a speaker or an event, narrating a presentation, writing a summary) 6.2.B organize their writing so that there is an introduction, logical arrangement of ideas, and a conclusion 6.2.C use transitions to link ideas 6.2.D choose vocabulary that communicates their messages clearly and precisely 6.2.E revise drafts by adding, elaborating, deleting, combining, and rearranging text 6.2.F revise drafts for coherence, progressions, and logical support 6.2.G edit drafts for specific purposes such as to ensure standard usage, varied sentence structure, and appropriate word choice 6.2.H create readable documents with legible handwriting or word processing at the appropriate time 6.4.C differentiate between fact and opinion in written and spoken forms
▪	6.2.A generate topics and develop ideas for a variety of writing and speaking purposes (for example, telling a story, publishing a class newsletter, writing a letter to an adult, writing or orally presenting a book report, creating and producing a play, introducing a speaker or an event, narrating a presentation, writing a summary) 6.2.B organize their writing so that there is an introduction, logical arrangement of ideas, and a conclusion 6.5.A frame questions to direct research 6.5.B organize prior knowledge about a topic in a variety of ways (for example, graphic organizer, Venn diagram, outline) 6.5.C take notes from relevant and authoritative sources (for example, guest speakers, periodicals, on-line searches) 6.5.D summarize and organize ideas gained from multiple sources in useful ways (for example, outlines, conceptual maps, learning logs, timelines) 6.5.E find information to support ideas 6.5.F present information in various forms using available technology 6.5.G evaluate own research and raise new questions for further investigation 6.5.H follow accepted formats for writing research, including documenting sources
▪	6.2.A generate topics and develop ideas for a variety of writing and speaking purposes (for example, telling a story, publishing a class newsletter, writing a letter to an adult, writing or orally presenting a book report, creating and producing a play, introducing a speaker or an event, narrating a presentation, writing a summary) 6.2.B organize their writing so that there is an introduction, logical arrangement of ideas, and a conclusion

B. Speaking and Listening	
▪	6.4.C differentiate between fact and opinion in written and spoken forms 6.4.D use reading, writing, speaking, and listening to define and solve problems 6.4.E respond to written and oral presentations as a reader, listener, and articulate speaker 6.4.F use listening skills to understand directions
▪	6.2.A generate topics and develop ideas for a variety of writing and speaking purposes (for example, telling a story, publishing a class newsletter, writing a letter to an adult, writing or orally presenting a book report, creating and producing a play, introducing a speaker or an event, narrating a presentation, writing a summary)
▪	6.2.A generate topics and develop ideas for a variety of writing and speaking purposes (for example, telling a story, publishing a class newsletter, writing a letter to an adult, writing or orally presenting a book report, creating and producing a play, introducing a speaker or an event, narrating a presentation, writing a summary)
C. Grammar and Usage	
▪	6.3.B write in complete sentences varying the types such as compound and complex, and using appropriately punctuated dependent clauses
▪	6.3.B write in complete sentences varying the types such as compound and complex, and using appropriately punctuated dependent clauses 6.3.D employ standard English usage in writing, including subject-verb agreement and pronoun referents
▪	6.3.E know and use correct capitalization, punctuation, and abbreviations
▪	
▪	
▪	6.3.C use adjectives (comparative and superlative forms) and adverbs correctly
D. Spelling	
▪	6.1.E identify the meaning of prefixes and suffixes
▪	
E. Vocabulary	
Teachers: Students should know the meaning of these Latin and Greek words that form common word roots and be able to give examples of English words that are based on them.	
	6.1.E identify the meaning of prefixes and suffixes 6.1.J locate meanings, pronunciations, and derivations of unfamiliar words using dictionaries, glossaries, and other sources
II. Poetry	
A. Poems	
▪	6.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, and plays 6.6.D identify the sound of poetry, including alliteration, assonance, consonance, onomatopoeia, and rhyme scheme
B. Terms	
▪	
III. Fiction and Drama	
A. Stories	
▪	6.1.A paraphrase, summarize, and synthesize information from a variety of text and genre 6.1.B identify main idea and supporting details in a variety of text and genres 6.1.C infer and predict using information in a variety of text and genres 6.1.D monitor own comprehension and make modifications when understanding breaks down by rereading a portion, using

	reference aids, and using contextual information 6.1.F use background knowledge of subject and text structure to make complex predictions of content and purpose of text 6.1.G use text structure, such as cause and effect, to locate and recall information 6.1.H establish and adjust purposes for reading, such as reading to find out, to understand, to interpret, to enjoy, and to solve problems 6.1.I use word recognition skills to understand unfamiliar words (for example, letter-sound correspondence, language structures, and context) 6.4.A determine author's purpose 6.4.B predict and draw conclusions about stories 6.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, and plays 6.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar 6.6.C identify and analyze elements of plot and characterization 6.6.G identify and analyze characters, setting, problem/conflict, action/plot/events, resolution/solution, theme, mood/tone/atmosphere, and sequence in literature
B. Drama	
▪	6.1.A paraphrase, summarize, and synthesize information from a variety of text and genre 6.1.B identify main idea and supporting details in a variety of text and genres 6.1.C infer and predict using information in a variety of text and genres 6.1.D monitor own comprehension and make modifications when understanding breaks down by rereading a portion, using reference aids, and using contextual information 6.1.F use background knowledge of subject and text structure to make complex predictions of content and purpose of text 6.1.G use text structure, such as cause and effect, to locate and recall information 6.1.H establish and adjust purposes for reading, such as reading to find out, to understand, to interpret, to enjoy, and to solve problems 6.1.I use word recognition skills to understand unfamiliar words (for example, letter-sound correspondence, language structures, and context) 6.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, and plays 6.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar 6.6.C identify and analyze elements of plot and characterization 6.6.G identify and analyze characters, setting, problem/conflict, action/plot/events, resolution/solution, theme, mood/tone/atmosphere, and sequence in literature
C. Classical Mythology	
▪	6.1.A paraphrase, summarize, and synthesize information from a variety of text and genre 6.1.B identify main idea and supporting details in a variety of text and genres 6.1.C infer and predict using information in a variety of text and genres 6.1.D monitor own comprehension and make modifications when understanding breaks down by rereading a portion, using reference aids, and using contextual information 6.1.F use background knowledge of subject and text structure to make complex predictions of content and purpose of text 6.1.G use text structure, such as cause and effect, to locate and recall information 6.1.H establish and adjust purposes for reading, such as reading to find out, to understand, to interpret, to enjoy, and to solve problems

	6.1.I use word recognition skills to understand unfamiliar words (for example, letter-sound correspondence, language structures, and context) 6.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, and plays 6.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar 6.6.C identify and analyze elements of plot and characterization 6.6.G identify and analyze characters, setting, problem/conflict, action/plot/events, resolution/solution, theme, mood/tone/atmosphere, and sequence in literature
D. Literary Terms	
▪	6.6.E understand and use literary terms (for example, foreshadowing, metaphor, simile, symbolism, dialogue, scene, flashback) 6.6.F understand how figurative language supports meaning in a given context
IV. Sayings and Phrases	
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
Grade 2: Language Arts: Spelling, Grammar, and Usage	6.3. A know and use regular and irregular plurals correctly
Grade 5: Language Arts: Grammar and Usage	6.3.F know and use correct pronoun cases
This can be covered in many other areas	6.4.F use listening skills to understand directions
Core Knowledge® Content (History & Geography-Grade 6)	**Colorado Grade Level Expectations** (Grade 6- History, Geography, & Civics)
World History and Geography	
I. World Geography	
A. Spatial Sense (working with maps, globes, and other geographic tools)	
▪	
▪	
▪	GEO.6.1.1.A understand the concept of the Tropics of Cancer and Capricorn – what they represent, what they are due to and their significance in terms of seasons and temperatures on Earth
▪	GEO.6.1.1.B understand the essence of climate zones: Arctic, Tropic, Temperate
▪	
▪	GEO.6.1.1.C locate and explain the Arctic Circle and the Antarctic Circle
B. Great Deserts of the World	
▪	GEO.6.1.2.A locate and discuss the great desserts of the world (hot and cold)
II. Lasting Ideas from Ancient Civilizations	
A. Judaism and Christianity	
▪	HIS.6.6.A describe different religious concepts that have developed throughout history (e.g. monotheism and polytheism) HIS.6.6.B describe how societies have used various forms of arts, dance, theater, and music to express their religious beliefs and philosophical ideas throughout history HIS.6.6.C explain how stories, myths, and other forms of literature and oral traditions reflect the beliefs of cultures and societies (also covered in Grade 6: language Arts: Fiction and Drama GEO.6.1.2.B demonstrate knowledge of the geography of the Middle East, in relation to its old civilizations, and the rise of important religions

B. Ancient Greece	
▪	GEO.6.1.2.C demonstrate expanded knowledge of the geography of Ancient Greece and Rome, in relation to important historical events of antiquity
C. Ancient Rome	
▪	GEO.6.1.2.C demonstrate expanded knowledge of the geography of Ancient Greece and Rome, in relation to important historical events of antiquity
III. The Enlightenment	
▪	GEO.6.1.2.D demonstrate knowledge of the geography of Western Europe, in relation to historical periods and events such as the Age of Enlightenment, the French Revolution, the Industrial Revolution, the Arts of the Time, the sociology of the time
IV. The French Revolution	
▪	GEO.6.1.2.D demonstrate knowledge of the geography of Western Europe, in relation to historical periods and events such as the Age of Enlightenment, the French Revolution, the Industrial Revolution, the Arts of the Time, the sociology of the time
V. Romanticism	
▪	
VI. Industrialism, Capitalism, and Socialism	
A. The Industrial Revolution	
▪	GEO.6.1.2.D demonstrate knowledge of the geography of Western Europe, in relation to historical periods and events such as the Age of Enlightenment, the French Revolution, the Industrial Revolution, the Arts of the Time, the sociology of the time
B. Capitalism	
▪	
C. Socialism	
▪	
VII. Latin American Independence Movements	
A. History	
▪	HIS.6.2.A pose and answer questions based on the history of the early North, Central, and South American civilizations (also covered in Grade 5: World History: Meso-American Civilizations) HIS.6.2.D analyze the regional development of Latin America and the Caribbean vis-avis physical, economic and cultural characteristics and historical evolution from 1000 A.D. to the present HIS.6.5.C explain the key historical issues in South America in the struggle for independence HIS.6.5.D explain Mexico's history from Spanish Conquest through the Mexican Revolution of 1910 (discuss how Mexico's government has affected its economy)
B. Geography of Latin America	
▪	GEO.6.1.2.E demonstrate knowledge of the geography of Latin America, in relation to the history of the Independence Movements
American History and Geography	
I. Immigration, Industrialization, and Urbanization	
A. Immigration	

▪	HIS.6.3.A describe the history, interactions, and contributions of various peoples and cultures that have lived in or migrated, immigrated, or were brought into the Western Hemisphere's history GEO.6.1.2.F demonstrate expanded knowledge of the geography of the U.S. and the world in relation to nineteenth century immigration, industrialization, urbanization, social reforms GEO.5-8.4.1.A describe and discuss the reasons for human migration (e.g. famine, slave trade, wars, persecution) after studying related literature GEO.5-8.2.3.C explain why immigrants to the United States hold on to customs from their home countries CIV.6.4.1 Read and grade themselves on the U.S. citizenship/naturalization test
B. Industrialization and Urbanization	
▪	
II. Reform	
▪	GEO.6.4.5.A describe political, social, and economic divisions throughout early American history
▪	
▪	CIV.6.1.4 Identify American reformers and symbols of political culture – "melting pot," "sweat shop," Jane Addams, Teddy Roosevelt, W. E. B. Du Bois, Ida B. Wells, Eugene Debs, Martin Luther King, Jr., Robert Kennedy, and others CIV.6.4.3 Explain how racial and sexual harassment deprive citizens of their rights
▪	CIV.6.1.1 Explain what life may have been like for American women who had fewer acknowledged rights before 1920 than today (also covered in Grade 4: American History: Reformers, Grade 7: History: America in the Twenties and Grade 8: History: Social and Environmental Activism CIV.6.4.3 Explain how racial and sexual harassment deprive citizens of their rights
▪	
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered and reviewed from many previous and future History units	HIS.6.1.A construct various time lines of history in the regional development of the Western Hemisphere from 2000 B.C. to the present, highlighting landmark dates, technological changes, major political and military events
This can be covered and reviewed from many previous and future History units	HIS.6.1.B trace patterns of change and continuity in the Western Hemisphere from long ago throughout the 20th century, using a variety of information sources
This can be covered and reviewed from many previous and future History units	HIS.6.2.B gather information from multiple sources, including electronic databases, to understand events from varying perspectives
This can be covered and reviewed from many previous and future History units	HIS.6.2.C interpret information from historical maps, photographs, art works, and other artifacts of the past
Grade 7: History: America Becomes a World Power and other units	HIS.6.3.B explain the key historical issues in Central American and U.S. relations (including the Panama Canal) and current issues of poverty and government instability throughout South and Central America (consider what common factors create governmental instability)
Grade 8: History: Geography of Canada and Mexico	HIS.6.3.C explain the issues brought forth by cultural diversity in Canada
Grade 5: World History: Meso-American Civilizations	HIS.6.3.D compare Incan to Aztec to Mayan civilizations
This can be covered and reviewed from many previous and future History units	HIS.6.4.A identify and explain the consequences of scientific and technological changes (e.g. navigation, transportation, printing, weaponry, agriculture, communication, and medicine)
This can be covered and reviewed from many previous and future History units	HIS.6.4.B explain how societies are and have been linked by economic factors
This can be covered and reviewed from many previous and future History units	HIS.6.4.C distinguish between developed and developing countries in the Western Hemisphere and relate the level of development to the quality of life (what part does education play in development, or the lack thereof)
Grade 3: American History: The Thirteen Colonies and Grade 5: World History: European Exploration, Trade, and the Clash of	HIS.6.4.D analyze the impact of European expansion into the Americas in view of the trade in slaves, tobacco, rum, fur, and gold; and economic and cultural transformations (e.g. plants like tobacco and corn became available in new places;

	Cultures	arrival of the horse in the Americas, etc.)
	This can be covered and reviewed from many previous and future History units	HIS.6.5.A describe how other nations have pursued, established, and maintained democratic forms of government
	Grade 8: History: Geography of Canada and Mexico	HIS.6.5.B give examples of how states and regions have become interdependent (e.g. the North American Free Trade Agreement (NAFTA))
	Grade 5: World History: Meso-American Civilizations	HIS.6.6.D study and explain the artistic, religious, oral traditions, and the architecture of the Incas, Aztecs, and Mayas
	Grade 5: History and Geography: Spatial Sense	GEO.6.1.1.D understand how a flat map represents the round globe – Mercator, conic and plane projections
	This can be covered in many other areas	GEO.5-8.1.3.A trace and/or draw custom maps featuring information according to the desired use of the maps
	This can be covered in many other areas	GEO.5-8.1.3.B analyze maps, in order to discover and summarize information about geographical areas
	This can be covered in many other areas	GEO.5-8.1.3.C organize information obtained through the reading of maps in graphs, diagrams, and other visual aids, in order to illustrate specific demographic, physical and other topics
	This can be covered in many other areas	GEO.5-8.1.3.D gather field information and record it on custom maps
	This can be covered in many other areas	GEO.5-8.1.3.E trace on maps the spread of human migrations, cultures, languages, religions, diseases
	This can be covered in many other areas	GEO.5-8.1.3.F discover patterns of human habitation and activities through the study of maps
	This can be covered in many other areas	GEO.5-8.1.3.G discuss the places of the world that America depends on for imported resources and goods
	This can be covered in many other areas	GEO.5-8.2.1.A describe and compare the physical characteristics of places, using a variety of visual materials and data sources
	This can be covered in many other areas	GEO.5-8.2.1.B describe and compare human characteristics of places
	This can be covered in many other areas	GEO.5-8.2.1.C examine and explain human impact on the landscape/environment
	This can be covered in many other areas	GEO.5-8.2.1.D identify and analyze how technology shapes the physical and human characteristics of places
	This can be covered in many of the History units	GEO.5-8.2.2.A identify and describe regions in terms of physical and human characteristics
	This can be covered in many of the History units	GEO.5-8.2.2.B explain how regions are connected through cultural ties, trade, language, resources, through the use of maps
	This can be covered in many of the History units	GEO.5-8.2.2.C explain how regions change over space and time
	This can be covered in many of the History units	GEO.5-8.2.3.A gather and compare information on how people of different backgrounds view the same place or region
	This can be covered in many of the History units	GEO.5-8.2.3.B compare ways in which people of different cultural origins build out and name places in the same regions
	This can be covered in many of the History units	GEO.5-8.3.1.A understand and describe how the environment can affect human settlement and vice versa
	This can be covered in many of the History units and Grade 3: Science: Ecology	GEO.5-8.3.1.B identify the elements of ecosystems and explain how they are related to life within
	This can be covered in many of the History units	GEO.5-8.3.1.C research and explain how physical processes influence ecosystems
	This can be covered in many of the History units	GEO.5-8.3.1.D explain the distribution of types of ecosystems and their impact on human populations
	This can be covered in many of the History units	GEO.5-8.3.1.E analyze the importance of distance in human interaction
	This can be covered in many other areas	GEO.5-8.3.2.A identify the physical components of the Earth's atmosphere, lithosphere, hydrosphere, and biosphere (e.g. climates, land forms, bodies of water, ecosystems)
	This can be covered in many other areas and Grade 4: Geology: The Earth and Its Changes	GEO.5-8.3.2.B understand how natural processes create or change land forms, and give actual geographic locations as examples
	This can be covered in many other areas	GEO.5-8.3.2.C define renewable and non-renewable Earth resources
	This can be covered in many other areas and Grade 4: Geology: The Earth and Its Changes	GEO.5-8.3.2.D predict the consequences of physical processes on the Earth's surface and weather conditions
	Grade 7: History: Geography of the United States	GEO.5-8.4.1.B create graphs depicting population numbers and distribution
	This can be covered in many of the History units	GEO.5-8.4.1.C describe the influence of population on environment
	This can be covered in many of the History units	GEO.5-8.4.1.D analyze the characteristics of a certain population
	This can be covered in many of the History units	GEO.5-8.4.2.A use interviews with real people to define cultural change
	This can be covered in many of the History units	GEO.5-8.4.2.B differentiate among different cultures in Colorado

	This can be covered in many of the History units	GEO.5-8.4.2.C differentiate among different cultures in other parts of the world
	This can be covered in many of the History units	GEO.5-8.4.2.D use cultural clues/artifacts to identify historical migrations
	This can be covered in many of the History units	GEO.5-8.4.2.E analyze the impact of various cultures on physical elements of the Earth
	This can be covered in many of the History units	GEO.5-8.4.2.F use a variety of maps to research information regarding the location and movements of various cultures
	This can be covered in many of the History units	GEO.5-8.4.2.G analyze geographical factors that have generated cultural change
	Grade 7: History: Geography of the United States	GEO.5-8.4.3.A identify economic activities within a region and examine the reasons for their locations
	This can be covered in many of the History units	GEO.5-8.4.3.B explain the need for trade among regions, based on local availability of resources and goods
	This can be covered in many of the History units	GEO.5-8.4.3.C construct maps to illustrate historical patterns of human origins and activities
	This can be covered in many of the History units	GEO.5-8.4.3.D compile examples of cultural and economic reasons for changes in human societies
	This can be covered in many of the History units	GEO.5-8.4.3.E analyze systems to deliver services and goods
	This can be covered in many of the History units	GEO.5-8.4.3.F discuss world trade and explain the systems that support it
	This can be covered in many of the History units	GEO.5-8.4.4.A use maps to compare and contrast historic factors that have changed land use in a region
	Grade 7: History: Geography of the United States	GEO.5-8.4.4.B deduct geographical reasons for human settlements in specific areas
	Grade 7: History: Geography of the United States	GEO.5-8.4.4.C classify cities according to their human and environmental characteristics
	Grade 7: History: Geography of the United States	GEO.5-8.4.4.D compare patterns of land use and human settlement in various regions
	This can be covered in many of the History units	GEO.5-8.4.4.E classify cities according to their physical characteristics
	This can be covered in many of the History units	GEO.5-8.4.4.F analyze the process of the creation of a megalopolis
	This can be covered in many of the History units	GEO.5-8.4.5.B understand and describe how people divide the Earth's surface into different types of territorial units
	This can be covered in many of the History units	GEO.5-8.4.5.C analyze the reasons for divisions and cooperation among people, in terms of geography
	Grade 7: Science: Evolution	GEO.5-8.5.1.A examine the factors that have caused the disappearance of an animal or plant species
	This can be covered in many other areas	GEO.5-8.5.1.B understand the interrelatedness of environmental systems and its impact on life (human and other)
	Grade 7: Science: Evolution	GEO.5-8.5.1.C describe ways in which humans adapt to physical changes in the Earth's environments
	Grade 3: Science: Ecology	GEO.5-8.5.1.D explain how environmental changes in one place affect other places (acid rain, pollution, pesticides, etc.)
	Grade 7: Science: Evolution	GEO.5-8.5.1.E predict new ways for humans to adapt to their environments
	This can be covered in many other areas	GEO.5-8.5.1.F use maps to track the influence of environmental changes from one place to another
	This can be covered in many other areas	GEO.5-8.5.2.A understand how population growth affects air, land, and water quality, and how they impact the physical environment
	This can be covered in many other areas	GEO.5-8.5.2.B explore the positive and negative effects of humans on the environment
	This can be covered in many other areas	GEO.5-8.5.2.C explain how people's lives are influenced by population movements
	This can be covered in many other areas	GEO.5-8.5.3.A track specific resources' distribution throughout the world
	This can be covered in many other areas	GEO.5-8.5.3.B compare countries and their development based on their available resources
	This can be covered in many other areas	GEO.5-8.5.3.C examine current impact of resource use
	This can be covered in many other areas	GEO.5-8.5.3.D predict the changes to a region with better management and resource use
	This can be covered in many other areas	GEO.5-8.5.3.E examine and report how energy resources in different countries are used
	Grade 7: History: Geography of the United States	GEO.5-8.6.1.A identify the various geographic aspects of a region
	This can be covered in many other areas	GEO.5-8.6.1.B analyze the impact human migration has had on regions and countries
	Grade 7: History: Geography of the United States	GEO.5-8.6.1.C examine how various regions/countries deal with social, economic, and political changes
	Grade 8: History: The Middle East and Oil Politics	GEO.5-8.6.1.D explain how competition for resources causes conflict
	Grade 7: History: Geography of the United States	GEO.5-8.6.2.A examine various social, political, and economic regions and see how they are different from past to present
	This can be covered in many other areas	GEO.5-8.6.2.B show how environments and resources have affected various areas from past to present
	This can be covered in many other areas	GEO.5-8.6.2.C predict the future of regions based on available resources and human interaction
	This can be covered in many other areas	GEO.5-8.6.2.D explain and discuss the need for responsible environmental management practices
	This can be covered in many of the History units in Grades 6, 7, and	CIV.6.1.2 Differentiate between anarchy, oligarchy, authoritarianism, and totalitarianism

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Grade 4: American History: Making a Constitutional Government and Grade 8: History: Civics: The Constitution	CIV.6.1.3 Describe how the U.S. Constitution built upon the Magna Carta
This can be covered in Grade 4: American History: Making a Constitutional Government and Grade 8: History: Civics: The Constitution	CIV.6.1.5 Explain the principles of "majority rules" and "minority rights" in representative government
This can be covered in many other areas	CIV.6.2.1 Identify the current U.S. President, Colorado Governor, Colorado Senators, and members of the House of Representatives
This can be covered in Grade 4: American History: Making a Constitutional Government and Grade 8: History: Civics: The Constitution	CIV.6.2.2 Explain which powers are primarily state powers (education, law enforcement, and highways)
Grade 7: History: Roosevelt and the New Deal	CIV.6.2.3 Explain how interest groups and leaders influence public policy – AFL-CIO, Martin Luther King, Jr, and others
This can be covered in many of the History units in Grades 6, 7, and 8	CIV.6.3.1 Demonstrate how in America, government expands from the local level to the county, state, national, and international levels and contrast to other countries
This can be covered in Grade 4: American History: Making a Constitutional Government and Grade 8: History: Civics: The Constitution	CIV.6.3.2 Compare what powers in foreign policy are given to the three branches of government by the U.S. Constitution – Executive branch, Legislative branch, and Judicial branch, e.g.: signing a treaty, declaring war
This can be covered in many of the History units in Grades 7 and 8	CIV.6.3.3 Define "diplomacy" and explain how the U.S. government has mediated international disputes of many kinds, e.g. Balkans, Ireland, Mideast, etc.
This can be covered in many of the History units in Grades 7 and 8	CIV.6.4.2 Compare the roles of the U.S. military services – Air Force, Army, Marines, and Navy, and discuss how serving in the military serves one's country
This can be covered in Grade 4: American History: Making a Constitutional Government and Grade 8: History: Civics: The Constitution	CIV.6.4.4 Give an example of how participating in political life can help solve problems
Core Knowledge® Content (Visual Arts-Grade 6)	**Colorado Grade Level Expectations** (Grade 6-Visual Arts)
I. Art History: Periods and Schools	
A. Classical Art: The Art of Ancient Greece and Rome	
▪	6.9 Recognize and apply the Principles of Design: Contrast, Rhythm (regular, random, alternating), Repetition, Pattern (simple and complex), Proportion (size relationships, exaggeration), Balance (asymmetry and symmetry, radial), Emphasis (focal point) 6.16 Identify unique features of particular art styles and movements. (S=4) 6.19 Use selected criteria as the basis of making judgments about works of art. (S=5)
B. Gothic Art (ca. 12th – 15th centuries)	
▪	6.16 Identify unique features of particular art styles and movements. (S=4)
C. The Renaissance (ca. 1350-1600)	
▪	6.9 Recognize and apply the Principles of Design: Contrast, Rhythm (regular, random, alternating), Repetition, Pattern (simple and complex), Proportion (size relationships, exaggeration), Balance (asymmetry and symmetry, radial), Emphasis (focal point) 6.16 Identify unique features of particular art styles and movements. (S=4) 6.19 Use selected criteria as the basis of making judgments about works of art. (S=5)
D. Baroque (ca. 17th century)	
▪	6.9 Recognize and apply the Principles of Design: Contrast, Rhythm (regular, random, alternating), Repetition, Pattern

	(simple and complex), Proportion (size relationships, exaggeration), Balance (asymmetry and symmetry, radial), Emphasis (focal point) 6.16 Identify unique features of particular art styles and movements. (S=4) 6.19 Use selected criteria as the basis of making judgments about works of art. (S=5)
E. Rococo (ca. mid- to late- 1700's)	
▪	6.9 Recognize and apply the Principles of Design: Contrast, Rhythm (regular, random, alternating), Repetition, Pattern (simple and complex), Proportion (size relationships, exaggeration), Balance (asymmetry and symmetry, radial), Emphasis (focal point) 6.16 Identify unique features of particular art styles and movements. (S=4) 6.19 Use selected criteria as the basis of making judgments about works of art. (S=5)
F. Neoclassical (ca. late 18th – early 19th century)	
▪	6.9 Recognize and apply the Principles of Design: Contrast, Rhythm (regular, random, alternating), Repetition, Pattern (simple and complex), Proportion (size relationships, exaggeration), Balance (asymmetry and symmetry, radial), Emphasis (focal point) 6.16 Identify unique features of particular art styles and movements. (S=4) 6.19 Use selected criteria as the basis of making judgments about works of art. (S=5)
G. Romantic (ca. late 18th – 19th century)	
▪	6.9 Recognize and apply the Principles of Design: Contrast, Rhythm (regular, random, alternating), Repetition, Pattern (simple and complex), Proportion (size relationships, exaggeration), Balance (asymmetry and symmetry, radial), Emphasis (focal point) 6.16 Identify unique features of particular art styles and movements. (S=4) 6.19 Use selected criteria as the basis of making judgments about works of art. (S=5)
H. Realism (ca. mid- to late- 19th century)	
▪	6.9 Recognize and apply the Principles of Design: Contrast, Rhythm (regular, random, alternating), Repetition, Pattern (simple and complex), Proportion (size relationships, exaggeration), Balance (asymmetry and symmetry, radial), Emphasis (focal point) 6.16 Identify unique features of particular art styles and movements. (S=4) 6.19 Use selected criteria as the basis of making judgments about works of art. (S=5)
▪	6.9 Recognize and apply the Principles of Design: Contrast, Rhythm (regular, random, alternating), Repetition, Pattern (simple and complex), Proportion (size relationships, exaggeration), Balance (asymmetry and symmetry, radial), Emphasis (focal point) 6.16 Identify unique features of particular art styles and movements. (S=4) 6.19 Use selected criteria as the basis of making judgments about works of art. (S=5)
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered in many other areas	6.1 Maintain a sketchbook journal of ideas and writings to use as a resource and planning tool. (S=1)
This can be covered in many other areas	6.2 Using their own artwork or works of others, write a statement which explains how the artist's feelings are portrayed visually. (S=5)
This can be covered in many other areas	6.3 Identify how the belief system of a viewer may influence the interpretation of works of art. (S=1)
This can be covered in many other areas	6.4 Create a work of art based upon an interpretation of a sensory experience. (S=1)
This can be covered in many other areas	6.5 State the rationale for the choices or options selected in resolving the artistic problem. (S=1)
This can be covered in many other areas	6.6 Recognize that there are various solutions to a single art problem. (S=1)
This can be covered in many other areas	6.7 Create art to communicate real and imaginary sources. (S=1)
Grade 6: Language Arts: Fiction and Drama and Poetry	6.8 Create works of art inspired by spoken and written stories and poems. (S=1)

This can be covered in many other areas	6.10.A Recognize and apply the Elements of Art: Lines (Types-straight, curved, zigzag, wavy, horizontal, vertical, diagonal, spiral, broken, contour, gesture, horizon, direction, angularity; Variation-width and length, depth, thick and thin, relationship-intersect, perpendicular, parallel)
This can be covered in many other areas	6.10.B Recognize and apply the Elements of Art: Shape (Types-geometric-square, circle, rectangle, oval, triangle; organic shapes-free- form, open and closed, simple and complex, silhouette, symbol; Variation-size)
This can be covered in many other areas	6.10.C Recognize and apply the Elements of Art: Form (Types-geometric, sphere, cube, box, pyramid, cone, organic; Variation-volume, mass, length, width, depth, thick and thin, simple and complex, functional, non-functional)
This can be covered in many other areas	6.10.D Recognize and apply the Elements of Art: Texture (Types-visual and tactile; Variation-rough, smooth, hard, soft, raised, lowered, matted, glossy, actual and implied)
This can be covered in many other areas	6.10.E Recognize and apply the Elements of Art: Space (Types-actual and implied; Concepts-overlapping, object size, positive and negative, empty and full, near and far, point of view-foreground, middleground, background, composition)
This can be covered in many other areas	6.1.F Recognize and apply the Elements of Art: Color (Types-primary, secondary, intermediate, neutral; Schemes-monochromatic, complementary, warm and c ool, analogous; Concepts-color wheel, hue, value, opaque, transparent, tone)
This can be covered in many other areas	6.10.G Recognize and apply the Elements of Art: Value (Types-value scale, light, medium, dark, highlights and shadows)
This can be covered in many other areas	6.11 Using paper mache in an additive method, create a figurative sculpture. (S=3)
This can be covered in many other areas	6.12 Create a composition using linear perspective. (S=3)
This can be covered in many other areas	6.13 Utilizing positive and negative space, create a linoleum print. (S=3)
This can be covered in many other areas	6.14 Use a computer and peripherals to manipulate and create artwork. (S=3)
This can be covered in many other areas	6.15 Follow directions for the safe use of tools, materials and procedures. Wear appropriate protection such as smocks, safety glass, gloves, and hair ties when necessary. When appropriate, pass a safety assessment. (S=3)
Grades 1, 2, 3, 4, and 5: Visual Arts	6.17 Observe and discuss the use of indigenous materials in various art forms used in other cultures. (S=4)
This can be covered in many other areas	6.18 Predict outcomes if the elements of design or the materials were altered in a particular work of art. (S=5)
This can be covered in many other areas	6.22 Apply the four steps of art criticism: 1) describe, 2) analyze the work in terms of elements and design principles, 3) interpret the work in terms of ideas and emotions, and 4) judge the work as to its success both technically and in either communicating an idea, and emotion, or fulfilling a practical purpose. (S=5)
This can be covered in many other areas	6.23 Develop and describe personal reasons for valuing works. (S=5)
Core Knowledge® Content (Music-Grade 6)	**Colorado Grade Level Expectations** (Grade 6-Music)
I. Elements of Music	
▪	6.5 discuss the role of the conductor (S1, S4) 6.9 compare and contrast the use of percussion instruments in varied ethnic cultures (S4, S5)
▪	6.4 identify and respond to all directional words and symbols, including tempo (S1, S4)
▪	
▪	
▪	
▪	
▪	6.2 read, notate, and perform rhythmic patterns, adding sixteenth-eighth note combinations and sixteenth rests to the notes already learned (S1, S2) 6.4 identify and respond to all directional words and symbols, including tempo (S1, S4)
II. Classical Music: From Baroque to Romantic	
A. Baroque (ca. 1600-1750)	
▪	
B. Classical (ca. 1750-1825)	

▪	
C. Romantic (ca. 1800-1900)	
▪	
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered in many areas	6.1 sing and play an individual part against a contrasting part (S1)
This can be covered in many areas	6.2 organize tones or bells or a keyboard instrument in major, minor, chromatic, and pentatonic scale patterns (S1, S3)
This can be covered in many areas	6.6 create an original composition within a given framework (S3)
Grade 5: Music: Elements of Music	6.7 differentiate between a steady beat and a syncopated beat (S4)
This can be covered in many areas	6.8 develop criteria for evaluating the quality of performances (S4)
This can be covered in many areas	6.10 analyze and contrast the use of form in music from varied world cultures (S4, S5)
This can be covered in many areas	6.11 demonstrate appropriate audience behavior (S5)
Core Knowledge® Content (Mathematics-Grade 6)	**Colorado Grade Level Expectations** (Grade 6-Mathematics)
I. Numbers and Number Sense	
▪	
▪	
▪	6.1.1.A continue to locate commonly-used positive rational numbers, including fractions, mixed numbers, terminating decimals through thousandths, and percents, on the number line 6.1.1.B locate integers on the number line 6.1.1.C identify subsets of integers, including counting and whole numbers 6.5.3.A read and interpret scales on number lines, graphs, and maps
▪	
▪	
▪	6.1.2.A read, write, and order positive rational numbers, including commonly-used fractions and terminating decimals through thousandths 6.1.2.B compare positive fractions and decimals using the symbols =, $<$, $>$
▪	6.1.3.E determine the greatest common factor and least common multiple of a pair of whole numbers
▪	6.1.3.E determine the greatest common factor and least common multiple of a pair of whole numbers
▪	6.1.1.E pictorially, demonstrate the meaning of square roots of perfect square numbers through 100 6.1.3.B write whole numbers in expanded form with powers of ten (for example, 579 = 500 + 70 + 9 = 5 x 100 + 7 x 10 + 9 x 1) 6.1.3.C write large whole numbers using scientific notation (for example, 246,000,000 = 2.46×10^8; 2.46×10^8 = 246,000,000)
II. Ratio, Percent, and Proportion	
A. Ratio and Proportion	
▪	
▪	6.1.4.B demonstrate the similarities and differences between ratios and fractions 6.1.4.C interpret and use ratios in different contexts (e.g., batting averages, miles per hour) to show the relative sizes of two quantities using appropriate notations, including a/b, a to b, a:b
▪	
▪	
B. Percent	
▪	6.1.1.D demonstrate the equivalence of commonly-used fractions, decimals, and percents

	6.6.1.A demonstrate the equivalence of fractions, decimals, and percents
▪	6.6.1.B using concrete materials, determine commonly-used percentages in real-world problems
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III. Computation	
A. Addition	
▪	6.6.2.E using paper-and-pencil, demonstrate with proficiency addition and subtraction of fractions including mixed numerals 6.6.2.A demonstrate order of operations including exponents with whole numbers
B. Multiplication	
▪	6.6.2.A demonstrate order of operations including exponents with whole numbers
▪	
▪	
▪	6.6.2.F using concrete materials, demonstrate multiplication and division of a common proper fraction and a whole number 6.6.2.G using concrete materials, demonstrate multiplication and division of proper fractions 6.6.2.H using concrete materials, demonstrate the meaning of multiplication and division of decimals by whole numbers
▪	
C. Division	
▪	6.6.2.I demonstrate, by modeling, the inverse relationship of multiplication and division of common proper fractions
▪	
▪	
▪	6.6.2.F using concrete materials, demonstrate multiplication and division of a common proper fraction and a whole number 6.6.2.G using concrete materials, demonstrate multiplication and division of proper fractions **6.6.2.H using concrete materials, demonstrate the meaning of multiplication and division of decimals by whole numbers**
D. Solving Problems and Equations	
▪	
▪	
IV. Measurement	
Teachers: Students should know all information regarding measurement presented in grades 4 and 5; review and reinforce as necessary.	6.5.1.E continue to estimate and use the capacity, weight, and mass measurements from previous grades 6.5.6.A select and use the appropriate units and tools to measure to the degree of accuracy required in a particular problem 6.5.6.B measure the length of the sides and heights of parallelograms and rhombuses to the nearest inch and nearest centimeter
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V. Geometry	
▪	6.4.2.B use correct geometric symbols for parallelism, perpendicularity, and triangles
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▪	6.5.6.C measure angles and draw complements and supplements, where possible, using a protractor
▪	6.4.2.B use correct geometric symbols for parallelism, perpendicularity, and triangles
▪	6.4.2.C reason informally about the properties (including lines of symmetry) of parallelograms, rhombuses, and triangular prisms 6.4.2.D reason informally about congruence involving parallelograms, rhombuses, and triangular prisms
▪	6.4.5.A solve problems involving perimeter and area of parallelograms and rhombuses 6.5.4.A develop and use formulas for perimeter and area of parallelograms and rhombuses using appropriate units 6.5.5.A describe how changes in the base of a triangle affect its area when it height is constant 6.5.5.B describe how changes in one of the dimensions of a rectangular prism affect its volume
▪	
▪	6.4.5.B solve problems involving volume of triangular prisms 6.5.4.B develop and use the formula for volume of triangular prisms using appropriate units
VI. Probability and Statistics	
▪	6.3.2.A determine the mean of a set of data by using an algorithm 6.3.2.B formally distinguish between mean, median, and mode
▪	6.3.2.C given various displays if the same set of data (line, bar, circle, stem-and-leaf, and histograms), determine which measure of central tendency is most evident
▪	6.3.3.A recognize a misleading display of data due to scaling 6.3.3.B critically evaluate biased sampling of a survey
▪	6.3.5.B assign 0% to an impossible event and 100% to a certain event 6.3.5.C perform experiments of independent compound events to estimate probability
▪	
▪	6.2.2.A solve problems from patterns involving positive rational numbers using tables, graphs, and rules 6.3.1.B read, interpret, and draw conclusions from various displays of data 6.3.6.A predict the probability of independent compound events, such as the sum of two number cubes, conduct an experiment or simulation to determine the probability, and assign the probability to all possible sums of two number cubes 6.5.3.A read and interpret scales on number lines, graphs, and maps 6.5.3.B select the appropriate scale for a given problem
▪	6.3.2.B formally distinguish between mean, median, and mode
▪	6.3.1.A organize and display data using appropriate graphs, such as line, bar, circle, dot plots, frequency tables, stem-and-leaf, and histograms 6.3.7.A determine the number of outcomes of independent compound events, such as the sum of tossing two number cubes by making a list or tree diagram
▪	6.4.4.A identify the four quadrants of the coordinate plane 6.4.4.B set up a coordinate graph (include axes, origin, and scale) and use it to mark and read coordinate pairs in all four quadrants 6.5.3.A read and interpret scales on number lines, graphs, and maps
VII. Pre-Algebra	
▪	6.2.1.B use variables such as boxes, letters, or other symbols to describe a general rule and to solve problems 6.2.3.A in any functional relationship involving positive rational numbers, describe how a change in one quantity affects the other
▪	6.2.1.B use variables such as boxes, letters, or other symbols to describe a general rule and to solve problems

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Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
Grade 5: Mathematics: Numbers and Number Sense	6.1.3.A write the prime factorization of whole numbers in exponential form (for example, 36 = 2 x 2 x 2 x 3)
This can be covered in many other areas	6.1.3.D demonstrate the divisibility rules for 2, 3, 5, 6, 9, and 10
Grade 5: Mathematics: Ratio and Percent	6.1.4.A represent fractions, decimals, and percents as ratios
Grade 5: Mathematics: Fractions and Decimals	6.1.5.A demonstrate multiplication inverses of positive rational numbers (for example, 1/9 x 9 = 1)
This can be covered in many other areas (Division)	6.1.5.B demonstrate that division by zero is undefined
This can be covered in many other areas	6.1.6.A estimate, using appropriate techniques, determine, and then, justify the reasonableness of solutions to problems involving whole numbers and sums and differences of commonly–used fractions and decimals
This can be covered in many other areas	6.2.1.A represent, describe, and analyze patterns for relationships involving positive rational numbers
Grade 5: Mathematics: Probability and Statistics	6.2.4.A graph discrete linear and nonlinear functions
Grade 5: Mathematics: Probability and Statistics	6.2.4.B graph a continuous linear function for a given situation
This can be covered in many other areas	6.2.5.A solve problems involving linear relationships in positive rational numbers
This can be covered in many other areas	6.2.5.B solve simple linear equations with whole number coefficients by informal methods using manipulatives, tables, graphs, or technology
This can be covered in many other areas (Probability and Statistics)	6.3.4.A demonstrate the meaning of random sampling and biased versus unbiased samples
This can be covered in many other areas (Probability and Statistics)	6.3.5.A pictorially demonstrate the equivalence of probabilities as either a common fraction, decimal, or percent
This can be covered in many other areas (Probability and Statistics)	6.3.6.B demonstrate that the sum of all probabilities of two number cubes equals one
This can be covered in many other areas (Probability and Statistics)	6.3.6.C using two chance devices, such as two number cubes or two spinners, design a fair game, and write the directions for each game
This can be covered in many other areas	6.4.1.A using a straight edge and a compass, paper folding, or computer software applications, demonstrate the geometric construction of an angle bisector
This can be covered in many other areas	6.4.1.B build models of triangular prisms including their nets
This can be covered in many other areas	6.4.1.C given a three-dimensional model built with cubes, draw the orthogonal drawings (that is, the front view, right side view, and top view) and the foundation drawing (that is, the shape of the foundation, placement and the number of cubes that are built on this foundation) and, conversely, given the orthogonal and foundation drawing, build the model
Grade 7: Mathematics: Geometry	6.4.2.A describe complimentary and supplementary angles
Grade 5: Mathematics: Probability and Statistics	6.4.4.C draw a graph from a given scenario
This can be covered in many other areas (Probability and Statistics)	6.4.4.D given a distance, find pairs of points in the coordinate plane separated by that horizontal or vertical distance
Grade 7: Mathematics: Geometry	6.4.5.C solve problems involving surface area of rectangular prisms
This can be covered in many other areas (Geometry)	6.4.6.A tile a plane with polygons
Grade 7: Mathematics: Geometry	6.4.6.B demonstrate clockwise and counterclockwise rotation with 90E, 180E, and 270E turns
This can be covered in many other areas (Geometry)	6.4.6.C using models, demonstrate the multiple transformations which occur to get from one congruent figure to the other, and give a written explanation of the transformations
This can be covered in many other areas (Geometry)	6.5.1.A estimate the length of sides and height of parallelograms and rhombuses
This can be covered in many other areas (Geometry)	6.5.1.B estimate the perimeter and area of parallelograms and rhombuses
This can be covered in many other areas (Geometry)	6.5.1.C estimate the volume of triangular prisms
This can be covered in many other areas (Geometry)	6.5.1.D estimate the surface area of rectangular prisms
This can be covered in many other areas (Geometry)	6.5.1.F estimate measures of angles
This can be covered in many other areas (Geometry)	6.5.2.A compare the estimates and direct measurements obtained in benchmarks 6.1, 6.4, and 6.6
Grade 5: Mathematics: Computation	6.6.2.B choose the appropriate representation of the remainder in a division problem

This can be covered in many other areas	6.6.2.C demonstrate equivalencies of mixed numerals and improper fractions
Grade 5: Mathematics: Fractions and Decimals	6.6.2.D simplify fractions
Grade 4: Mathematics: Money	6.6.2.J count change up to the given amount
This can be covered in many other areas	6.6.3.A determine from real-world problems whether an estimated or exact answer is acceptable
This can be covered in many other areas	6.6.3.B use estimation techniques before performing operations
This can be covered in many other areas	6.6.4.A determine whether information given in a problem-solving situation is sufficient, insufficient, or extraneous
This can be covered in many other areas	6.6.4.B given a real-world problem-solving situation, use the correct operation and appropriate method (mental arithmetic, estimation, paper-and-pencil, calculator, or computer) to solve the problem
This can be covered in many other areas	6.6.4.C given a math sentence with sums and differences of common fractions and decimals, create and illustrate a real-world problem
This can be covered in many other areas	6.6.4.D in a problem-solving situation, determine whether the results are reasonable and justify those results with correct computations
Core Knowledge® Content (Science-Grade 6)	**Colorado Grade Level Expectations** (Grade 6-Science)
<u>Teachers</u>: Effective instruction in science requires not only hands-on experience and observation but also book learning, which helps bring coherence and order to student's scientific knowledge. Only when topics are presented systematically and clearly can students make steady and secure progress in selective study of topics, a number of which were introduced in earlier grades. It also continues the practice of studying topics from each of the major realms of science (physical, life, and earth science). Students are expected to do experiments and write reports on their findings.	
I. Plate Tectonics	
▪	
II. Oceans	
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▪	
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▪	6.6.G recognize that patterns exist within and across systems
▪	
III. Astronomy: Gravity, Stars, and Galaxies	
▪	6.4.I know that the path of a planet around the sun is due to the gravitational attraction between the sun and the planet
▪	6.4.J know that the sun, an average star, is the central and largest body in the solar system and is comprised primarily of hydrogen and helium
▪	6.4.G know that the Solar System forms part of the Milky Way Galaxy which is one of many galaxies that comprise the Universe
IV. Energy, Heat, and Energy Transfer	
A. Energy	
▪	6.2.H know that energy can be carries from one place to another by heat flow or by waves including water eaves, light and sound, or by moving objects)
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▪	
▪	6.5.C describe uses of renewable and non-renewable resources (e.g. forests and fossil fuels)

▪	
B. Heat	
▪	
C. Physical Change: Energy Transfer	
▪	6.6.G recognize that patterns exist within and across systems
▪	
▪	
▪	
▪	
▪	6.2.D investigate changes in the state of water and use the particle model to explain these changes
▪	
V. The Human Body	
▪	
VI. Science Biographies	
▪	6.5.A describe how people use science and technology in their professions 6.6.E recognize the scientific contributions that are made by individuals of diverse backgrounds, interests, talents, and motivations
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered in many other areas, see note to teachers above	6.1.A choose measurement methods and devices according to the level of precision demanded by the problem
This can be covered in many other areas, see note to teachers above	6.1.B predict an outcome based on a set of experimental data
This can be covered in many other areas, see note to teachers above	6.1.C recognize that scientific investigations sometimes lead to new methods or procedures for conducting an investigation or new technologies to improve the collection of data
This can be covered in many other areas, see note to teachers above	6.1.D construct a model that illustrates a concept developed from an inquiry
This can be covered in many other areas, see note to teachers above	6.1.E refine hypotheses from a previous investigation
This can be covered in many other areas, see note to teachers above	6.1.F identify the variables in an investigation
This can be covered in many other areas, see note to teachers above	6.1.G create a written plan to include the question to be investigated, and appropriate hypothesis, design of the experiment, identification of the variables, a developed scientific procedure to collect and record data; the design should also include a number of repeated trials, accurate measurements and record keeping and a comparison to a control
Grade 5 and Grade 6: Mathematics: Probability and Statistics	6.1.H organize and present the data in appropriate formats (e.g. histograms, circle graphs, flow charts) and make inferences based on that data
Grade 5 and Grade 6: Mathematics: Probability and Statistics	6.1.I identify, and interpret patterns, trends, relationships in collected data
This can be covered in many other areas, see note to teachers above	6.1.J identify data that does not fit a pattern
This can be covered in many other areas, see note to teachers above	6.1.K analyze the results of an experiment, draw conclusions about the question being investigated, and defend those conclusions
Grade 6: Mathematics: Measurement	6.1.L use metric units in measuring, calculating, and reporting results
This can be covered in many other areas	6.2.A describe the difference between the student's own weight and mass
Grade 5: Science: Chemistry: Matter and Change and Grade 7: Science: Atomic Structure	6.2.B construct models of several kinds of atoms and describes their general properties (nucleus, proton, neutron, electron)
Grade 5: Science: Chemistry: Matter and Change and Grade 7: Science: Atomic Structure	6.2.C use laboratory investigations to demonstrate the formation of new compounds
Grade 4: Science: Electricity and Grade 8: Science: Electricity and	6.2.E design a simple circuit that can do work and explain the energy transfer taking place in the system

	Magnetism	
	Grade 8: Science: Physics	6.2.F calculate the average speed of a toy or an animal moving in a straight or curved path by making appropriate measurements (motion of an object can be described by its position, direction of motion, and speed)
	Grade 8: Science: Physics	6.2.G measure the various net forces acting on an object and their effects (explain in terms of forces involved, why a satellite orbits the Earth)
	Grade 7: Science: Evolution	6.3.A explain how adaptations affect a species survival
	Grade 1: Science: Living Things and Their Environments and Grade 3: Science: Ecology	6.3.B explain interactions and interdependence of nonliving and living components within ecosystems with first order consumers, second order consumers, and biotic factors
	Grade 1: Science: Living Things and Their Environments and Grade 3: Science: Ecology	6.3.C explore bio-diversity in ecosystems
	Grade 5: Science: Plant Structures and Processes and Grade 8: Chemistry of Food and Respiration	6.3.D know that energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis and then from organism to organism in food webs
	Grade 1: Science: Living Things and Their Environments and Grade 3: Science: Ecology	6.3.E categorizes organisms according to their roles in food chains and food webs as carnivores, herbivores, omnivores, producers, consumers, or decomposers
	Grade 5: Science: Cells: Structures and Processes	6.3.F identify the difference between plant and animal cells
	Grade 5: Science: Cells: Structures and Processes	6.3.G identify parts of a cell explaining the structure and function of a cell
	Grade 7: Science: Cell Division and Genetics	6.3.H describe the role of chromosomes and genes in heredity (e.g. a typical cell of any organism contains genetic instructions that specify its traits; these traits may be modified by environmental influences)
	Grade 7: Science: Cell Division and Genetics	6.3.I understand that DNA is the genetic material of living organisms and is located in the chromosomes of each cell
	Grade 4: Science: Geology: The Earth and Its Changes	6.4.A know that soils are found in layers with each having a different composition and texture
	Grade 7: Science: History of the Earth and Life Forms	6.4.B know that layers of sedimentary rocks confirm the long history of the earth and its changing life forms
	Grade 2: Science: The Earth and Grade 4: Science: Geology: The Earth and Its Changes	6.4.C use characteristics to identify selected minerals and rocks
	Grade 2: Science: The Earth and Grade 4: Science: Geology: The Earth and Its Changes	6.4.D explain the difference between rocks and minerals
	Grade 1: Science: Matter	6.4.E describe major differences in the physical properties of water as a solid, liquid, and gas
	Grade 4: Science: Meteorology	6.4.F describe the cycling of water in a closed system (e.g. bottle terrarium)
	Grade 3: Science: Astronomy	6.4.H know that the nine planets, their respective moons, comets, many asteroids and meteorites orbit the sun which is the gravitational center of the Solar System
	This can be covered in many other areas, see note to teachers above	6.5.B describe ways in which innovations address human biological, physical, and psychological needs
	This can be covered in many other areas, see note to teachers above	6.6.A know that scientific knowledge is subject to modifications as new information is discovered
	This can be covered in many other areas, see note to teachers above	6.6.B challenge prevailing theories and new theories which leads to looking at old observations in a new way
	This can be covered in many other areas, see note to teachers above	6.6.C know that the study of the events that led scientists to discoveries can provide information about the inquiry process and its effects
	This can be covered in many other areas, see note to teachers above	6.6.D know that a change in one or more variables may alter the outcome of an investigation
	This can be covered in many other areas, see note to teachers above	6.6.F know that when similar investigations give different results, the scientific challenge is to verify whether the differences are significant by further study

Correlation of *Core Knowledge*® *Sequence* & Colorado Grade Level Expectations

Core Knowledge® Content (English-Grade 7)	Colorado Grade Level Expectations (Grade 7-Reading & Writing)
I. Writing, Grammar, and Usage	
A. Writing and Research	
Teachers: Students should be given opportunities to write fiction, poetry, or drama, but instruction should emphasize repeated expository writing. Students should examine their work with attention to unity, coherence, and emphasis. Expository essays should have a main point and stick to it, and have a coherent structure, typically following the pattern of introduction, body, and conclusion. Paragraphs should have a unified focus, be developed with evidence, and examples, and have transitions between them. Essays should have appropriate tone and diction, as well as correct spelling and grammar in their final form. Standards for writing apply across the disciplines.	7.2.A write in a variety of genres such as personal narratives, informational brochures, essays, stories, and letters for specific purposes such as to entertain, to persuade, and to inform 7.2.B develop ideas and content with significant details, examples, and/or reasons 7.2.C organize ideas so that there is an inviting introduction, logical arrangement of ideas, and a satisfying conclusion 7.2.D use transitions to link ideas 7.2.E plan, draft, revise, and edit for a legible final copy 7.2.F use a variety of sentence structures with varied length 7.2.G write with a voice appropriate to purpose and audience 7.2.H choose a range of words that are precise and vivid 7.3.F use paragraphs correctly so that each paragraph is differentiated by indenting or blocking and includes on major but focused idea 7.3.G use conventional spelling in published work
▪	7.2.A write in a variety of genres such as personal narratives, informational brochures, essays, stories, and letters for specific purposes such as to entertain, to persuade, and to inform
▪	7.5.A use organizational features of printed text such as chapter preview and summaries, prefaces, annotations, bold face print, and appendices 7.5.C locate and select relevant information 7.5.D paraphrase, summarize, organize, and synthesize information 7.5.E use available media resources, including technology, to research and produce a document
B. Speaking and Listening	
▪	7.4.B use reading, writing, speaking, listening, and viewing to solve problems and answer questions 7.4.D make predictions, draw conclusions, and analyze what the read, hear, and view
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▪	
C. Grammar	
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▪	7.3.B use standard English usage in writing, including subject/verb agreement, pronoun referents, modifiers, homonyms, and homophones
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▪	7.3.C write in complete sentences
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▪	
D. Spelling	

▪	7.3.H use writing resources such as dictionaries to monitor spelling accuracy
▪	7.3.G use conventional spelling in published work
E. Vocabulary	
▪	7.1.G use word recognition skills to comprehend text (for example, roots, prefixes, and suffixes)
II. Poetry	
A. Poems	
▪	7.1.B summarize text read such as newspaper and magazine articles, technical writing, stories, and poetry 7.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, and plays
B. Elements of Poetry	
▪	7.6.D apply knowledge of literary techniques, including foreshadowing, metaphor, simile, personification, onomatopoeia, alliteration, and flashback, to understand text
▪	
▪	
▪	
III. Fiction, Nonfiction, and Drama	
A. Short Stories	
▪	7.1.A compare and contrast texts with similar characters, plots, and/or themes 7.1.B summarize text read such as newspaper and magazine articles, technical writing, stories, and poetry 7.1.C determine the main idea or essential message in a text 7.1.D make reasonable inferences from information that is implied but not directly stated 7.1.E infer by making connections between separated sections of a text 7.1.F find support in the text for main ideas 7.1.G use word recognition skills to comprehend text (for example, roots, prefixes, and suffixes) 7.4.A recognize an author's or speaker's point of view or purpose 7.4.D make predictions, draw conclusions, and analyze what the read, hear, and view 7.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, and plays 7.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar
B. Novels/Novellas	
▪	7.1.A compare and contrast texts with similar characters, plots, and/or themes 7.1.B summarize text read such as newspaper and magazine articles, technical writing, stories, and poetry 7.1.C determine the main idea or essential message in a text 7.1.D make reasonable inferences from information that is implied but not directly stated 7.1.E infer by making connections between separated sections of a text 7.1.F find support in the text for main ideas 7.1.G use word recognition skills to comprehend text (for example, roots, prefixes, and suffixes) 7.4.A recognize an author's or speaker's point of view or purpose 7.4.D make predictions, draw conclusions, and analyze what the read, hear, and view 7.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, and plays 7.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar
C. Elements of Fiction	
▪	7.6.C use literature terminology accurately, including setting, character, conflict, plot, resolution, dialect, and point of

	view
D. Essays and Speeches	
▪	7.1.A compare and contrast texts with similar characters, plots, and/or themes 7.1.B summarize text read such as newspaper and magazine articles, technical writing, stories, and poetry 7.1.C determine the main idea or essential message in a text 7.1.D make reasonable inferences from information that is implied but not directly stated 7.1.E infer by making connections between separated sections of a text 7.1.F find support in the text for main ideas 7.1.G use word recognition skills to comprehend text (for example, roots, prefixes, and suffixes) 7.4.A recognize an author's or speaker's point of view or purpose 7.4.D make predictions, draw conclusions, and analyze what the read, hear, and view 7.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, and plays 7.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar
E. Autobiography	
▪	7.1.A compare and contrast texts with similar characters, plots, and/or themes 7.1.B summarize text read such as newspaper and magazine articles, technical writing, stories, and poetry 7.1.C determine the main idea or essential message in a text 7.1.D make reasonable inferences from information that is implied but not directly stated 7.1.E infer by making connections between separated sections of a text 7.1.F find support in the text for main ideas 7.1.G use word recognition skills to comprehend text (for example, roots, prefixes, and suffixes) 7.4.A recognize an author's or speaker's point of view or purpose 7.4.D make predictions, draw conclusions, and analyze what the read, hear, and view 7.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, and plays 7.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar
F. Drama	
▪	7.1.A compare and contrast texts with similar characters, plots, and/or themes 7.1.B summarize text read such as newspaper and magazine articles, technical writing, stories, and poetry 7.1.C determine the main idea or essential message in a text 7.1.D make reasonable inferences from information that is implied but not directly stated 7.1.E infer by making connections between separated sections of a text 7.1.F find support in the text for main ideas 7.1.G use word recognition skills to comprehend text (for example, roots, prefixes, and suffixes) 7.4.A recognize an author's or speaker's point of view or purpose 7.4.D make predictions, draw conclusions, and analyze what the read, hear, and view 7.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, and plays 7.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar
▪	7.6.C use literature terminology accurately, including setting, character, conflict, plot, resolution, dialect, and point of view
G. Literary Terms	
▪	7.6.D apply knowledge of literary techniques, including foreshadowing, metaphor, simile, personification, onomatopoeia, alliteration, and flashback, to understand text

IV. Foreign Phrases Commonly Used in English	
▪	
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered in many other areas	7.1.H find the sequence of steps in a technical publication
Grade 5: Language Arts: Grammar and Usage	7.3.A identify parts of speech such as nouns, pronouns, verbs, and adjectives
Grade 2 and 3: Language Arts: Spelling, Grammar, and Usage	7.3.D use capitals correctly, such as in titles, direct quotations, and proper nouns
Grade 4, 5, 6: Language Arts: Grammar and Usage	7.3.E punctuate correctly, including apostrophes; commas in dialogue, compound sentences, complex sentences, and direct address; and semi-colons
This can be covered in many other areas	7.4.C distinguish between fact and opinion
This can be covered in many other areas	7.5.B use library and interlibrary catalog databases and organizational features of electronic information (for example, microfiche headings and numbering, Internet, electronic mail, CD-ROM, laser disc)
Core Knowledge® Content (History & Geography-Grade 7)	**Colorado Grade Level Expectations** (Grade 7- History, Geography, & Civics)
I. America Becomes a World Power	
▪	GEO.7.1.2.A demonstrate expanded knowledge of world geography in relation to America's becoming a world power
▪	
▪	HIS.7.5.C describe how military and/or economic expansion resulted in the assumption or seizure of political power throughout history (emphasize Spanish-American War and World War I: causes, effects, and connections to later international wars) HIS.7.5.D study the personal histories of Kaiser Wilhelm and Theodore Roosevelt (compare the two and discuss their apparent values and beliefs as shown by their actions and major decisions)
▪	
▪	
II. World War I: "The Great War," 1914-1918	
A. History	
▪	HIS.7.5.C describe how military and/or economic expansion resulted in the assumption or seizure of political power throughout history (emphasize Spanish-American War and World War I: causes, effects, and connections to later international wars) GEO.7.1.2.B locate and discuss the geography of important events – parts of World War I (1914-1918)
▪	
▪	
▪	
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▪	HIS.7.5.D study the personal histories of Kaiser Wilhelm and Theodore Roosevelt (compare the two and discuss their apparent values and beliefs as shown by their actions and major decisions)
▪	
▪	
B. Geography of Western and Central Europe	
▪	GEO.7.1.2.C demonstrate thorough knowledge of the geography of the countries of Western and Central Europe, as related to population, industrialization, resources, transportation, alliances, etc.
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▪	GEO.5-8.4.1.A describe and discuss the reasons for human migrations (e.g. famine, slave trade, wars, persecution) after studying related literature
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▪	
III. The Russian Revolution	
A. History	
▪	
B. Geography	
▪	GEO.7.1.2.D discuss the geography of Russia in relation to the Russian Revolution (1917)
▪	
▪	
IV. America from the Twenties to the New Deal	
A. America in the Twenties	
▪	GEO.7.1.2.E discuss the geography of the United States in relation to the history of the Twenties and the Great Depression
B. The Great Depression	
▪	
C. Roosevelt and the New Deal	
▪	
V. World War II	
A. The Rise of Totalitarianism in Europe	
▪	GEO.7.1.2.F demonstrate knowledge of the geography of Europe and the world in relation to the major events of World War II
B. World War II in Europe and at Home, 1939-45	
▪	CIV.7.4.1 Describe a great American military leader in detail – e.g.: General Eisenhower, General Powell, U.S. Grant, Robert E. Lee, General MacArthur, others
C. World War II in the Pacific, and the End of the War	
▪	
VI. Geography of the United States	
▪	GEO.7.1.2.G demonstrate expanded knowledge of the geography of the United States, including mountains, water features, political and economic features, cities, population, etc. GEO.5-8.4.1.B create graphs depicting population numbers and distribution GEO.5-8.4.3.A identify economic activities within a region and examine the reasons for their locations

	GEO.5-8.4.4.B deduct geographical reasons for human settlements in specific areas GEO.5-8.4.4.C classify cities according to their human and environmental characteristics GEO.5-8.4.4.D compare patterns of land use and human settlement in various regions GEO.5-8.4.4.E classify cities according to their physical characteristics GEO.5-8.4.4.F analyze the process of the creation of a megalopolis GEO.5-8.6.1.A identify the various geographic aspects of a region GEO.5-8.6.1.C examine how various regions/countries deal with social, economic, and political changes GEO.5-8.6.2.A examine various social, political, and economic regions and see how they are different from past to present
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered and reviewed from many previous and future History units	HIS.7.1.A construct various time lines of history in the regional development of the Eastern Hemisphere from 2000 B.C. to the present, highlighting landmark dates, technological changes, major political and military events
This can be covered and reviewed from many previous and future History units	HIS.7.1.B trace patterns of change and continuity in the Eastern Hemisphere from long ago throughout the 20th century, using a variety of information sources
This can be covered and reviewed from many previous and future History units	HIS.7.1.C compare and contrast the distribution, growth rates, and characteristics of human population, with attention to settlement patterns in Asia and Africa
This can be covered and reviewed from many previous and future History units	HIS.7.2.A pose and answer questions about the history of South, Central, and East Asia and Africa
This can be covered in many of the History units	HIS.7.2.B examine historical writings for point of view, historical context, bias, distortion, or propaganda
This can be covered in many of the History units	HIS.7.2.C use specific examples to explain that judgment and generalizations about the past are often tentative and must be used carefully when dealing with present issues
This can be covered and reviewed from many previous and future History units	HIS.7.2.D analyze the regional development of Asia, Africa, and the Middle East relative to physical, economic and cultural characteristics and historical evolution from 1000 A.D. to the present
This can be covered and reviewed from many previous and future History units	HIS.7.3.A describe the history, interactions, and contributions of various peoples who make up major culture regions of the world (e.g. Africa, India, China, Japan, Southeast Asia, the Middle East, Europe)
Grade 1: World History: Early Civilizations	HIS.7.3.B explain how the cultures of the earliest civilizations spread (for example, the civilizations of the river valleys of India, Mesopotamia, Europe)
Grade 6: World History: Industrialism, Capitalism, and Socialism	HIS.7.4.A describe and identify how industrialization influenced the movement of people (e.g. to, and from, urban, suburban, and rural areas)
Other grade levels: Science: Science Biographies	HIS.7.4.B explain the significance of the achievements of individual scientists and inventors from many cultures (e.g. the impact of germ theory on medical practice and sanitation; the impact of the steamship on transportation and trade; the impact of the printing press on who had access to books)
This can be covered in many of the History units	HIS.7.4.C relate the differences in technology to differences in how people live in various regions of the world
This can be covered in many of the History units	HIS.7.4.D distinguish between developed and developing countries in the Eastern Hemisphere and relate the level of development to the quality of life (consider why some develop more evenly and quickly than others)
Grade 4: World History: The Spread of Islam and Grade 6: World History: Lasting Ideas from Ancient Civilizations	HIS.7.5.A identify the ancient and medieval roots of governmental principles and institutions (e.g. Hammurabi's Code, Roman republicanism, Mosaic Law, Greek Democracy, Islamic Law)
This can be covered and reviewed from many previous and future History units	HIS.7.5.B describe the basic forms of government, giving examples of societies that have practiced them (e.g. monarchy, oligarchy, clan/tribal, autocracy, theocracy, republic, democracy)
Grade 1: World History: Early Civilizations	HIS.7.5.E explain the historic and geographic importance of river valley civilizations (e.g. Nile, Huang He, Tigris Euphrates, etc.)
Grade 1: World History: Early Civilizations, Grade 4: World History: Europe in the Middle Ages	HIS.7.6.A explain the religious or philosophical significance of structures such as pyramids, cathedrals, and burial mounds
Grade 6: World History: Lasting Ideas from Ancient Civilizations	HIS.7.6.B explain the origins and significance of Judaism as the first monotheistic religion based on the concept of one

		God who sets down moral laws for humanity
	Grade 4: World History: The Spread of Islam	HIS.7.6.C explain the origins of Islam and the life and teachings of Mohammed, including Islamic teachings on the connection with Judaism and Christianity
	Grade 2: World History: China	HIS.7.6.D explain the fundamental teachings and influence of Confucianism and Taoism
	Grade 4: World History: The Spread of Islam	HIS.7.6.E explain the influence of Islam on the religions of West Africa
	Grade 4: World History: The Spread of Islam	HIS.7.6.F explain the life and moral teachings of Hinduism and its spread to India, Ceylon, and Central Asia
	Grade 2: World History: India	HIS.7.6.G explain the reasons for the spread of Buddhism and its influence on China and Japan
	Grade 8: History: The Middle East and Oil Politics	HIS.7.6.H explain long standing religious conflicts and current manifestations (e.g. Middle East conflict, Bosnia, Ireland, etc.)
	This can be covered in many other areas	GEO.5-8.1.3.A trace and/or draw custom maps featuring information according to the desired use of the maps
	This can be covered in many other areas	GEO.5-8.1.3.B analyze maps, in order to discover and summarize information about geographical areas
	This can be covered in many other areas	GEO.5-8.1.3.C organize information obtained through the reading of maps in graphs, diagrams, and other visual aids, in order to illustrate specific demographic, physical and other topics
	This can be covered in many other areas	GEO.5-8.1.3.D gather field information and record it on custom maps
	This can be covered in many other areas	GEO.5-8.1.3.E trace on maps the spread of human migrations, cultures, languages, religions, diseases
	This can be covered in many other areas	GEO.5-8.1.3.F discover patterns of human habitation and activities through the study of maps
	This can be covered in many other areas	GEO.5-8.1.3.G discuss the places of the world that America depends on for imported resources and goods
	This can be covered in many other areas	GEO.5-8.2.1.A describe and compare the physical characteristics of places, using a variety of visual materials and data sources
	This can be covered in many other areas	GEO.5-8.2.1.B describe and compare human characteristics of places
	This can be covered in many other areas	GEO.5-8.2.1.C examine and explain human impact on the landscape/environment
	This can be covered in many other areas	GEO.5-8.2.1.D identify and analyze how technology shapes the physical and human characteristics of places
	This can be covered in many of the History units	GEO.5-8.2.2.A identify and describe regions in terms of physical and human characteristics
	This can be covered in many of the History units	GEO.5-8.2.2.B explain how regions are connected through cultural ties, trade, language, resources, through the use of maps
	This can be covered in many of the History units	GEO.5-8.2.2.C explain how regions change over space and time
	This can be covered in many of the History units	GEO.5-8.2.3.A gather and compare information on how people of different backgrounds view the same place or region
	This can be covered in many of the History units	GEO.5-8.2.3.B compare ways in which people of different cultural origins build out and name places in the same regions
	Grade 6: American History: Immigration, Industrialization, Urbanization	GEO.5-8.2.3.C explain why immigrants to the United States hold on to customs from their home countries
	This can be covered in many of the History units	GEO.5-8.3.1.A understand and describe how the environment can affect human settlement and vice versa
	This can be covered in many of the History units and Grade 3: Science: Ecology	GEO.5-8.3.1.B identify the elements of ecosystems and explain how they are related to life within
	This can be covered in many of the History units	GEO.5-8.3.1.C research and explain how physical processes influence ecosystems
	This can be covered in many of the History units	GEO.5-8.3.1.D explain the distribution of types of ecosystems and their impact on human populations
	This can be covered in many of the History units	GEO.5-8.3.1.E analyze the importance of distance in human interaction
	This can be covered in many other areas	GEO.5-8.3.2.A identify the physical components of the Earth's atmosphere, lithosphere, hydrosphere, and biosphere (e.g. climates, land forms, bodies of water, ecosystems)
	This can be covered in many other areas and Grade 4: Geology: The Earth and Its Changes	GEO.5-8.3.2.B understand how natural processes create or change land forms, and give actual geographic locations as examples
	This can be covered in many other areas	GEO.5-8.3.2.C define renewable and non-renewable Earth resources
	This can be covered in many other areas and Grade 4: Geology: The Earth and Its Changes	GEO.5-8.3.2.D predict the consequences of physical processes on the Earth's surface and weather conditions
	This can be covered in many of the History units	GEO.5-8.4.1.C describe the influence of population on environment
	This can be covered in many of the History units	GEO.5-8.4.1.D analyze the characteristics of a certain population

	This can be covered in many of the History units	GEO.5-8.4.2.A use interviews with real people to define cultural change
	This can be covered in many of the History units	GEO.5-8.4.2.B differentiate among different cultures in Colorado
	This can be covered in many of the History units	GEO.5-8.4.2.C differentiate among different cultures in other parts of the world
	This can be covered in many of the History units	GEO.5-8.4.2.D use cultural clues/artifacts to identify historical migrations
	This can be covered in many of the History units	GEO.5-8.4.2.E analyze the impact of various cultures on physical elements of the Earth
	This can be covered in many of the History units	GEO.5-8.4.2.F use a variety of maps to research information regarding the location and movements of various cultures
	This can be covered in many of the History units	GEO.5-8.4.2.G analyze geographical factors that have generated cultural change
	This can be covered in many of the History units	GEO.5-8.4.3.B explain the need for trade among regions, based on local availability of resources and goods
	This can be covered in many of the History units	GEO.5-8.4.3.C construct maps to illustrate historical patterns of human origins and activities
	This can be covered in many of the History units	GEO.5-8.4.3.D compile examples of cultural and economic reasons for changes in human societies
	This can be covered in many of the History units	GEO.5-8.4.3.E analyze systems to deliver services and goods
	This can be covered in many of the History units	GEO.5-8.4.3.F discuss world trade and explain the systems that support it
	This can be covered in many of the History units	GEO.5-8.4.4.A use maps to compare and contrast historic factors that have changed land use in a region
	This can be covered in many of the History units	GEO.5-8.4.5.A describe political, social, and economic divisions throughout early American history
	This can be covered in many of the History units	GEO.5-8.4.5.B understand and describe how people divide the Earth's surface into different types of territorial units
	This can be covered in many of the History units	GEO.5-8.4.5.C analyze the reasons for divisions and cooperation among people, in terms of geography
	Grade 7: Science: Evolution	GEO.5-8.5.1.A examine the factors that have caused the disappearance of an animal or plant species
	This can be covered in many other areas	GEO.5-8.5.1.B understand the interrelatedness of environmental systems and its impact on life (human and other)
	Grade 7: Science: Evolution	GEO.5-8.5.1.C describe ways in which humans adapt to physical changes in the Earth's environments
	Grade 3: Science: Ecology	GEO.5-8.5.1.D explain how environmental changes in one place affect other places (acid rain, pollution, pesticides, etc.)
	Grade 7: Science: Evolution	GEO.5-8.5.1.E predict new ways for humans to adapt to their environments
	This can be covered in many other areas	GEO.5-8.5.1.F use maps to track the influence of environmental changes from one place to another
	This can be covered in many other areas	GEO.5-8.5.2.A understand how population growth affects air, land, and water quality, and how they impact the physical environment
	This can be covered in many other areas	GEO.5-8.5.2.B explore the positive and negative effects of humans on the environment
	This can be covered in many other areas	GEO.5-8.5.2.C explain how people's lives are influenced by population movements
	This can be covered in many other areas	GEO.5-8.5.3.A track specific resources' distribution throughout the world
	This can be covered in many other areas	GEO.5-8.5.3.B compare countries and their development based on their available resources
	This can be covered in many other areas	GEO.5-8.5.3.C examine current impact of resource use
	This can be covered in many other areas	GEO.5-8.5.3.D predict the changes to a region with better management and resource use
	This can be covered in many other areas	GEO.5-8.5.3.E examine and report how energy resources in different countries are used
	This can be covered in many other areas	GEO.5-8.6.1.B analyze the impact human migration has had on regions and countries
	Grade 8: History: The Middle East and Oil Politics	GEO.5-8.6.1.D explain how competition for resources causes conflict
	This can be covered in many other areas	GEO.5-8.6.2.B show how environments and resources have affected various areas from past to present
	This can be covered in many other areas	GEO.5-8.6.2.C predict the future of regions based on available resources and human interaction
	This can be covered in many other areas	GEO.5-8.6.2.D explain and discuss the need for responsible environmental management practices
	This can be covered in Grade 4: American History: Making a Constitutional Government and Grade 8: History: Civics: The Constitution	CIV.7.1.1 Produce a bulletin board of articles about Congress, the President, or the Supreme Court showing which government function is being exercised
	This can be covered in many of the History units	CIV.7.1.2 Analyze two newspaper articles about the actions of the federal government
	This can be covered in many other areas	CIV.7.1.3 Differentiate between "natural rights" and "social contract"
	This can be covered in many other areas	CIV.7.1.4 Formulate ways in which conflicts are resolved, i.e.: mediation, compromise, and civil disobedience
	This can be covered in many other areas	CIV.7.1.5 Speculate as to how a decision of the local City Council, School Board, or County Commission might affect the average citizen – e.g.: zoning open space for a shopping mall, eliminating school athletics

This can be covered in Grade 4: American History: Making a Constitutional Government and Grade 8: History: Civics: The Constitution	CIV.7.2.1 Know which branch of government to contact to get information, express an opinion, or challenge a law
This can be covered in Grade 4: American History: Making a Constitutional Government and Grade 8: History: Civics: The Constitution	CIV.7.2.2 Explain why certain powers are primarily national powers – military, income tax, and treaties
This can be covered in Grade 4: American History: Making a Constitutional Government and Grade 8: History: Civics: The Constitution	CIV.7.2.3 Apply *Miranda v. Arizona* to the U.S. Constitution and the Colorado Constitution
This can be covered in many other areas	CIV.7.2.4 Evaluate the role of the mass media influencing public policy – e.g.: gun control and the right to bear arms
This can be covered in Grade 8: History: The Middle East and Oil Politics	CIV.7.3.1 Construct a hypothetical improvement on the Oslo Accord and the Dayton Accord to negotiate a peace treaty in the Middle East, and then argue the pitfalls of the plan
This can be covered in many other areas	CIV.7.3.2 Give an example of how citizens can influence foreign policy – e.g.: calling a Senator or Representative to express an opinion
This can be covered in many of the History units	CIV.7.3.3 Describe how U.S. political ideas influence other nations and how other nations' ideas influence the U.S. – e.g.: trade with China and human right disputes
This can be covered in many other areas	CIV.7.4.2 Hypothesize what would happen to a country if its citizens did not fulfill any citizen responsibilities
This can be covered in many other areas	CIV.7.4.3 Defend or oppose a school's dress code, using at least five reasons for your position
This can be covered in many other areas	CIV.7.4.4 Prepare and deliver a two-minute speech for a hypothetical local School Board about your position for or against a school dress code
Core Knowledge® Content (Visual Arts-Grade 7)	**Colorado Grade Level Expectations** (Grade 7-Visual Arts)
I. Art History: Periods and Schools	
A. Impressionism	
▪	7/8.3 Using their own artwork or works of others, write a statement which explains how the artist's feelings are portrayed visually. (S=1) 7/8.4 Generate questions and possible answers to questions about works of art. (S=1, S=5) 7/8.5 Describe ways that social and cultural beliefs can affect responses to works of art. (S=1, S=5) 7/8.7 Identify how the belief systems of a viewer may influence the interpretation of works of art. (S=1) 7/8.9 Recognize and apply the Principles of Design: Contrast (variation of elements), Rhythm (irregular, regular, random, alternating, progressive, flowing), Movement (center of interested, illusion of action), Repetition (kinetic), Pattern (simple and complex), Proportion (human, realistic, size relationships, exaggeration, golden mean, abstraction), Balance (asymmetry and symmetry, radial, formal and informal), Emphasis (focal point, placement, framing, simple and complex, isolation, rule of thirds), Unity (continuity) 7/8.22 Participate in a debate regarding the purposes, values, and meaning in works of art. (S=5)
B. Post-Impressionism	
▪	7/8.3 Using their own artwork or works of others, write a statement which explains how the artist's feelings are portrayed visually. (S=1) 7/8.4 Generate questions and possible answers to questions about works of art. (S=1, S=5) 7/8.5 Describe ways that social and cultural beliefs can affect responses to works of art. (S=1, S=5) 7/8.7 Identify how the belief systems of a viewer may influence the interpretation of works of art. (S=1) 7/8.9 Recognize and apply the Principles of Design: Contrast (variation of elements), Rhythm (irregular, regular, random, alternating, progressive, flowing), Movement (center of interested, illusion of action), Repetition (kinetic), Pattern (simple and complex), Proportion (human, realistic, size relationships, exaggeration, golden mean, abstraction), Balance (asymmetry and symmetry, radial, formal and informal), Emphasis (focal point, placement, framing, simple and

	complex, isolation, rule of thirds), Unity (continuity) 7/8.22 Participate in a debate regarding the purposes, values, and meaning in works of art. (S=5)
C. Expressionism and Abstraction	
▪	7/8.3 Using their own artwork or works of others, write a statement which explains how the artist's feelings are portrayed visually. (S=1) 7/8.4 Generate questions and possible answers to questions about works of art. (S=1, S=5) 7/8.5 Describe ways that social and cultural beliefs can affect responses to works of art. (S=1, S=5) 7/8.7 Identify how the belief systems of a viewer may influence the interpretation of works of art. (S=1) 7/8.9 Recognize and apply the Principles of Design: Contrast (variation of elements), Rhythm (irregular, regular, random, alternating, progressive, flowing), Movement (center of interested, illusion of action), Repetition (kinetic), Pattern (simple and complex), Proportion (human, realistic, size relationships, exaggeration, golden mean, abstraction), Balance (asymmetry and symmetry, radial, formal and informal), Emphasis (focal point, placement, framing, simple and complex, isolation, rule of thirds), Unity (continuity) 7/8.22 Participate in a debate regarding the purposes, values, and meaning in works of art. (S=5)
D. Modern American Painting	
▪	7/8.3 Using their own artwork or works of others, write a statement which explains how the artist's feelings are portrayed visually. (S=1) 7/8.4 Generate questions and possible answers to questions about works of art. (S=1, S=5) 7/8.5 Describe ways that social and cultural beliefs can affect responses to works of art. (S=1, S=5) 7/8.7 Identify how the belief systems of a viewer may influence the interpretation of works of art. (S=1) 7/8.9 Recognize and apply the Principles of Design: Contrast (variation of elements), Rhythm (irregular, regular, random, alternating, progressive, flowing), Movement (center of interested, illusion of action), Repetition (kinetic), Pattern (simple and complex), Proportion (human, realistic, size relationships, exaggeration, golden mean, abstraction), Balance (asymmetry and symmetry, radial, formal and informal), Emphasis (focal point, placement, framing, simple and complex, isolation, rule of thirds), Unity (continuity) 7/8.22 Participate in a debate regarding the purposes, values, and meaning in works of art. (S=5)
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered in many other areas	7/8.1 Will maintain a sketchbook journal of ideas and writings to use as a resource and planning tool. (S=1)
This can be covered in many other areas	7/8.2 Develop ideas for works of art by conducting research and making preliminary sketches or models. (S=1)
This can be covered in many other areas	7/8.6 Identify the role of the artist in mass media. (S=1, S=3)
This can be covered in many other areas	7/8.8 Use brainstorming as a means to generate ideas for works of art. (S=1)
This can be covered in many other areas	7/8.10.A Recognize and apply the Elements of Art: Lines (Types-mechanical and lyrical; Concepts-expressive, implied, leading)
This can be covered in many other areas	7/8.10.B Recognize and apply the Elements of Art: Shape (Types-geometric-ellipse-organic-biomorphic; Concepts-abstract, expressive, symbolic, dynamic)
This can be covered in many other areas	7/8.10.C Recognize and apply the Elements of Art: Form (Types-actual, illusionary)
This can be covered in many other areas	7/8.10.D Recognize and apply the Elements of Art: Texture
This can be covered in many other areas	7/8.10.E Recognize and apply the Elements of Art: Space
This can be covered in many other areas	7/8.1.F Recognize and apply the Elements of Art: Color (Concepts-advanced and recede, psychological, symbolic, realistic)
This can be covered in many other areas	7/8.10.G Recognize and apply the Elements of Art: Value (Concepts-gradation, high/low key, reflected)
This can be covered in many other areas	7/8.11 Using a variety of materials (e.g. charcoal, oil pastels, paintbrush), create a figurative drawing using highlights. (S=3)

This can be covered in many other areas	7/8.12 Create a sculpture piece using a subtractive technique. (S=3)
This can be covered in many other areas	7/8.13 Utilizing colored inks, create a linoleum or woodblock print. (S=3)
This can be covered in many other areas	7/8.14 Using two point perspective, create an architectural scene. (S=3)
This can be covered in many other areas	7/8.15 Use a computer and peripherals to manipulate and create artwork. (S=3)
This can be covered in many other areas	7/8.16 Follow directions for the safe use of tools, materials and procedures. Wear appropriate protection such as smocks, safety glass, gloves, and hair ties when necessary. When appropriate, pass a safety assessment. (S=3)
This can be covered in many other areas	7/8.17 Examine and discuss artwork created as a social comment or to protest social conditions. (S=4)
This can be covered in many other areas	7/8.18 Identify major works of art by diverse groups of people (e.g. women, ethnic cultures or outsider art). (S=4)
This can be covered in many other areas	7/8.19 Use selected criteria as the basis of making judgments about works of art. (S=4)
This can be covered in many other areas	7/8.20 Predict outcomes if the elements of design or the materials were altered in a particular work of art. (S=5)
This can be covered in many other areas	7/8.21 Apply the four steps of art criticism: 1) describe, 2) analyze the work in terms of elements and design principles, 3) interpret the work in terms of ideas and emotions, and 4) judge the work as to its success both technically and in either communicating an idea, and emotion, or fulfilling a practical purpose. (S=5)

Core Knowledge® Content (Music-Grade 7)	**Colorado Grade Level Expectations** (Grade 7-Music)
I. Elements of Music	
▪	
▪	
▪	
▪	
▪	
▪	
▪	7.5 read notes in the appropriate clef for the instrument being played (S2) 7.3 read, notate, and perform all previously learned rhythmic patters in a variety of meters (S1, S2, S3)
II. Classical Music: Romantics and Nationalists	
A. Romantic Composers and Works	
▪	7.9 identify how a composer used syncopation to create rhythmic excitement in a musical piece (S4, S5) 7.7 identify the style and form of a piece performed or heard in class, and describe it using musical terms (S4) 7.8 listen to a musical selection and study one element in depth (S4, S5)
B. Music and National Identity	
▪	7.9 identify how a composer used syncopation to create rhythmic excitement in a musical piece (S4, S5) 7.7 identify the style and form of a piece performed or heard in class, and describe it using musical terms (S4)
III. American Musical Traditions	
▪	
▪	7.9 identify how a composer used syncopation to create rhythmic excitement in a musical piece (S4, S5) 7.7 identify the style and form of a piece performed or heard in class, and describe it using musical terms (S4)

Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered in many areas	7.1 sing in two-part harmony (S1)
This can be covered in many areas	7.2 sing or play the home tone (tonic) and locate it on the staff of a musical example in any major key (S1, S2)
This can be covered in many areas	7.4 create and play or sing a two-measure ending to a musical composition and explain why the notes and rhythms were selected (S1, S2, S3, S4)
This can be covered in many areas	7.6 recognize that instruments and voices can be combined to create different textures and timbres (S4)

Correlation of the *Core Knowledge Sequence* and the Colorado Grade Level Expectations

This can be covered in many areas	7.10 list expectations for audience behavior at a concert
Core Knowledge[®] Content (Mathematics-Grade 7)	**Colorado Grade Level Expectations** (Grade 7-Mathematics)
I. Pre-Algebra	
A. Properties of the Real Numbers	
▪	7.1.5.B demonstrate the distributive property of multiplication over addition for whole numbers (also covered in Grade 6: Mathematics: Computation)
▪	
B. Linear Applications and Proportionality	
▪	
▪	
▪	
▪	7.2.3.A in any functional relationship involving positive rational numbers, describe how a change in one quantity affects the other
▪	
C. Polynomial Arithmetic	
▪	
D. Equivalent Equations and Inequalities	
▪	
▪	
▪	
▪	7.2.5.B using formal methods, solve one step linear equations involving integers 7.2.5.C solve linear equations with variables and constants on both sides of the equation by informal methods using manipulatives, tables, graphs, or technology
▪	7.2.4.A graph discrete linear and nonlinear functions
E. Integer Exponents	
▪	
▪	
▪	
▪	
▪	7.1.3.B write rational numbers in expanded form without negative powers of ten (for example, 579.42 = 5 x 100 + 7 x 10 + 9 x 1 + 4 x 1/10 + 2 x 1/100)
▪	
II. Geometry	
A. Three-Dimensional Objects	
▪	7.4.1.B build models of cones, cylinders, pyramids and their nets 7.4.5.C solve problems involving surface area of triangular prisms
▪	
▪	
▪	7.4.5.B solve problems involving volume of cylinders 7.5.4.D develop and use the formula for volume of cylinders using appropriate units
B. Angle Pairs	
▪	

▪	7.4.2.C identify and reason informally about angle relationships formed by intersecting lines (for example, adjacent and vertical angles) 7.5.6.C using a protractor, measure angles of adjacent and vertical angles of intersecting lines
C. Triangles	
▪	
D. Measurement	
▪	7.5.6.A select and use the appropriate units and tools to measure to the degree of accuracy required in a particular problem
▪	
▪	
▪	7.5.4.C develop a procedure to find the area and perimeter of irregularly-shaped polygons
▪	7.5.5.A describe how changes in the base of a parallelogram and rhombus affect its area when its height is constant 7.5.5.B describe how scale factor changes in the dimension of a rectangular prism affect its volume 7.5.5.C describe how changes in the distance between the bases of a triangular prism affect its volume
▪	7.5.1.B estimate the circumference and area of circles 7.5.4.B develop and use the formula for circumference and area of circles using appropriate units
▪	
III. Probability and Statistics	
▪	7.3.1.A organize and display data using appropriate graphs, such as line, bar, circle, dot plots, frequency tables, stem-and-leaf, histograms, scatter plots, and box-and-whiskers (other graphs covered in earlier grades) 7.4.4.E describe the relationship between two different points on the coordinate plane
▪	7.3.2.A determine the quartiles of a data set
▪	7.3.6.C demonstrate that the sum of all the probabilities of the events in a sample space is equal to one
▪	7.3.6.A predict the probability of independent compound events with two different chance devices and conduct an experiment or simulation to determine the probability 7.3.6.B demonstrate that the probability of independent compound events is the same as the product of the probabilities of the two simple events
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
Grade 6: Mathematics: Numbers and Number Sense	7.1.1.A locate integers and positive rational numbers in the number line (for example, –6, $\frac{3}{4}$, 1.81)
This can be covered in many other areas	7.1.1.B identify subsets of rational numbers, including counting and whole numbers and integers
Grade 6: Mathematics: Ratio, Percent, and Proportion	7.1.1.C demonstrate equivalence of positive fractions, decimals, and percents
Grade 6: Mathematics: Geometry	7.1.1.D demonstrate the relationship of the circumference to the diameter of a circle as approximating
Grades 4, 5, and 6: Mathematics: Numbers and Number Sense	7.1.1.E demonstrate the meaning of square roots of perfect square numbers
Grades 4, 5, and 6: Mathematics: Numbers and Number Sense	7.1.2.A read, write, and order integers and positive rational numbers
Grades 4, 5, and 6: Mathematics: Numbers and Number Sense	7.1.2.B compare integers and positive rational numbers using the symbols =, <, >
This can be covered in many other areas	7.1.3.A express 100 as 1
This can be covered in many other areas	7.1.3.C demonstrate the divisibility rules for 2, 3, 4, 5, 6, 9, and 10
Grade 6: Mathematics: Numbers and Number Sense	7.1.3.D determine the greatest common factor and least common multiple for whole numbers using prime factorization
This can be covered in many other areas	7.1.3.E demonstrate the meaning of an, where 'a' is a positive rational number and 'n' is a counting number
Grade 6: Mathematics: Ratio, Percent, and Proportion	7.1.4.A demonstrate the equivalent relationships among fractions, decimals, and percents
Grades 5 and 6: Mathematics: Numbers and Number Sense	7.1.5.A demonstrate properties for integers
This can be covered in many other areas	7.1.6.A estimate, using appropriate techniques, determine, and, then, justify the reasonableness of solutions to problems involving positive rational numbers

Correlation of the *Core Knowledge Sequence* and the Colorado Grade Level Expectations

	This can be covered in many other areas	7.2.1.A represent, describe, and analyze patterns with positive rational numbers and integers
	This can be covered in many other areas	7.2.1.B identify the algebraic terms 'expression,' 'equation,' 'term,' 'variable,' 'coefficient,' and 'constant'
	This can be covered in many other areas	7.2.2.A solve problems from patterns involving positive rational numbers and integers using tables, graphs, and rules
	This can be covered in many other areas	7.2.4.B graph a continuous nonlinear function for a given situation
	This can be covered in many other areas	7.2.5.A translate written expressions or equations to algebraic expressions or equations, and vice versa
	Grades 4, 5, and 6: Mathematics: Probability and Statistics	7.3.1.B read, interpret, and draw conclusions from various displays of data
	Grade 6: Mathematics: Probability and Statistics	7.3.2.B demonstrate the basic concepts of frequency distribution, percentiles, and dispersion of data (for example, evenly distributed, one or more outliners)
	Grade 6: Mathematics: Probability and Statistics	7.3.2.C given various displays of the same set of data (line, bar, stem-and-leaf, histograms, and box-and-whiskers), determine which measure of central tendency is most evident
	Grade 6: Mathematics: Probability and Statistics	7.3.2.D given sets of data, identify the most appropriate measure of central tendency which typifies each set
	Grade 6: Mathematics: Ratio, Percent, and Proportion	7.3.3.A determine the improper computation of percent in articles or advertising
	Grade 6: Mathematics: Probability and Statistics	7.3.3.B evaluate and correct an improperly selected measure of central tendency
	This can be covered in many other areas	7.3.4.A critically evaluate survey questions and possible errors in experimental designs
	This can be covered in many other areas	7.3.4.B use appropriate simulations to collect and analyze data
	Grade 6: Mathematics: Ratio, Percent, and Proportion	7.3.5.A demonstrate the equivalence of probabilities as either a common fraction, decimal, or percent
	Grade 6: Mathematics: Probability and Statistics	7.3.5.B perform experiments of independent compound events with two different chance devices to estimate probability
	Grade 6: Mathematics: Probability and Statistics	7.3.5.C perform experiments of sampling with replacement to estimate probability
	This can be covered in many other areas (Probability and Statistics)	7.3.6.D analyze games of chance to determine whether they are fair or unfair; if unfair, decide which player has a greater probability of winning and find that probability
	This can be covered in many other areas (Probability and Statistics)	7.3.7.A determine the number of outcomes of independent compound events involving two different chance devices by making a list or tree diagram
	Grade 6: Mathematics: Geometry	7.4.1.A using a straight edge and a compass, paper folding, or computer software application, demonstrate the geometric construction of a perpendicular bisector of a segment
	This can be covered in many other areas (Geometry)	7.4.1.C given a three-dimensional model built with cubes, use isometric dot paper to draw the isometric drawing (that is, a drawing that shows the corner view and the top or bottom view) and, conversely, given the isometric drawing, build the model
	This can be covered in many other areas (Geometry)	7.4.1.D given nets, determine which would form a cube
	Grade 6: Mathematics: Geometry	7.4.2.A describe the properties of circles (including radius and diameter)
	This can be covered in many other areas (Geometry)	7.4.2.B recognize properties and use correct geometric symbols of overlapping geometric figures
	Grade 6: Mathematics: Geometry	7.4.2.D reason informally about the properties (including lines of symmetry) of isosceles trapezoids and pyramids
	Grade 6: Mathematics: Geometry	7.4.2.E reason informally about the sides and angles of congruent and similar polygons
	Grade 6: Mathematics: Probability and Statistics	7.4.4.A set up a coordinate graph (include axes, origin, and scale) and use it to mark and read coordinate pairs in all four quadrants
	This can be covered in many other areas (Probability and Statistics)	7.4.4.B write a scenario from a given graph
	This can be covered in many other areas (Probability and Statistics)	7.4.4.C enlarge figures on a coordinate plane by positive integral scale factors
	This can be covered in many other areas (Probability and Statistics)	7.4.4.D reduce figures on a coordinate plane by the scale factor one-half
	This can be covered in many other areas (Probability and Statistics)	7.4.4.F given a distance, find pairs of points in the coordinate plane separated by that distance
	Grade 6: Mathematics: Geometry	7.4.5.A solve problems involving circumference and area of circles
	This can be covered in many other areas (Geometry)	7.4.6.A state and justify the types of polygons which will tile a plane
	This can be covered in many other areas (Geometry)	7.4.6.B state the coordinates to describe the translation of a figure on a coordinate plane
	This can be covered in many other areas (Geometry)	7.5.1.A estimate the radius and diameter of circles
	This can be covered in many other areas (Geometry)	7.5.1.C compare the perimeter and area of transformed geometric figures
	This can be covered in many other areas (Geometry)	7.5.1.D estimate the volume of cylinders

	This can be covered in many other areas (Geometry)	7.5.1.E estimate the surface area of triangular prisms
	Grades 4, 5, and 6: Mathematics: Measurement	7.5.1.F continue to estimate and use the capacity, weight, and mass measurements from previous grades
	This can be covered in many other areas (Geometry)	7.5.1.G estimate measures of angles
	This can be covered in many other areas (Geometry)	7.5.2.A compare the estimates and direct measurements obtained in benchmarks 5.1, 5.4, and 5.6
	Grades 4, 5, and 6: Mathematics: Measurement	7.5.3.A read and interpret scales on number lines, graphs, and maps
	Grades 4, 5, and 6: Mathematics: Measurement	7.5.3.B select the appropriate scale for a given problem
	This can be covered in many other areas	7.5.3.C construct scale drawings
	Grade 6: Mathematics: Geometry	7.5.4.A demonstrate the relationship of circumference to diameter of a circle to approximate units
	This can be covered in many other areas (Geometry)	7.5.6.B measure the radius and diameter of circles to the nearest sixteenth inch and nearest millimeter
	Grade 6: Mathematics: Ratio, Percent, and Proportion	7.6.1.A demonstrate equivalence of fractions, decimals, and percents using proportions
	Grade 6: Mathematics: Ratio, Percent, and Proportion	7.6.1.B solve real-world problems using appropriate and convenient forms of fractions, decimals, and percents
	Grade 6: Mathematics: Computation	7.6.2.A demonstrate order of operations with positive rational numbers and integers
	Grade 5: Mathematics: Computation	7.6.2.B choose the appropriate representation of the remainder in a division problem
	Grade 6: Mathematics: Computation	7.6.2.C using paper-and-pencil, demonstrate with proficiency computation of fractions
	Grade 6: Mathematics: Computation	7.6.2.D using paper-and-pencil, demonstrate with proficiency the four basic operations of decimals
	Grade 6: Mathematics: Computation	7.6.2.E demonstrate the inverse relationship of multiplication and division of decimals
	Grade 6: Mathematics: Computation	7.6.2.F demonstrate the meaning of the four basic operations of integers
	Grade 6: Mathematics: Computation	7.6.2.G using paper-and-pencil, demonstrate proficiency in computation of integers
	Grade 6: Mathematics: Computation	7.6.2.H demonstrate the inverse relationship of addition and subtraction of integers
	Grade 6: Mathematics: Computation	7.6.2.I demonstrate the inverse relationship of multiplication and division of integers
	This can be covered in many other areas	7.6.2.J demonstrate multiplication of integers as repeated addition
	Grade 6: Mathematics: Ratio, Percent, and Proportion	7.6.2.K using paper-and-pencil, solve real-world problems involving percents
	This can be covered in many other areas	7.6.3.A determine from real-world problems whether an estimated or exact answer is acceptable
	This can be covered in many other areas	7.6.3.B use estimation techniques before performing operations
	This can be covered in many other areas	7.6.4.A determine whether information given in a problem-solving situation is sufficient, insufficient, or extraneous
	This can be covered in many other areas	7.6.4.B given a real-world problem-solving situation, use the correct operation and appropriate method (mental arithmetic, estimation, paper-and-pencil, calculator, or computer) to solve the problem
	This can be covered in many other areas	7.6.4.C given a math sentence with sums and differences of common fractions and decimals, create and illustrate a real-world problem
	This can be covered in many other areas	7.6.4.D in a problem-solving situation, determine whether the results are reasonable and justify those results with correct computations

Core Knowledge® Content (Science-Grade 7)	**Colorado Grade Level Expectations** (Grade 7-Science)
Teachers: Effective instruction in science requires not only hands-on experience and observation but also book learning, which helps bring coherence and order to student's scientific knowledge. Only when topics are presented systematically and clearly can students make steady and secure progress in selective study of topics, a number of which were introduced in earlier grades. It also continues the practice of studying topics from each of the major realms of science (physical, life, and earth science). Students are expected to do experiments and write reports on their findings.	
I. Atomic Structure	
▪	7.2.G classify matter in terms of elements, compounds, and mixtures 7.6.E identify and illustrate natural cycles within systems
▪	
▪	7.2.F recognize that substances are often placed in categories or groups if they react in similar ways (e.g. periodic

	table) 7.2.G classify matter in terms of elements, compounds, and mixtures
II. Chemical Bonds and Reactions	
▪	
▪	
▪	
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▪	
▪	7.2.E identify and describe the chemical changes in various materials by observing everyday events (e.g. nail left in water), also covered in Grade 5: Science: Chemistry: Matter and Change and Grade 8: Science: Chemical Bonds and Reactions 7.2.I examine, describe, compare, measure, and classify objects using common properties of matter including mass, volume, temperature, density, rating solutions by pH, and relative solubility in water, also covered in Grade 5: Science: Chemistry: Matter and Change and Grade 8: Science: Chemical Bonds and Reactions
▪	7.2.H use word equations to describe a chemical change, also covered in Grade 5: Science: Chemistry: Matter and Change and Grade 8: Science: Chemical Bonds and Reactions
▪	
III. Cell Division and Genetics	
▪	
▪	7.3.H know that a typical cell of an organism contains genetic instructions that specify its traits and those traits may be modified by environmental influences
▪	
IV. History of the Earth and Life Forms	
A. Paleontology	
▪	7.3.G construct a simple branching diagram to classify living groups of organisms by shared derived characteristics, and expand the diagram to include fossil organisms (e.g. fossils provide evidence of how life and environmental conditions have changed) 7.4.C explain how fossils indicate that life has changed through geologic time
▪	
B. Geologic Time	
▪	
V. Evolution	
A. Evolution	
▪	
B. Natural Selection	
▪	
C. Extinction and Speciation	
▪	
VI. Science Biographies	
▪	7.6.C describe the contributions of science made by people in different cultures and at different times in history
Grade level or other area Grade Level Expectations	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be**

	are covered in the *Core Knowledge Sequence*	**covered in other areas**
	This can be covered in many other areas, see note to teachers above	7.1.A propose and critique alternative explanations and procedures
	This can be covered in many other areas, see note to teachers above	7.1.B suggest alternative explanations for the same observations
	This can be covered in many other areas, see note to teachers above	7.1.C predict an outcome based on a set of experimental data
	This can be covered in many other areas, see note to teachers above	7.1.D recognize that scientific investigations sometimes generate new methods or procedures for an investigation or develop new technologies to improve the collection of data
	This can be covered in many other areas, see note to teachers above	7.1.E identify the assumptions that influence and guide their investigations
	This can be covered in many other areas, see note to teachers above	7.1.F propose and execute design changes to correct what might be wrong with an experiment design
	This can be covered in many other areas, see note to teachers above	7.1.G cite subject matter knowledge when making judgments
	This can be covered in many other areas, see note to teachers above	7.1.H refine hypotheses from a previous investigation
	This can be covered in many other areas, see note to teachers above	7.1.I construct a model that demonstrates change within a system
	This can be covered in many other areas, see note to teachers above	7.1,J construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge
	This can be covered in many other areas, see note to teachers above	7.1.K create a written plan to include the question to be investigated, an appropriate hypotheses, design of the experiment, identification of the control and variables, a developed scientific procedure to collect and record data; the design should also include a number of repeated trials, accurate measurements and record keeping and a comparison to a control
	Grade 5 and Grade 6: Mathematics: Probability and Statistics	7.1.L organize and construct representation of data into appropriate formats (e.g. histograms, circle graphs, flow charts) and make inferences based on that data
	Grade 5 and Grade 6: Mathematics: Probability and Statistics	7.1.M interpret patterns, trends, relationships in collected data
	This can be covered in many other areas, see note to teachers above	7.1.N decide what data to use and what data to ignore in forming conclusions
	This can be covered in many other areas, see note to teachers above	7.1.O form a logical argument about cause and effect relationships in conclusions
	Grade 7: Mathematics	7.1.P use mathematics to structure convincing explanations
	Grade 7: Mathematics: Measuring	7.1.Q use metric units in measuring, calculating, and reporting results
	Grade 5 and Grade 6: Mathematics: Probability and Statistics	7.1.R construct appropriate graphs from data and develop qualitative statements about the relationships between the variables
	This can be covered in many other areas, see note to teachers above	7.1.S use analogies to understand how things work
	This can be covered in many other areas, see note to teachers above	7.1.T summarize the results of others' investigations to see if findings will result in new questions and more investigations
	This can be covered in many other areas, see note to teachers above	7.1.U share findings and offer explanations for inconsistencies, limitations, and variability in recorded observations
	This can be covered in many other areas, see note to teachers above	7.1.V acknowledge different ideas and explanations, be able to accept the skepticism of others; and consider alternative explanations
	Grade 6: Science: Oceans and Grade 8: Science: Sound Waves	7.2.A know the qualitative properties of waves (e.g. frequency, wavelength, crests, troughs)
	Grade 6: Science: Energy, Heat, and Energy Transfer	7.2.B give examples of heat transfer
	Grade 6: Science: Energy, Heat, and Energy Transfer	7.2.C measure the amount of energy required to melt a known mass of ice and compare it to the energy needed to boil water
	Grade 6: Science: Energy, Heat, and Energy Transfer	7.2.D know that the states of matter (solid, liquid, gas) depend on molecular motion
	Grade 8: Science: Physics and Electricity and Magnetism	7.2.J separate mixtures based on their physical properties, including solubility in water, particle size, density, and magnetism
	Grade 8: Science: Physics	7.2.K know that all objects experience a buoyant force when immersed in a fluid (the buoyant force on an object in a fluid is equal to the weight of the fluid it has displaced)
	Grade 5: Science: Cells: Structures and Processes	7.3.A understand that plants and animals have levels of organization for structure and function, including cells, tissues, organs, organ systems, and the whole organism
	Grade 5: Science: Cells: Structures and Processes	7.3.B understand that organ systems function because of the contributions of individual organs, tissues, and cells; the failure of any part can affect the entire system (e.g. bones and muscles work together to provide a structural framework for movement)

Correlation of the *Core Knowledge Sequence* and the Colorado Grade Level Expectations

	Grade 1: Science: Living Things and Their Environments and Grade 3: Science: Ecology	7.3.C identify the characteristics of plants and animals that enable them to survive
	Grade 1: Science: Living Things and Their Environments and Grade 3: Science: Ecology	7.3.D create and interpret food chains and webs
	Grade 1: Science: Living Things and Their Environments and Grade 3: Science: Ecology	7.3.E describe the biodiversity of different ecosystems and understand that there is a relationship between the biotic and abiotic factors in an ecosystem
	Grade 3: Science: Ecology	7.3.F investigate and describe the causes and effects of changes in populations (e.g. predator-prey, human, and carrying capacity)
	Grade 4: Science: Geology: The Earth and Its Changes	7.4.A identify and explain the components of the rock cycle
	Grade 5: Science: Chemistry: Matter and Change	7.4.B understand how minerals form (e.g. evaporation, precipitation, crystallization)
	Grade 3: Science: Astronomy and Grade 6: Science: Oceans	7.4.D explain the effects of the motions of the Earth and moon in space (e.g. tidal patterns and seasonal changes related to the motion of the moon and the tilt of the Earth in space)
	Grade 3: Science: Astronomy	7.4.E know that Earth rotates on a tilted axis and revolves around the sun; this combination causes changes in the amount of sunlight reaching the Earth's surface and makes our seasons
	Grade 4: Science: Geology and Grade 6: Science: Plate Tectonics	7.4.F know that the solid Earth is layered with cold, brittle lithosphere, hot convecting mantle and dense metallic core
	Grade 6: Science: Plate Tectonics	7.4.G know that the surface of the Earth has changed as a result of dynamic forces originating with the mantle; the physical evidence (e.g. faulting, volcanoes, folding of rock, etc.) of these constructive and destructive forces is associated with plate movement
	Grade 6: Science: Plate Tectonics	7.4.H identify areas of volcanic activity based upon understanding of plate tectonics
	Grade 6: Science: Plate Tectonics	7.4.I demonstrate continental drift using models
	Grade 6: Science: Plate Tectonics	7.4.J know that earthquakes are sudden motions along breaks in the crust called faults and volcanoes/fissures are locations where magma reaches the surface
	This can be covered in many other areas, see note to teachers above	7.5.A describe advantages and disadvantages that might accompany the introduction of a new technology
	This can be covered in many other areas, see note to teachers above	7.5.B explain how the choice of materials depends upon their properties and characteristics and how they interact with other materials
	This can be covered in many other areas, see note to teachers above	7.6.A explain why a controlled experiment must have comparable results when repeated
	This can be covered in many other areas, see note to teachers above	7.6.B give examples of how scientific knowledge changes as new knowledge is acquired and previous ideas are modified
	This can be covered in many other areas, see note to teachers above	7.6.D identify, compare, and predict variables and conditions related to change
	This can be covered in many other areas, see note to teachers above	7.6.F use models to predict change

Correlation of *Core Knowledge®* *Sequence* & Colorado Grade Level Expectations

Core Knowledge® Content (English-Grade 8)	**Colorado Grade Level Expectations** (Grade 8-Reading & Writing)
I. Writing, Grammar, and Usage	
A. Writing and Research	
Teachers: Students should be given opportunities to write fiction, poetry, or drama, but instruction should emphasize repeated expository writing. Students should examine their work with attention to unity, coherence, and emphasis. Expository essays should have a main point and stick to it, and have a coherent structure, typically following the pattern of introduction, body, and conclusion. Paragraphs should have a unified focus, be developed with evidence, and examples, and have transitions between them. Essays should have appropriate tone and diction, as well as correct spelling and grammar in their final form. Standards for writing apply across the disciplines.	8.2.A write stories, letters, and reports with greater detail and supporting material 8.2.B choose vocabulary and figures of speech that communicate clearly 8.2.C draft, revise, edit, and proofread for a legible final copy 8.2.D apply skills in analysis, synthesis, evaluation, and explanation to their writing and speaking 8.2.F write and speak in the content areas (for example, science, geography, history, literature), using the technical vocabulary of the subject accurately 8.3.F use possessives and correct paragraphing in writing
▪	8.2.A write stories, letters, and reports with greater detail and supporting material 8.2.B choose vocabulary and figures of speech that communicate clearly 8.2.C draft, revise, edit, and proofread for a legible final copy 8.2.D apply skills in analysis, synthesis, evaluation, and explanation to their writing and speaking 8.2.F write and speak in the content areas (for example, science, geography, history, literature), using the technical vocabulary of the subject accurately
▪	8.2.C draft, revise, edit, and proofread for a legible final copy 8.2.D apply skills in analysis, synthesis, evaluation, and explanation to their writing and speaking 8.2.E incorporate source materials into their speaking and writing (for example, interviews, news articles, encyclopedia information) 8.5.A use organizational features of printed text such as prefaces, afterwards, and appendices 8.5.C locate and select relevant information 8.5.E give credit for borrowed information in a bibliography
B. Speaking and Listening	
▪	8.4.B use reading, writing, speaking, listening, and viewing to solve problems and answer questions 8.4.C make predictions, draw conclusions, and analyze what the read, hear, and view
▪	8.2.D apply skills in analysis, synthesis, evaluation, and explanation to their writing and speaking 8.4.D recognize, express, and defend a point of view orally in an articulate manner and in writing
▪	
C. Grammar	
▪	
▪	8.3.E punctuate and capitalize titles and direct quotations
▪	8.3.C use modifiers, homonyms, and homophones in writing and speaking
▪	
▪	8.3.D use simple, compound, complex, and compound/complex sentences in writing and speaking
D. Spelling	
▪	8.1.J apply knowledge of letter-sound correspondence, language structures, and context to recognize words 8.3.H expand spelling skills to include more complex words 8.3.I demonstrate use of conventional spelling in their published works 8.3.J use resources such as spell checkers, dictionaries, and charts to monitor their spelling and accuracy

E. Vocabulary	
	8.1.J apply knowledge of letter-sound correspondence, language structures, and context to recognize words 8.1.K locate meanings, pronunciations, and derivations of unfamiliar words using dictionaries, glossaries, and other sources 8.3.G use prefixes, root words, and suffixes correctly in writing and speaking
II. Poetry	
A. Poems	
▪	8.1.A use a full range of strategies to comprehend technical writing, newspapers, magazines, poetry, short stories, plays, and novels 8.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, content-area and technical material, and plays
B. Elements of Poetry	
▪	
▪	8.6.D apply knowledge of literary techniques, including foreshadowing, metaphor, simile, personification, onomatopoeia, alliteration, and flashback, to understand text
III. Fiction, Nonfiction, and Drama	
A. Short Stories	
▪	8.1.A use a full range of strategies to comprehend technical writing, newspapers, magazines, poetry, short stories, plays, and novels 8.1.B paraphrase, summarize, synthesize, and evaluate information from a variety of text and genres 8.1.C identify main idea and supporting details in a variety of texts and genres 8.1.D infer and predict using information in a variety of text and genres 8.1.E monitor own comprehension and make modifications when understanding breaks down by reading a portion, using reference aids, and searching for clues 8.1.G use background knowledge of subject and text structure to make complex predictions of content and purpose of text 8.1.H use text structure, such as cause and effect, to locate and recall information 8.1.I establish and adjust purposes for reading, such as reading to find out, to understand, to interpret, to enjoy, and to solve problems 8.4.A recognize an author's or speaker's point of view and purpose, separating fact from fiction 8.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, content-area and technical material, and plays 8.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar
B. Novels	
▪	8.1.A use a full range of strategies to comprehend technical writing, newspapers, magazines, poetry, short stories, plays, and novels 8.1.B paraphrase, summarize, synthesize, and evaluate information from a variety of text and genres 8.1.C identify main idea and supporting details in a variety of texts and genres 8.1.D infer and predict using information in a variety of text and genres 8.1.E monitor own comprehension and make modifications when understanding breaks down by reading a portion, using reference aids, and searching for clues 8.1.G use background knowledge of subject and text structure to make complex predictions of content and purpose of text

	8.1.H use text structure, such as cause and effect, to locate and recall information 8.1.I establish and adjust purposes for reading, such as reading to find out, to understand, to interpret, to enjoy, and to solve problems 8.4.A recognize an author's or speaker's point of view and purpose, separating fact from fiction 8.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, content-area and technical material, and plays 8.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar
C. Elements of Fiction	
▪	8.2.G recognize stylistic elements such as voice, tone, and style 8.4.E determine literary quality based on elements such as the author's use of vocabulary, character development, plot development, description of setting, and realism of dialogue 8.6.C use literature terminology accurately, including setting, character, conflict, plot, resolution, dialect, and point of view
D. Essays and Speeches	
▪	8.1.A use a full range of strategies to comprehend technical writing, newspapers, magazines, poetry, short stories, plays, and novels 8.1.B paraphrase, summarize, synthesize, and evaluate information from a variety of text and genres 8.1.C identify main idea and supporting details in a variety of texts and genres 8.1.D infer and predict using information in a variety of text and genres 8.1.E monitor own comprehension and make modifications when understanding breaks down by reading a portion, using reference aids, and searching for clues 8.1.G use background knowledge of subject and text structure to make complex predictions of content and purpose of text 8.1.H use text structure, such as cause and effect, to locate and recall information 8.1.I establish and adjust purposes for reading, such as reading to find out, to understand, to interpret, to enjoy, and to solve problems 8.4.A recognize an author's or speaker's point of view and purpose, separating fact from fiction 8.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, content-area and technical material, and plays 8.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar
E. Autobiography	
▪	8.1.A use a full range of strategies to comprehend technical writing, newspapers, magazines, poetry, short stories, plays, and novels 8.1.B paraphrase, summarize, synthesize, and evaluate information from a variety of text and genres 8.1.C identify main idea and supporting details in a variety of texts and genres 8.1.D infer and predict using information in a variety of text and genres 8.1.E monitor own comprehension and make modifications when understanding breaks down by reading a portion, using reference aids, and searching for clues 8.1.G use background knowledge of subject and text structure to make complex predictions of content and purpose of text 8.1.H use text structure, such as cause and effect, to locate and recall information 8.1.I establish and adjust purposes for reading, such as reading to find out, to understand, to interpret, to enjoy, and to solve problems

	8.4.A recognize an author's or speaker's point of view and purpose, separating fact from fiction 8.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, content-area and technical material, and plays 8.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar
F. Drama	
▪	8.1.A use a full range of strategies to comprehend technical writing, newspapers, magazines, poetry, short stories, plays, and novels 8.1.B paraphrase, summarize, synthesize, and evaluate information from a variety of text and genres 8.1.C identify main idea and supporting details in a variety of texts and genres 8.1.D infer and predict using information in a variety of text and genres 8.1.E monitor own comprehension and make modifications when understanding breaks down by reading a portion, using reference aids, and searching for clues 8.1.G use background knowledge of subject and text structure to make complex predictions of content and purpose of text 8.1.H use text structure, such as cause and effect, to locate and recall information 8.1.I establish and adjust purposes for reading, such as reading to find out, to understand, to interpret, to enjoy, and to solve problems 8.4.A recognize an author's or speaker's point of view and purpose, separating fact from fiction 8.6.A read, respond to, and discuss a variety of novels, poetry, short stories, non-fiction, content-area and technical material, and plays 8.6.B read, respond to, and discuss literature that represents points of view from places, people, and events that are familiar and unfamiliar
▪	
G. Literary Terms	
▪	8.6.D apply knowledge of literary techniques, including foreshadowing, metaphor, simile, personification, onomatopoeia, alliteration, and flashback, to understand text
IV. Foreign Phrases Commonly Used in English	
▪	
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
Grade 6: English: Literary Terms	**8**.1.F confirm meaning of figurative, idiomatic, and technological language using context clues
Grade 5: Language Arts: Grammar and Usage	**8**.3.A identify the parts of speech such as nouns, pronouns, verbs, adverbs, adjectives, conjunctions, prepositions, and interjections
Grade 5: Language Arts: Grammar and Usage, Grade 6: English: Grammar and Usage, Grade 7: English: Grammar	**8**.3.B use correct pronoun case, regular and irregular noun and verb forms, and subject-verb agreement involving comparisons in writing and speaking
This can be covered in many other areas	**8**.5.B use organizational features of electronic information (for example, microfiche headings and numbering, headings for accessing nested information in hypertext media), and library and interlibrary catalog databases
This can be covered in many other areas	**8.5**.D use available technology to research and produce and end-product that is accurately documented
This can be covered in many other areas	**8**.6.E use new vocabulary from literature in other context
Core Knowledge® Content (History & Geography-Grade 8)	**Colorado Grade Level Expectations** (Grade 8-History, Geography, and Civics)
I. The Decline of European Colonialism	
A. Breakup of the British Empire	

▪	
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▪	
▪	GEO.8.1.2.A discuss the geography of the British colonial empire in light of its break-up in the 1950s, 1960s, and 1970s
▪	
B. Creation of People's Republic of China	
▪	
▪	
▪	GEO.8.1.2.B discuss from geographical point of view the emergence of the Communist Empire, including the creation of the People's Republic of China, the Korean and Vietnam Wars, the political alliances of the Cold War period
II. The Cold War	
A. Origins of Cold War	
▪	HIS.8.5.I study and compare the personal histories of Hitler, Mussolini, Tojo, DeGaulle, Churchill, Eisenhower, MacArthur, and others GEO.8.1.2.B discuss from geographical point of view the emergence of the Communist Empire, including the creation of the People's Republic of China, the Korean and Vietnam Wars, the political alliances of the Cold War period
B. The Korean War	
▪	HIS.8.5.E describe how the relationships between the United States and external powers developed with the growth of the nation (build on wars addressed in seventh grade and apply sequence, causes, affects of World War II, Korean War and Vietnam) HIS.8.5.F identify key leaders of World War I, World War II, Korean War, and Vietnam (World War I and II covered in Grade 7) HIS.8.5.G explain specific ways in which events in each of the preceding wars affect us today (how was our nation changed by this war) HIS.8.5.H locate and interview veterans of World War II, Korea, and Vietnam (prepare written reports of interviews) GEO.8.1.2.B discuss from geographical point of view the emergence of the Communist Empire, including the creation of the People's Republic of China, the Korean and Vietnam Wars, the political alliances of the Cold War period
C. America in the Cold War	
▪	HIS.8.5.I study and compare the personal histories of Hitler, Mussolini, Tojo, DeGaulle, Churchill, Eisenhower, MacArthur, and others HIS.8.6.C compare the non-violent "passive resistance" movements of Martin Luther King, Jr. and Mahatma Gandhi with political change forced through violence (e.g. Castro/Cuba, Mao Tse-tung/China, American Revolution, the War Between the States, etc.) GEO.8.1.2.B discuss from geographical point of view the emergence of the Communist Empire, including the creation of the People's Republic of China, the Korean and Vietnam Wars, the political alliances of the Cold War period
III. The Civil Rights Movement	
▪	GEO.8.1.2.C discuss the Civil Rights Movement in the U.S. in connection with the geographical "hot spots"
▪	
▪	
▪	
▪	HIS.8.6.C compare the non-violent "passive resistance" movements of Martin Luther King, Jr. and Mahatma Gandhi with political change forced through violence (e.g. Castro/Cuba, Mao Tse-tung/China, American Revolution, the War Between the States, etc.)
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IV. The Vietnam War and the Rise of Social Activism	
A. The Vietnam War	
▪	HIS.8.5.E describe how the relationships between the United States and external powers developed with the growth of the nation (build on wars addressed in seventh grade and apply sequence, causes, affects of World War II, Korean War and Vietnam) HIS.8.5.F identify key leaders of World War I, World War II, Korean War, and Vietnam (World War I and II covered in Grade 7) HIS.8.5.G explain specific ways in which events in each of the preceding wars affect us today (how was our nation changed by this war) HIS.8.5.H locate and interview veterans of World War II, Korea, and Vietnam (prepare written reports of interviews) GEO.8.1.2.B discuss from geographical point of view the emergence of the Communist Empire, including the creation of the People's Republic of China, the Korean and Vietnam Wars, the political alliances of the Cold War period
B. Social and Environmental Activism	
▪	
V. The Middle East and Oil Politics	
A. History	
▪	GEO.5-8.6.1.D explain how competition for resources causes conflict
B. Geography of the Middle East	
▪	GEO.8.1.2.D demonstrate knowledge of the relationship between the geography/resources of the Middle East and "Oil Politics" CIV.8.3.2 Study the history of U.S. policy in the Middle East and analyze actions taken over time to protect civil rights
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▪	
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▪	
VI. The End of the Cold War: The Expansion of Democracy and Continuing Challenges	
A. The American Policy of Détente	
▪	
B. Breakup of the USSR	
▪	
▪	GEO.8.1.2.E describe, from a geographical point of view, the break-up of the Soviet Union and the realignment of countries after the end of the Cold War
▪	
C. China Under Communism	
▪	
D. Contemporary Europe	
▪	
E. The End of Apartheid in South Africa	

▪	GEO.8.1.2.F discuss conflicts in Africa and the end of Apartheid in Africa
▪	
▪	
VII. Civics: The Constitution—Principles and Structure of American Democracy	
▪	CIV.8.1.1 Produce a bulletin board of articles about Colorado legislature, Colorado Governor, or the Colorado Supreme Court showing which government function is being exercised CIV.8.1.2 Analyze and present two newspaper articles about the actions of the state government CIV.8.1.3 Defend a position on a current issue involving a constitutional protection of individual rights CIV.8.1.4 Analyze the process for expanding civil rights to more people throughout U.S. history and into the future CIV.8.1.5 Compare the effects on a country of a low voter turnout vs. a higher voter turnout CIV.8.2.1 Compare the advantages of a bicameral (two house) state legislature with a unicameral (one house) state legislature CIV.8.2.2 Identify five decisions which need to be agreed upon by the local, state, and federal governments for the construction of a new interstate highway CIV.8.2.3 Apply the Colorado Constitution to the *Gideon v. Wainwright* decision CIV.8.2.4 Explain how immigration and changing demographics might affect civic involvements in the future
VIII. Geography of Canada and Mexico	
▪	GEO.8.1.2.G demonstrate expanded knowledge of the geography of Canada and Mexico in light of the North American Free Trade Agreement (NAFTA)
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered and reviewed from many previous and future History units	HIS.8.1.A construct various time lines of American history during the 19th century, highlighting landmark dates, technological changes, major political and military events
Grade 6: World History: Industrialism American History: Immigration, Industrialization, and Urbanization	HIS.8.1.B demonstrate a chronological understanding of the study of the major topics in the study *Expanding Nation: The North and South* (1815-1850) including geographic expansion; market expansion, early industrialization (industrial revolution; the plantation system, growth of cities, the immigrants and their experiences)
Grade 5: American History: Westward Expansion Before the Civil War	HIS.8.1.C demonstrate a chronological understanding of the major topics in the study *Expanding Nation: Westward Movement* (1815-1850) including the Louisiana Purchase, Indian policy and treaties; Manifest Destiny; the significance of the War with Mexico; interactions of white and black Americans, Native Americans, Asians, and Mexicans, and the social, economic, and political impact of the West on the growing nation
Grade 5: American History: The Civil War: Causes, Conflicts, Consequences	HIS.8.1.D demonstrate a chronological understanding of the Civil War and Reconstruction (1850-1877) including the slave system in the Old South and its defenders and opponents; the causes, conduct, and course of the war and the failures of Reconstruction
This can be covered and reviewed from many previous and future History units	HIS.8.1.E trace patterns of change and continuity in the history of the United States and compare the laws of various people of various cultures from long ago until 21st century America
This can be covered in many of the History units	HIS.8.2.A identify, analyze, and interpret primary sources (artifacts, diaries, letters, photographs, art, documents, and newspapers) and contemporary media (computer information systems) and make generalizations about events and life in the United States history in the 19th century
This can be covered in many of the History units	HIS.8.2.B recognize and explain how different points of view have been influenced by nationalism, race, religion, and ethnicity
This can be covered in many of the History units	HIS.8.2.C distinguish fact from fiction by examining documentary sources
This can be covered in many of the History units	HIS.8.3.A describe the common traits and characteristics that unite the United States as a nation and as a society (note and describe those cultural characteristics and beliefs which can divide us if we permit it)

	This can be covered in many of the History units	HIS.8.3.B describe how the social roles and the characteristics of social organization have both changed and endured in the United States throughout history (e.g. family structures, English language, community structures, etc.)
	Grade 6: World History: Industrialism, Capitalism, and Socialism and American History: Immigration, Industrialization, and Urbanization and Reform	HIS.8.4.A explain and analyze the American public's response to industrialization and urbanization, with emphasis on "muckraking" literature and the rise of the Progressive Movement, women's suffrage, and child labor laws, reaction to working conditions, and the rise of organized labor
	This can be covered in many other areas	HIS.8.4.B explain how the economy of the Western United States has historically depended upon natural resources and how this has affected western states, especially Colorado
	This can be covered in many other areas	HIS.8.4.C explain how economic factors influenced historical events in the United States and in various regions of the world (e.g. Colorado's "boom and bust" economy)
	Grade 5: American History: The Civil War: Causes, Conflicts, Consequences	HIS.8.5.A identify the causes, key events and effects of the Civil War and Reconstruction, with emphasis on the events leading to secession and war; and the impact of Reconstruction on the South
	Grade 5: American History: The Civil War: Causes, Conflicts, Consequences	HIS.8.5.B identify leaders on both sides of the war including Abraham Lincoln, Ulysses S. Grant, Jefferson Davis, Robert E. Lee, Frederick Douglass, and William Lloyd Garrison, etc.
	This can be covered in many other areas	HIS.8.5.C describe how forms of involuntary servitude have been used to maintain and expand political power throughout history (e.g. slavery and serfdom), discuss 21st century Sudan and other slave nations of today
	Grade 5: American History: Westward Expansion After the Civil War and Grade 6: World History: Industrialism, Capitalism, and Socialism and American History: Immigration, Industrialization, and Urbanization and Reform	HIS.8.5.D explain how, following the Civil War, massive immigration, combined with the rise of big business, heavy industry, and mechanized farming transformed American life
	This can be covered in many of the History units	HIS.8.6.A give examples of the unique art forms that characterize the various ethnic groups in the United States and their religious beliefs and philosophical ideas throughout history
	Grade 5: Language Arts: Poetry (Emerson and Longfellow) and Fiction and Drama (Twain and Alcott), Grade 6: Language Arts: Poetry (Longfellow), Grade 8: Language Arts: Fiction, Nonfiction, and Drama (Hawthorne, Crane)	HIS.8.6.B examine the common themes in American literature, using writings about and by Emerson, Thoreau, Melville, Alcott, Hawthorne, Longfellow, Twain, Crane, and others
	This can be covered in many other areas	GEO.5-8.1.3.A trace and/or draw custom maps featuring information according to the desired use of the maps
	This can be covered in many other areas	GEO.5-8.1.3.B analyze maps, in order to discover and summarize information about geographical areas
	This can be covered in many other areas	GEO.5-8.1.3.C organize information obtained through the reading of maps in graphs, diagrams, and other visual aids, in order to illustrate specific demographic, physical and other topics
	This can be covered in many other areas	GEO.5-8.1.3.D gather field information and record it on custom maps
	This can be covered in many other areas	GEO.5-8.1.3.E trace on maps the spread of human migrations, cultures, languages, religions, diseases
	This can be covered in many other areas	GEO.5-8.1.3.F discover patterns of human habitation and activities through the study of maps
	This can be covered in many other areas	GEO.5-8.1.3.G discuss the places of the world that America depends on for imported resources and goods
	This can be covered in many other areas	GEO.5-8.2.1.A describe and compare the physical characteristics of places, using a variety of visual materials and data sources
	This can be covered in many other areas	GEO.5-8.2.1.B describe and compare human characteristics of places
	This can be covered in many other areas	GEO.5-8.2.1.C examine and explain human impact on the landscape/environment
	This can be covered in many other areas	GEO.5-8.2.1.D identify and analyze how technology shapes the physical and human characteristics of places
	This can be covered in many of the History units	GEO.5-8.2.2.A identify and describe regions in terms of physical and human characteristics
	This can be covered in many of the History units	GEO.5-8.2.2.B explain how regions are connected through cultural ties, trade, language, resources, through the use of maps
	This can be covered in many of the History units	GEO.5-8.2.2.C explain how regions change over space and time
	This can be covered in many of the History units	GEO.5-8.2.3.A gather and compare information on how people of different backgrounds view the same place or region
	This can be covered in many of the History units	GEO.5-8.2.3.B compare ways in which people of different cultural origins build out and name places in the same regions
	Grade 6: American History: Immigration, Industrialization,	GEO.5-8.2.3.C explain why immigrants to the United States hold on to customs from their home countries

Correlation of the *Core Knowledge Sequence* and the Colorado Grade Level Expectations

	Urbanization	
	This can be covered in many of the History units	GEO.5-8.3.1.A understand and describe how the environment can affect human settlement and vice versa
	This can be covered in many of the History units and Grade 3: Science: Ecology	GEO.5-8.3.1.B identify the elements of ecosystems and explain how they are related to life within
	This can be covered in many of the History units	GEO.5-8.3.1.C research and explain how physical processes influence ecosystems
	This can be covered in many of the History units	GEO.5-8.3.1.D explain the distribution of types of ecosystems and their impact on human populations
	This can be covered in many of the History units	GEO.5-8.3.1.E analyze the importance of distance in human interaction
	This can be covered in many other areas	GEO.5-8.3.2.A identify the physical components of the Earth's atmosphere, lithosphere, hydrosphere, and biosphere (e.g. climates, land forms, bodies of water, ecosystems)
	This can be covered in many other areas and Grade 4: Geology: The Earth and Its Changes	GEO.5-8.3.2.B understand how natural processes create or change land forms, and give actual geographic locations as examples
	This can be covered in many other areas	GEO.5-8.3.2.C define renewable and non-renewable Earth resources
	This can be covered in many other areas and Grade 4: Geology: The Earth and Its Changes	GEO.5-8.3.2.D predict the consequences of physical processes on the Earth's surface and weather conditions
	Grades 6 and 7: History	GEO.5-8.4.1.A describe and discuss the reasons for human migrations (e.g. famine, slave trade, wars, persecution) after studying related literature
	Grade 7: History: Geography of the United States	GEO.5-8.4.1.B create graphs depicting population numbers and distribution
	This can be covered in many of the History units	GEO.5-8.4.1.C describe the influence of population on environment
	This can be covered in many of the History units	GEO.5-8.4.1.D analyze the characteristics of a certain population
	This can be covered in many of the History units	GEO.5-8.4.2.A use interviews with real people to define cultural change
	This can be covered in many of the History units	GEO.5-8.4.2.B differentiate among different cultures in Colorado
	This can be covered in many of the History units	GEO.5-8.4.2.C differentiate among different cultures in other parts of the world
	This can be covered in many of the History units	GEO.5-8.4.2.D use cultural clues/artifacts to identify historical migrations
	This can be covered in many of the History units	GEO.5-8.4.2.E analyze the impact of various cultures on physical elements of the Earth
	This can be covered in many of the History units	GEO.5-8.4.2.F use a variety of maps to research information regarding the location and movements of various cultures
	This can be covered in many of the History units	GEO.5-8.4.2.G analyze geographical factors that have generated cultural change
	Grade 7: History: Geography of the United States	GEO.5-8.4.3.A identify economic activities within a region and examine the reasons for their locations
	This can be covered in many of the History units	GEO.5-8.4.3.B explain the need for trade among regions, based on local availability of resources and goods
	This can be covered in many of the History units	GEO.5-8.4.3.C construct maps to illustrate historical patterns of human origins and activities
	This can be covered in many of the History units	GEO.5-8.4.3.D compile examples of cultural and economic reasons for changes in human societies
	This can be covered in many of the History units	GEO.5-8.4.3.E analyze systems to deliver services and goods
	This can be covered in many of the History units	GEO.5-8.4.3.F discuss world trade and explain the systems that support it
	This can be covered in many of the History units	GEO.5-8.4.4.A use maps to compare and contrast historic factors that have changed land use in a region
	Grade 7: History: Geography of the United States	GEO.5-8.4.4.B deduct geographical reasons for human settlements in specific areas
	Grade 7: History: Geography of the United States	GEO.5-8.4.4.C classify cities according to their human and environmental characteristics
	Grade 7: History: Geography of the United States	GEO.5-8.4.4.D compare patterns of land use and human settlement in various regions
	Grade 7: History: Geography of the United States	GEO.5-8.4.4.E classify cities according to their physical characteristics
	Grade 7: History: Geography of the United States	GEO.5-8.4.4.F analyze the process of the creation of a megalopolis
	This can be covered in many of the History units	GEO.5-8.4.5.A describe political, social, and economic divisions throughout early American history
	This can be covered in many of the History units	GEO.5-8.4.5.B understand and describe how people divide the Earth's surface into different types of territorial units
	This can be covered in many of the History units	GEO.5-8.4.5.C analyze the reasons for divisions and cooperation among people, in terms of geography
	Grade 7: Science: Evolution	GEO.5-8.5.1.A examine the factors that have caused the disappearance of an animal or plant species
	This can be covered in many other areas	GEO.5-8.5.1.B understand the interrelatedness of environmental systems and its impact on life (human and other)
	Grade 7: Science: Evolution	GEO.5-8.5.1.C describe ways in which humans adapt to physical changes in the Earth's environments
	Grade 3: Science: Ecology	GEO.5-8.5.1.D explain how environmental changes in one place affect other places (acid rain, pollution, pesticides, etc.)

Grade 7: Science: Evolution	GEO.5-8.5.1.E predict new ways for humans to adapt to their environments
This can be covered in many other areas	GEO.5-8.5.1.F use maps to track the influence of environmental changes from one place to another
This can be covered in many other areas	GEO.5-8.5.2.A understand how population growth affects air, land, and water quality, and how they impact the physical environment
This can be covered in many other areas	GEO.5-8.5.2.B explore the positive and negative effects of humans on the environment
This can be covered in many other areas	GEO.5-8.5.2.C explain how people's lives are influenced by population movements
This can be covered in many other areas	GEO.5-8.5.3.A track specific resources' distribution throughout the world
This can be covered in many other areas	GEO.5-8.5.3.B compare countries and their development based on their available resources
This can be covered in many other areas	GEO.5-8.5.3.C examine current impact of resource use
This can be covered in many other areas	GEO.5-8.5.3.D predict the changes to a region with better management and resource use
This can be covered in many other areas	GEO.5-8.5.3.E examine and report how energy resources in different countries are used
Grade 7: History: Geography of the United States	GEO.5-8.6.1.A identify the various geographic aspects of a region
This can be covered in many other areas	GEO.5-8.6.1.B analyze the impact human migration has had on regions and countries
Grade 7: History: Geography of the United States	GEO.5-8.6.1.C examine how various regions/countries deal with social, economic, and political changes
Grade 7: History: Geography of the United States	GEO.5-8.6.2.A examine various social, political, and economic regions and see how they are different from past to present
This can be covered in many other areas	GEO.5-8.6.2.B show how environments and resources have affected various areas from past to present
This can be covered in many other areas	GEO.5-8.6.2.C predict the future of regions based on available resources and human interaction
This can be covered in many other areas	GEO.5-8.6.2.D explain and discuss the need for responsible environmental management practices
This can be covered in many other areas	CIV.8.3.1 Discuss and critique U.S> strategies for containing terrorism in the U.S. and around the world
This can be covered in many other areas	CIV.8.3.3 Describe how an NGO (non-governmental agency) seeks to help with an international problem – e.g.: International Red Cross, others
Grade 5: American History: The Civil War	CIV.8.4.1 Write a paragraph about a good public servant/citizen from the Civil War era – e.g.: a nurse on the battleground, a war veteran from the North or South
This can be covered in many other areas	CIV.8.4.2 Defend a position in favor of, or in opposition to, establishing a halfway house for rehabilitating felons in their neighborhood
This can be covered in many other areas	CIV.8.4.3 Write a letter to the hypothetical editor of a local newspaper defending or opposing the right of the First Christian Church to rent your school on Sundays
Core Knowledge® Content (Visual Arts-Grade 8)	**Colorado Grade Level Expectations** (Grade 8-Visual Arts)
I. Art History: Periods and Schools	
A. Painting Since World War II	
▪	7/8.3 Using their own artwork or works of others, write a statement which explains how the artist's feelings are portrayed visually. (S=1) 7/8.4 Generate questions and possible answers to questions about works of art. (S=1, S=5) 7/8.5 Describe ways that social and cultural beliefs can affect responses to works of art. (S=1, S=5) 7/8.7 Identify how the belief systems of a viewer may influence the interpretation of works of art. (S=1) 7/8.9 Recognize and apply the Principles of Design: Contrast (variation of elements), Rhythm (irregular, regular, random, alternating, progressive, flowing), Movement (center of interested, illusion of action), Repetition (kinetic), Pattern (simple and complex), Proportion (human, realistic, size relationships, exaggeration, golden mean, abstraction), Balance (asymmetry and symmetry, radial, formal and informal), Emphasis (focal point, placement, framing, simple and complex, isolation, rule of thirds), Unity (continuity) 7/8.22 Participate in a debate regarding the purposes, values, and meaning in works of art. (S=5)
B. Photography	
▪	7/8.3 Using their own artwork or works of others, write a statement which explains how the artist's feelings are

	portrayed visually. (S=1) 7/8.4 Generate questions and possible answers to questions about works of art. (S=1, S=5) 7/8.5 Describe ways that social and cultural beliefs can affect responses to works of art. (S=1, S=5) 7/8.7 Identify how the belief systems of a viewer may influence the interpretation of works of art. (S=1) 7/8.9 Recognize and apply the Principles of Design: Contrast (variation of elements), Rhythm (irregular, regular, random, alternating, progressive, flowing), Movement (center of interested, illusion of action), Repetition (kinetic), Pattern (simple and complex), Proportion (human, realistic, size relationships, exaggeration, golden mean, abstraction), Balance (asymmetry and symmetry, radial, formal and informal), Emphasis (focal point, placement, framing, simple and complex, isolation, rule of thirds), Unity (continuity) 7/8.22 Participate in a debate regarding the purposes, values, and meaning in works of art. (S=5)
C. 20th Century Sculpture	
▪	7/8.3 Using their own artwork or works of others, write a statement which explains how the artist's feelings are portrayed visually. (S=1) 7/8.4 Generate questions and possible answers to questions about works of art. (S=1, S=5) 7/8.5 Describe ways that social and cultural beliefs can affect responses to works of art. (S=1, S=5) 7/8.7 Identify how the belief systems of a viewer may influence the interpretation of works of art. (S=1) 7/8.9 Recognize and apply the Principles of Design: Contrast (variation of elements), Rhythm (irregular, regular, random, alternating, progressive, flowing), Movement (center of interested, illusion of action), Repetition (kinetic), Pattern (simple and complex), Proportion (human, realistic, size relationships, exaggeration, golden mean, abstraction), Balance (asymmetry and symmetry, radial, formal and informal), Emphasis (focal point, placement, framing, simple and complex, isolation, rule of thirds), Unity (continuity) 7/8.22 Participate in a debate regarding the purposes, values, and meaning in works of art. (S=5)
II. Architecture Since the Industrial Revolution	
▪	7/8.3 Using their own artwork or works of others, write a statement which explains how the artist's feelings are portrayed visually. (S=1) 7/8.4 Generate questions and possible answers to questions about works of art. (S=1, S=5) 7/8.5 Describe ways that social and cultural beliefs can affect responses to works of art. (S=1, S=5) 7/8.7 Identify how the belief systems of a viewer may influence the interpretation of works of art. (S=1) 7/8.9 Recognize and apply the Principles of Design: Contrast (variation of elements), Rhythm (irregular, regular, random, alternating, progressive, flowing), Movement (center of interested, illusion of action), Repetition (kinetic), Pattern (simple and complex), Proportion (human, realistic, size relationships, exaggeration, golden mean, abstraction), Balance (asymmetry and symmetry, radial, formal and informal), Emphasis (focal point, placement, framing, simple and complex, isolation, rule of thirds), Unity (continuity) 7/8.22 Participate in a debate regarding the purposes, values, and meaning in works of art. (S=5)
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered in many other areas	7/8.1 Will maintain a sketchbook journal of ideas and writings to use as a resource and planning tool. (S=1)
This can be covered in many other areas	7/8.2 Develop ideas for works of art by conducting research and making preliminary sketches or models. (S=1)
This can be covered in many other areas	7/8.6 Identify the role of the artist in mass media. (S=1, S=3)
This can be covered in many other areas	7/8.8 Use brainstorming as a means to generate ideas for works of art. (S=1)
This can be covered in many other areas	7/8.10.A Recognize and apply the Elements of Art: Lines (Types-mechanical and lyrical; Concepts-expressive, implied, leading)
This can be covered in many other areas	7/8.10.B Recognize and apply the Elements of Art: Shape (Types-geometric-ellipse-organic-biomorphic; Concepts-abstract, expressive, symbolic, dynamic)

This can be covered in many other areas	7/8.10.C Recognize and apply the Elements of Art: Form (Types-actual, illusionary)
This can be covered in many other areas	7/8.10.D Recognize and apply the Elements of Art: Texture
This can be covered in many other areas	7/8.10.E Recognize and apply the Elements of Art: Space
This can be covered in many other areas	7/8.1.F Recognize and apply the Elements of Art: Color (Concepts-advanced and recede, psychological, symbolic, realistic)
This can be covered in many other areas	7/8.10.G Recognize and apply the Elements of Art: Value (Concepts-gradation, high/low key, reflected)
This can be covered in many other areas	7/8.11 Using a variety of materials (e.g. charcoal, oil pastels, paintbrush), create a figurative drawing using highlights. (S=3)
This can be covered in many other areas	7/8.12 Create a sculpture piece using a subtractive technique. (S=3)
This can be covered in many other areas	7/8.13 Utilizing colored inks, create a linoleum or woodblock print. (S=3)
This can be covered in many other areas	7/8.14 Using two point perspective, create an architectural scene. (S=3)
This can be covered in many other areas	7/8.15 Use a computer and peripherals to manipulate and create artwork. (S=3)
This can be covered in many other areas	7/8.16 Follow directions for the safe use of tools, materials and procedures. Wear appropriate protection such as smocks, safety glass, gloves, and hair ties when necessary. When appropriate, pass a safety assessment. (S=3)
This can be covered in many other areas	7/8.17 Examine and discuss artwork created as a social comment or to protest social conditions. (S=4)
This can be covered in many other areas	7/8.18 Identify major works of art by diverse groups of people (e.g. women, ethnic cultures or outsider art). (S=4)
This can be covered in many other areas	7/8.19 Use selected criteria as the basis of making judgments about works of art. (S=4)
This can be covered in many other areas	7/8.20 Predict outcomes if the elements of design or the materials were altered in a particular work of art. (S=5)
This can be covered in many other areas	7/8.21 Apply the four steps of art criticism: 1) describe, 2) analyze the work in terms of elements and design principles, 3) interpret the work in terms of ideas and emotions, and 4) judge the work as to its success both technically and in either communicating an idea, and emotion, or fulfilling a practical purpose. (S=5)
Core Knowledge® Content (Music-Grade 8)	**Colorado Grade Level Expectations** (Grade 8-Music)
I. Elements of Music	
▪	
▪	
▪	
▪	
▪	
▪	
▪	8.2 identify appropriate key signatures in the music performed (S1, S2) 8.3 read, notate, and perform rhythmic and melodic patterns adding dotted rhythms, mixed meter, chromatics, and other key signatures to those already learned (S1, S2) 8.6 read notes in the appropriate clef for the instrument being played (S2)
II. Non-Western Music	
▪	8.7 listen to selected music with varied instrumentation and voicing, and discuss textures and timbres (S4) 8.8 listen to a musical selection and explain how the composer used specified musical elements (S4, S5)
III. Classical Music: Nationalists and Moderns	
A. Music and National Identity	
▪	8.5 sing or play syncopation in folk, classical, or jazz music (S1, S2, S4) 8.7 listen to selected music with varied instrumentation and voicing, and discuss textures and timbres (S4) 8.8 listen to a musical selection and explain how the composer used specified musical elements (S4, S5)
B. Modern Music	
▪	8.5 sing or play syncopation in folk, classical, or jazz music (S1, S2, S4)

	8.7 listen to selected music with varied instrumentation and voicing, and discuss textures and timbres (S4) 8.8 listen to a musical selection and explain how the composer used specified musical elements (S4, S5)
IV. Vocal Music	
A. Opera	
▪	
▪	8.7 listen to selected music with varied instrumentation and voicing, and discuss textures and timbres (S4) 8.8 listen to a musical selection and explain how the composer used specified musical elements (S4, S5)
B. American Musical Theater	
▪	8.7 listen to selected music with varied instrumentation and voicing, and discuss textures and timbres (S4) 8.8 listen to a musical selection and explain how the composer used specified musical elements (S4, S5) 8.9 discuss the music from a live performance, film or video performance as it relates to today's youth culture (S4, S5)
▪	8.7 listen to selected music with varied instrumentation and voicing, and discuss textures and timbres (S4) 8.8 listen to a musical selection and explain how the composer used specified musical elements (S4, S5) 8.9 discuss the music from a live performance, film or video performance as it relates to today's youth culture (S4, S5)
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered in many areas	8.1 sing or play, in two or more parts, with musical accuracy (S1)
This can be covered in many areas	8.4 organize, notate, and perform a rhythmic composition which accurately conforms to the natural stress of a prose selection (S1, S2, S3)
This can be covered in many areas	8.10 discuss audience behavior and listening criteria for a live performance (S5)
Core Knowledge® Content (Mathematics-Grade 8)	**Colorado Grade Level Expectations** (Grade 8-Mathematics)
I. Algebra	
A. Properties of the Real Numbers	
▪	
B. Relations, Functions, and Graphs (Two Variables)	
▪	
C. Linear Equations and Functions (Two Variables)	
▪	8.2.4.A graph discrete linear and nonlinear functions 8.2.4.B graph and distinguish between continuous linear and nonlinear functions, such as, $y = 3x + 2$, $y = x^2$, and $y = x^3$, either by creating a table or using technology
▪	8.2.3.B in a linear function, explain the meaning of slope as a rate of change
▪	
▪	
▪	
▪	
▪	8.2.3.C identify independent and dependent variables 8.2.5.C solve linear equations involving integers with variables and constants on both sides of the equation
▪	
▪	8.2.5.B using formal methods, solve one-step linear equations involving rational numbers
D. Arithmetic of Rational Expression	
▪	

E. Quadratic Equations and Functions	
▪	
II. Geometry	
A. Analytic Geometry	
▪	
B. Introduction to Trigonometry	
▪	
C. Triangles and Proofs	
▪	
▪	
▪	8.5.4.C develop and use the Pythagorean Theorem
▪	
▪	
▪	
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered in many other areas	8.1.1.A locate rational numbers and commonly-used irrational numbers on the number line (for example, -7/2, -2.48, 0, 15/16)
This can be covered in many other areas	8.1.1.B demonstrate the equivalence of fractions, terminating decimals, and percents of positive and negative rational numbers
This can be covered in many other areas	8.1.1.C distinguish between the sets of rational and irrational numbers
This can be covered in many other areas	8.1.1.D determine the two consecutive whole numbers between which the square root of a whole number lies (for example, 72 lies between 8 and 9)
This can be covered in many other areas	8.1.1.E pictorially, demonstrate the meaning of commonly-used irrational numbers
This can be covered in many other areas	8.1.2.A read, write, and order rational numbers and commonly-used irrational numbers
This can be covered in many other areas	8.1.2.B compare rational numbers and commonly-used irrational numbers using the symbols =, <, >
Grade 7: Mathematics: Pre-Algebra	8.1.3.A write and use appropriately negative powers of ten (for example, 1/102 = 10-2)
Grade 7: Mathematics: Pre-Algebra	8.1.3.B write rational numbers in expanded form with negative powers of ten (for example, 579.24 = 5 x 100 + 7 x 10 + 9 x 1 + 4 x 10-1 + 2 x 10-2)
Grade 7: Mathematics: Pre-Algebra	8.1.3.C write very small rational numbers in scientific notation (for example, .00036 = 3.6 x 10-4)
Grade 7: Mathematics: Pre-Algebra	8.1.3.D demonstrate the meaning of an, where 'a' is any rational number and 'n' is a counting number
This can be covered in many other areas	8.1.4.A apply proportional reasoning to solve problems
Grade 7: Mathematics: Pre-Algebra	8.1.5.A demonstrate properties for rational numbers, including closure
This can be covered in many other areas	8.1.6.A estimate, using appropriate techniques, determine, and, then, justify the reasonableness of solutions to problems involving positive and negative rational numbers
This can be covered in many other areas	8.2.1.A represent, describe, and analyze patterns with rational numbers
This can be covered in many other areas	8.2.2.A solve problems from patterns involving rational numbers using tables, graphs, and rules
Grade 7: Mathematics: Pre-Algebra	8.2.3.A in any functional relationship involving rational numbers, describe how a change in one quantity affects the other
This can be covered in many other areas	8.2.5.A translate written expressions or equations to algebraic expressions or equations, and vice versa
Grade 7: Mathematics: Probability and Statistics	8.3.1.A organize and display data using appropriate graphs, such as line, bar, circle (using ratios to determine degrees and draw with protractors), dot plots, frequency tables, stem-and-leaf, histograms, scatter plots, box-and-whiskers)
Grades 4, 5, and 6: Mathematics: Probability and Statistics	8.3.1.B read, interpret, and draw conclusions from various displays of data

Correlation of the *Core Knowledge Sequence* and the Colorado Grade Level Expectations

	Grade 6: Mathematics: Probability and Statistics	8.3.2.A state the purpose of using measures of central tendency and variability with data sets
	Grade 6: Mathematics: Probability and Statistics	8.3.2.B create sets of data with the same mean and different ranges and compare the variability
	Grade 6: Mathematics: Probability and Statistics	8.3.2.C in a problem-solving situation, select the most appropriate display and measure of central tendency to solve the problem
	Grade 6: Mathematics: Ratio, Percent, and Proportion	8.3.3.A determine the improper computation of percent increase or decrease
	This can be covered in many other areas	8.3.3.B recognize a misleading display of data which arises from area and volume models
	This can be covered in many other areas	8.3.4.A display, analyze, and draw conclusions from a given set of data or student generated set of data
	Grades 6 and 7: Mathematics: Probability and Statistics	8.3.5.A perform experiments of simple independent and dependent events to estimate probability
	Grade 6: Mathematics: Probability and Statistics	8.3.5.B perform experiments to estimate probability of complementary events
	Grade 7: Mathematics: Probability and Statistics	8.3.6.A determine the probability of independent, dependent, and complementary events with replacement and without replacement
	This can be covered in many other areas	8.3.6.B analyze games of chance to determine whether they are fair or unfair; if unfair, rewrite the rules of the game to make it fair
	This can be covered in many other areas	8.3.7.A determine the number of outcomes of independent compound events by using the fundamental counting principle (for example, if one choice occurs in "m" ways and the second choice occurs in "n" ways, then the number of ways for them to occur together in m x n)
	This can be covered in many other areas	8.3.7.B use Pascal's triangle to determine how many and which outcomes occur for independent compound events with exactly two outcomes
	Grade 7: Mathematics: Geometry	8.4.1.A using a straight edge and a compass, paper folding, or computer software application, demonstrate the geometric constructions of a perpendicular to a point on a line segment, a perpendicular to a line from a point not on the line segment, and triangle congruence of Side-Side-Side, Side-Angle-Side, and Angle-Side-Angle
	Grade 7: Mathematics: Geometry	8.4.1.B build models of three-dimensional oblique solids
	Grade 7: Mathematics: Geometry	8.4.1.C given a three-dimensional model built with cubes, use isometric paper to draw the isometric drawing (that is, a drawing that shows the corner view and the top or bottom view), the orthogonal drawings (that is, the front view, right side view, and top view) and the foundation view (that is, the shape of the foundation, placement and the number of cubes that are built on this foundation) and, conversely, given the drawings, build the models
	Grade 7: Mathematics: Geometry	8.4.2.A identify and use correct notation for triangle congruence of Side-Side-Side, Side-Angle-Side, and Angle-Side-Angle
	Grade 7: Mathematics: Geometry	8.4.2.B reason informally about the relationships among angles formed by two lines cut by a transversal and two parallel lines cut by a transversal
	Grade 7: Mathematics: Geometry	8.4.2.C reason informally about the sum of the measures of the angles of a triangle equaling 180E
	Grade 7: Mathematics: Geometry	8.4.2.D reason informally about the properties of the special right triangles, 30E-60E-90E and 45E-45E-90E
	Grade 7: Mathematics: Geometry	8.4.2.E continue to reason informally about the sides and angles of congruent and similar polygons
	Grade 7: Mathematics: Geometry	8.4.2.F demonstrate proportional reasoning to indirectly determine lengths of segments of similar polygons
	This can be covered in many other areas	8.4.4.A enlarge figures on a coordinate plane by rational scale factors
	This can be covered in many other areas	8.4.4.B reduce figures on a coordinate plane by rational scale factors
	This can be covered in many other areas	8.4.4.C determine the percent increase or decrease of perimeter and area of the enlargement or reduction of squares, rectangles, and triangles
	This can be covered in many other areas	8.4.4.D describe the relationship of more than two points on the coordinate plane
	This can be covered in many other areas	8.4.4.E given a distance, find pairs of points on the coordinate plane separated by that distance
	This can be covered in many other areas	8.4.4.F determine the distance between a pair of points in the coordinate plane
	Grade 6: Mathematics: Geometry	8.4.5.A solve problems involving perimeter and area of trapezoids
	Grade 7: Mathematics: Geometry	8.4.5.B solve problems involving volume of square pyramids and cones
	Grade 7: Mathematics: Geometry	8.4.5.C solve problems involving surface area of cylinders
	This can be covered in many other areas	8.4.6.A determine the scale factor for dilations to illustrate similarity

Correlation of the *Core Knowledge Sequence* and the Colorado Grade Level Expectations

This can be covered in many other areas	8.4.6.B create Escher-type tessellations to illustrate congruence
This can be covered in many other areas	8.4.6.C state the coordinates to describe the reflection of a figure across the x- and y-axes
This can be covered in many other areas (Geometry)	8.5.1.A estimate the length of the sides and height of trapezoids
This can be covered in many other areas (Geometry)	8.5.1.B estimate the perimeter and area of trapezoids
This can be covered in many other areas (Geometry)	8.5.1.C continue to compare the perimeter and area of transformed geometric figures
This can be covered in many other areas (Geometry)	8.5.1.D estimate the volume of square pyramids and cones
This can be covered in many other areas (Geometry)	8.5.1.E estimate the surface area of cylinders
Grades 4, 5, and 6: Mathematics: Measurement	8.5.1.F continue to estimate and use the capacity, weight, and mass measurements from previous grades
This can be covered in many other areas (Geometry)	8.5.1.G estimate measures of angles
This can be covered in many other areas	8.5.2.A compare the estimates and direct measurements obtained in benchmarks 5.1, 5.4, and 5.6
This can be covered in many other areas	8.5.2.B demonstrate proportional reasoning to indirectly determine lengths of segments of similar polygons
Grades 4, 5, and 6: Mathematics: Measurement	8.5.3.A read and interpret scales on number lines, graphs, and maps
Grades 4, 5, and 6: Mathematics: Measurement	8.5.3.B select the appropriate scale for a given problem
This can be covered in many other areas	8.5.3.C construct scale drawings
Grade 7: Mathematics: Geometry	8.5.4.A develop and use formulas for the perimeter and area of trapezoids using appropriate units
Grade 7: Mathematics: Geometry	8.5.4.B develop and use the formula for volume of square pyramids and cones using appropriate units
Grade 7: Mathematics: Geometry	8.5.4.D use the relationships in 30-60-90 and 45-45-90 triangles to solve problems
Grade 6: Mathematics: Geometry	8.5.5.A describe how changing the radius of a circle affects the circumference and area
Grade 6: Mathematics: Geometry	8.5.5.B describe how changing the height or radius of the base of a cylinder affects the volume
Grade 7: Mathematics: Geometry	8.5.6.A select and use the appropriate units and tools to measure to the degree of accuracy required in a particular problem
This can be covered in many other areas (Geometry)	8.5.6.B measure the length of the sides and heights of trapezoids to the nearest sixteenth inch and nearest millimeter
This can be covered in many other areas (Geometry)	8.5.6.C using a protractor, measure angles of two lines cut by a transversal and angles of two parallel lines cut by a transversal
Grade 6: Mathematics: Ratio, Percent, and Proportion	8.6.1.A compute percent of increase or decrease in real-world problems
This can be covered in many other areas	8.6.1.B apply proportional reasoning in problem-solving situations (for example, scale, similarity, percentage, unit pricing, simple interest, and rate)
Grade 6: Mathematics: Computation	8.6.2.A demonstrate order of operations with rational numbers
Grade 6: Mathematics: Computation	8.6.2.B demonstrate the meaning of the four basic operations of rational numbers
Grade 6: Mathematics: Computation	8.6.2.C using paper-and-pencil, demonstrate with proficiency computation of rational numbers
Grade 6: Mathematics: Computation	8.6.2.D demonstrate the inverse relationship of addition and subtraction of rational numbers
Grade 6: Mathematics: Computation	8.6.2.E demonstrate the inverse relationship of multiplication and division of rational numbers
Grade 6: Mathematics: Computation	8.6.2.F demonstrate multiplication of rational numbers as repeated addition
This can be covered in many other areas	8.6.3.A determine from real-world problems whether an estimated or exact answer is acceptable
This can be covered in many other areas	8.6.3.B use estimation techniques before performing operations
This can be covered in many other areas	8.6.4.A determine whether information given in a problem-solving situation is sufficient, insufficient, or extraneous
This can be covered in many other areas	8.6.4.B given a real-world problem-solving situation, use the correct operation and appropriate method (mental arithmetic, estimation, paper-and-pencil, calculator, or computer) to solve the problem
This can be covered in many other areas	8.6.4.C given a math sentence using the four operations with positive rational numbers and integers, create and illustrate a real-world problem
This can be covered in many other areas	8.6..4D in a problem-solving situation, determine whether the results are reasonable and justify those results with correct computations
Core Knowledge® Content (Science-Grade 8)	**Colorado Grade Level Expectations** (Grade 8-Science)
Teachers: Effective instruction in science requires not only hands-on experience	

and observation but also book learning, which helps bring coherence and order to student's scientific knowledge. Only when topics are presented systematically and clearly can students make steady and secure progress in selective study of topics, a number of which were introduced in earlier grades. It also continues the practice of studying topics from each of the major realms of science (physical, life, and earth science). Students are expected to do experiments and write reports on their findings.	
I. Physics	
A. Motion	
▪	
▪	8.2.I interpret graphs of position versus time and speed versus time for motion in a single direction
B. Forces	
▪	8.2.J know that force has both direction and magnitude and when an object is subject to two or more forces at once, the effect is the cumulative effect of all the forces
▪	8.2.J know that force has both direction and magnitude and when an object is subject to two or more forces at once, the effect is the cumulative effect of all the forces 8.2.K know that when forces on an object are balances, the motion of the object does not change; when the forces are unbalanced the object will change its motion (e.g. speed up, slow down, or change direction) 8.2.L demonstrate that simple machines can be used to change the direction or size of a force (e.g. measure the effectiveness of a lever in moving objects with different masses)
C. Density and Buoyancy	
▪	
D. Work	
▪	
E. Energy	
▪	
▪	
▪	8.2.G determine the potential and kinetic energy of a cart as it moves up and down an inclined lane 8.2.H interpret and explain the relationship among kinetic energy, potential energy, and mechanical advantage (e.g. demonstrate the types of energy, changes in motion, and mechanical advantage involved in shooting an arrow) 8.2.R understand that chemical energy is stored in chemical bonds between atoms in elements and compounds
▪	
F. Power	
▪	
II. Electricity and Magnetism	
A. Electricity	
▪	8.2.M compare series and parallel circuits 8.2.N use various materials in a simple circuit, show the difference between conductors and insulators and compare the efficiency of electrical conductors)
B. Magnetism and Electricity	
▪	
III. Electromagnetic Radiation and Light	
▪	8.2.B classify waves as mechanical (sound, tidal, earthquake) or electromagnetic (radio, sunlight)

▪	8.2.C draw an electromagnetic spectrum and identify the forms of radiant energy in the visible part of the spectrum and the use of the non visible part of the spectrum (e.g. x-rays, microwaves, ultra violet light)
▪	8.2.D know that white light is a mixture of many wavelengths and that retinal cells react differently with different wavelengths 8.2.E know that light interacts with matter by transmission (including refraction), absorption, or scattering (including reflection) 8.2.F know that the angle of reflection of a light beam is equal to the angle of incidence
IV. Sound Waves	
▪	8.2.A experiment with tuning forks, ripple tanks, "slinkys," and other objects to observe and analyze problems with waves
▪	8.2.B classify waves as mechanical (sound, tidal, earthquake) or electromagnetic (radio, sunlight)
IV. Chemistry of Food and Respiration	
▪	
▪	8.2.O understand that chemical reactions are processes in which atoms are rearranged into different combinations of molecules, also covered in Grade 5: Science: Chemistry: Matter and Change and Grade 7: Science: Chemical Bonds and Reactions
▪	8.6.E identify and illustrate natural cycles within systems
▪	
▪	
▪	
VI. Science Biographies	
▪	8.6.C describe the contributions of science made by people in different cultures and at different times in history
Grade level or other area Grade Level Expectations are covered in the *Core Knowledge Sequence*	**Grade Level Expectations not directly covered in the *Core Knowledge Sequence*, but can be covered in other areas**
This can be covered in many other areas, see note to teachers above	8.1.A create a written plan to include the question to be investigated, an appropriate hypothesis, design of the experiment, identification of the control and labeled variables, a developed scientific procedure to collect and record data; the design should also include a number of repeated trials, unbiased sampling, accurate measurements and record keeping and a comparison to a control
This can be covered in many other areas, see note to teachers above	8.1.B apply scientific ideas, concepts, and relationships to the formation of scientific questions
This can be covered in many other areas, see note to teachers above	8.1.C evaluate explanations by examining evidence, comparing evidence, identifying faulty reasoning, and pointing out statements that go beyond the evidence
This can be covered in many other areas, see note to teachers above	8.1.D predict an outcome based on a set of experimental data
This can be covered in many other areas, see note to teachers above	8.1.E recognize that scientific investigations sometimes generate new methods or procedures for an investigation or develop new technologies to improve the collection of data
This can be covered in many other areas, see note to teachers above	8.1.F refine hypotheses from a previous investigation
This can be covered in many other areas, see note to teachers above	8.1.G construct a model to predict change (e.g. stream table, computer simulation)
Grade 5 and Grade 6: Mathematics: Probability and Statistics	8.1.H organize and construct representation of data into appropriate formats (e.g. histograms, circle graphs, flow charts) and make inferences based on that data
Grade 5 and Grade 6: Mathematics: Probability and Statistics	8.1.I interpret patterns, trends, relationships in collected data
This can be covered in many other areas, see note to teachers above	8.1.J state relationships in terms of the relationship between two or more variables
This can be covered in many other areas, see note to teachers above	8.1.K evaluate the accuracy and reproductibility of data
This can be covered in many other areas, see note to teachers above	8.1.L analyze data and evaluate hypothesis
This can be covered in many other areas, see note to teachers above	8.1.M identify areas for further investigation
Grade 5 and Grade 6: Mathematics: Probability and Statistics	8.1.N construct appropriate graphs from data and develop quantitative statements about the relationships between

		variables
	This can be covered in many other areas, see note to teachers above	8.1.O communicate the logical connection among hypothesis, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence
	Grade 5 and Grade 6: Mathematics: Probability and Statistics	8.1.P distinguish between linear and non-linear relationships on a graph of data
	Grade 7: Mathematics: Measuring	8.1.Q use metric units in measuring, calculating, and reporting results
	This can be covered in many other areas, see note to teachers above	8.1.R acknowledge that the scientific community accepts and uses explanations until those explanations are displaced by better scientific ones
	This can be covered in many other areas, see note to teachers above	8.1.S acknowledge different ideas and explanations, be able to accept the skepticism of others, and consider alternative explanations
	Grade 7: Science: Chemical Bonds and Reactions	8.2.P know that in chemical reactions, the number of atoms stays the same no matter how they are arranged so their total mass stays the same (conservation of matter)
	Grade 7: Science: Chemical Bonds and Reactions	8.2.Q determine whether a solution is acidic, basic, or neutral
	Grade 1: Science: Living Things and Their Environments and Grade 3: Science: Ecology	8.3.A explain the characteristics of plants and animals that enable them to survive
	Grade 1: Science: Living Things and Their Environments and Grade 3: Science: Ecology	8.3.B compare, contrast, and explain the difference in biodiversity of different ecosystems
	Grade 1: Science: Living Things and Their Environments and Grade 3: Science: Ecology	8.3.C explain the causes and effects of changes in populations (e.g. predator-prey, human, and carrying capacity)
	Grade 5: Science: Cells: Structures and Processes	8.3.D organize information into a model that demonstrates the interaction of systems of cells, tissues, organs, and organ networks in a complex multi cellular organism through chemical and physical processes)
	Grade 7: Science: Cell Division and Genetics	8.3.E use models to demonstrate how genetic material is transmitted and how gene traits are expressed in offspring (e.g. Punnett squares and pedigree charts to show how single gene traits are expressed in offspring)
	Grade 5: Science: Plant Structures and Processes and Life Cycles and Reproduction	8.3.F describe sexual reproduction patterns in flowering plants and a variety of animals
	Grade 2: Science: Life Cycles, Grade 5: Science: Plant Structures and Processes and Life Cycles and Reproduction	8.3.G observe, describe, and measure changes that occur in an organism as it develops from a seed or fertilized egg to an adult (e.g. bean plant, frog, chicken)
		8.3.H research the evolutionary adaptation of a number of present day organisms and explain how these adaptations contributed to the survival of the organism (e.g. beak shape, protective coloration, flower color)
	Grade 4: Science: Meteorology	8.4.A describe the gaseous composition of the atmosphere
	Grade 4: Science: Meteorology	8.4.B measure humidity, temperature, and pressure of the troposphere
	Grade 4: Science: Meteorology and Grade 7: Science: Energy, Heat, and Energy Transfer	8.4.C explain how atmospheric circulation is driven by solar heating which involves radiation, convection, and conduction
	Grade 4: Science: Meteorology and Grade 6: Science: Plate Tectonics	8.4.D know that the Earth has three distinct physical spheres (atmosphere, hydrosphere, and lithosphere) and each has different compositions yet interfaces with each other
	Grade 3: Science: History and Geography: World Geography: Important Rivers of the World, Grade 4: Science: Meteorology, Grade 5: History and Geography: World Geography: Great Lakes of the World, and Grade 6: Science: Oceans	8.4.E use graphs and charts to describe and compare the distribution of the world's water including rivers, oceans, ground water, and atmosphere
	Grade 3: Science: History and Geography: World Geography: Important Rivers of the World, Grade 4: Science: Meteorology, Grade 5: History and Geography: World Geography: Great Lakes of the World, and Grade 6: Science: Oceans	8.4.F use diagrams/models and show the direction of water circulation through Earth's systems
	Grade 3: Science: Astronomy, Grade 4: Science: Meteorology	8.4.G know that the yearly revolution of Earth in its orbit around the sun and the tilt on it axis cause the angle at which sunlight strikes the Earth to vary at different locations; this causes differences in the heating of Earth's surface which produce seasonal variations in weather and a variety of climates

	This can be covered in many other areas, see note to teachers above	8.5.A identify and analyze ways in which advances in science and technology have affected each other and society
	This can be covered in many other areas, see note to teachers above	8.5.B use the results of material tests (e.g. hardness, tensile strength, conductivity) to suggest appropriate uses for materials
	This can be covered in many other areas, see note to teachers above	8.5.C evaluate designs, devices, or solutions and develop measures of quality
	This can be covered in many other areas, see note to teachers above	8.6.A explain why a controlled experiment must have comparable results when repeated
	This can be covered in many other areas, see note to teachers above	8.6.B give examples of how scientific knowledge changes as new knowledge is acquired and previous ideas are modified
	This can be covered in many other areas, see note to teachers above	8.6.D identify, compare, and predict variables and conditions related to change
	This can be covered in many other areas, see note to teachers above	8.6.F use models to predict change

APPENDIX AM – DCCHS MATH AND SCIENCE TEXTS

DCCHS Science

Course	Text Title	Publisher	Author
Earth Space Life	BSCS: An Inquiry Approach Level 1	BSCS	
	Voyages through Time	VTT	
Principals of Bio and Chemistry	BSCS: An Inquiry Approach Level 2	BSCS	
Physics	Physics	Holt	Seway Faugin
Earth Science	Earth Science	Holt	Allison, DeGaetano, Pasachoff
Chemistry	Glencoe	Matter and Change	
Biology	Biology	Miller and Levine	
IB Bio	Higher Level Bio	IB	
IB Chem	Higher Level Chem	IB	
AP Bio	Senior Bio 1& 2	BioZone	
DCCHS Math			
Principals of Algebra and Geometry	Integrated Math 1	McDougal and Littell	
Intermediate Algebra and Geometry	Integrated Math 2	McDougal and Littell	
Advanced Algebra and Geometry	Integrated Math 3	McDougal and Littell	
FST	FST	Chicago Math Project	
Precalculus	Precalc	Larson Hostetler and Edwards	
Calculus	Early Transcendental Functions	Larson Hostetler and Edwards	
Statistics	The Practice of Statistics		Freeman
IB HL/SL Math		IB	

APPENDIX AN – CORE KNOWLEDGE CSAP DATA

Colorado Student Assessment Program Data

The National Core Knowledge Coordinator of Colorado has compiled test data from the Colorado Core Knowledge schools and their performance on the Colorado Student Assessment Program (CSAP). This data can help schools share information about best practices and successful programs being used in schools around the state. Please note that there is no one to one correlation between Core Knowledge implementation and test scores, but in answering the question, "Why should scores go up on standardized tests in Core Knowledge schools if the tests aren't tied to the Core Knowledge curriculum," E. D. Hirsch summarized the power of knowledge in creating general skills and competence in students in three statements that scientists have confirmed:

1. More knowledge makes you smarter.
2. More general knowledge makes you more generally competent in the tasks of life.
3. Giving everybody more general knowledge makes everybody more competent, and therefore creates a more just society.

For more information on this topic, please see the Core Knowledge Foundation website. http://www.ckcolorado.org/stats.asp

APPENDIX AO – CORE KNOWLEDGE DATA, 6TH GRADE MATH

School Name	2002	Points ↑/↓	2003	Points ↑/↓	2004	Points ↑/↓
Academy Charter School	68%	+17	66%	+16	67%	+14
Academy of Charter Schools	41%	-10	48%	-2	58%	+5
Alta Vista Charter School	NA		NA		NA	
Aurora Academy	31%	-20	52%	+2	44%	-9
Belle Creek Charter School					26%	-27
Bromley East Charter School	39%	-12	48%	-2	51%	-2
Cardinal Community Academy	NA		NA		NA	
Cesar Chavez Academy	48%	-3	63%	+13	96%	+43
Cherry Creek Academy	88%	+37	63%	+13	80%	+27
Cheyenne Mtn. Charter Academy	96%	+45	90%	+40	95%	+42
Collegiate Academy	65%	+14	52%	+2	74%	+21
Crown Pointe Charter School	64%	+13	63%	+13	63%	+10
Elbert County Charter School	56%	+5	79%	+29	76%	+23
Excel Academy	NA		79%	+29	69%	+16
Frontier Academy	53%	+2	70%	+20	70%	+17
Frontier Charter Academy	NA		NA		NA	
Hotchkiss K-8	55%	+4	45%	-5	49%	-4
Indian Peaks Charter	NA		NA		NA	
James Irwin Charter Middle School					59%	+6
Jefferson Academy	69%	+18	64%	+14	91%	+38

Knowledge Quest Academy			NA		41%	-12
Liberty Common School	88%	+37	86%	+36	96%	+43
Lincoln Academy	75%	+24	74%	+24	73%	+20
Littleton Academy	85%	+34	91%	+41	98%	+45
Littleton Prep Academy	58%	+7	49%	-1	66%	+13
Moffat Middle School	NA		NA		NA	
Monument Academy	80%	+29	82%	+32	81%	+28
Moore Elementary School	61%	+10	46%	-4	41%	-12
Mountain View Core Knowledge School	62%	+11	69%	+19	48%	-5
Normandy Elementary	85%	+34	80%	+30	79%	+26
O'Dea Elementary	48%	-3	65%	+15	69%	+16
Parker Core Knowledge Charter School	86%	+35	84%	+34	73%	+20
Peak to Peak Charter School	85%	+34	75%	+25	76%	+23
Platte River Academy	79%	+28	85%	+35	78%	+25
Ridgeview Classical Schools	73%	+22	66%	+16	83%	+30
Rocky Mountain Academy	72%	+21	90%	+40	86%	+33
Sanford Junior/Senior High School	65%	+14	65%	+15	65%	+12
Sierra Grande School	29%	-22	38%	-12	26%	-27
Swallows Charter Academy	78%	+27	88%	+38	78%	+25
The Classical Academy	88%	+37	77%	+27	84%	+31
The Pinnacle	45%	-6	42%	-8	38%	-15
Traut Core Knowledge School	95%	+44	93%	+43	91%	+38

Twin Peaks Charter School	71%	+20	64%	+14	89%	+36
Windsor Charter Academy	55%	+4	50%	0	67%	+14
Woodrow Wilson Academy	48%	-3	57%	+7	68%	+15
Zach Elementary			67%	+17	84%	+31
State Average	51%		50%		53%	

APPENDIX AP – CORE KNOWLEDGE DATA, 6TH GRADE READING

School Name	2002	Points ↑/↓	2003	Points ↑/↓	2004	Points ↑/↓
Academy Charter School	82%	+17	85%	+18	87%	+20
Academy of Charter Schools	58%	-7	76%	+9	72%	+5
Alta Vista Charter School	NA		NA		NA	
Aurora Academy	52%	-13	64%	-3	65%	-2
Belle Creek Charter School					54%	-13
Bromley East Charter School	73%	+8	68%	+1	71%	+4
Cardinal Community Academy	NA		NA		NA	
Cesar Chavez Academy	74%	+9	76%	+9	93%	+26
Cherry Creek Academy	94%	+28	97%	+30	88%	+21
Cheyenne Mtn. Charter Academy	100%	+35	97%	+30	98%	+31
Collegiate Academy	74%	+9	69%	+2	91%	+24
Crown Pointe Charter School	68%	+3	75%	+8	71%	+4
Elbert County Charter School	71%	+6	85%	+18	84%	+17
Excel Academy	NA		89%	+22	79%	+12
Frontier Academy	64%	-1	80%	+13	86%	+19
Frontier Charter Academy	NA		NA		53%	-14
Hotchkiss K-8	80%	+15	62%	-5	63%	-4
Indian Peaks Charter	NA		NA		NA	
James Irwin Charter Middle School					92%	+25
Jefferson Academy	88%	+23	85%	+18	94%	+27

Knowledge Quest Academy			NA		76%	
Liberty Common School	91%	+26	96%	+29	100%	+33
Lincoln Academy	86%	+21	89%	+22	90%	+23
Littleton Academy	93%	+28	91%	+24	100%	+33
Littleton Prep Academy	77%	+12	68%	+1	86%	+19
Moffat Middle School	NA		NA		NA	
Monument Academy	88%	+23	94%	+27	91%	+24
Moore Elementary School	82%	+17	58%	-9	59%	-8
Mountain View Core Knowledge School	92%	+27	92%	+25	76%	+9
Normandy Elementary	81%	+16	84%	+17	89%	+22
O'Dea Elementary	76%	+11	91%	+24	88%	+21
Parker Core Knowledge Charter School	95%	+30	98%	+31	91%	+24
Peak to Peak Charter School	92%	+27	91%	+24	91%	+24
Platte River Academy	77%	+12	98%	+31	89%	+22
Ridgeview Classical School	96%	+31	93%	+26	96%	+29
Rocky Mountain Academy	83%	+18	90%	+23	90%	+23
Sanford Junior/Senior High School	55%	-10	69%	+2	77%	+10
Sierra Grande School	42%	-23	63%	-4	48%	-19
Swallows Charter Academy	83%	+18	76%	+9	89%	+22
The Classical Academy	91%	+26	91%	+24	94%	+27
The Pinnacle	63%	-2	61%	-6	62%	-5
Traut Core Knowledge School	96%	+31	99%	+32	99%	+32

Twin Peaks Charter School	87%	+22	77%	+10	96%	+29
Windsor Charter Academy	73%	+8	77%	+10	76%	+9
Woodrow Wilson Academy	57%	-8	74%	+7	84%	+17
Zach Elementary			90%	+23	88%	+21
State Average	65%		67%		67%	

APPENDIX AQ – CORE KNOWLEDGE DATA, 6TH GRADE WRITING

School Name	2002	Points ↑/↓	2003	Points ↑/↓	2004	Points ↑/↓
Academy Charter School	68%	+18	71%	+17	77%	+21
Academy of Charter Schools	34%	-16	57%	+3	65%	+9
Alta Vista Charter School	NA		NA		NA	
Aurora Academy	29%	-21	55%	+1	50%	-6
Belle Creek Charter School					54%	-2
Bromley East Charter School	52%	+2	68%	+14	71%	+15
Cardinal Community Academy	NA		NA		NA	
Cesar Chavez Academy	52%	+2	63%	+9	78%	+22
Cherry Creek Academy	85%	+35	87%	+33	82%	+26
Cheyenne Mtn. Charter Academy	96%	+46	100%	+46	95%	+39
Collegiate Academy	63%	+13	63%	+9	81%	+25
Crown Pointe Charter School	59%	+9	75%	+21	58%	+2
Elbert County Charter School	74%	+24	83%	+29	70%	+14
Excel Academy	NA		79%	+25	79%	+23
Frontier Academy	48%	-2	71%	+17	74%	+18
Frontier Charter Academy	NA		NA		35%	-21
Hotchkiss K-8	65%	+15	43%	-11	46%	-1
Indian Peaks Charter	NA		NA		NA	
James Irwin Charter Middle School					59%	+3
Jefferson Academy	71%	+21	83%	+29	85%	+29

Knowledge Quest Academy			NA		41%	-15
Liberty Common School	82%	+32	91%	+37	96%	+4
Lincoln Academy	68%	+18	85%	+31	71%	+15
Littleton Academy	80%	+30	91%	+37	94%	+38
Littleton Prep Academy	63%	+13	56%	+2	79%	+23
Moffat Middle School	NA		NA		NA	
Monument Academy	88%	+38	83%	+29	86%	+30
Moore Elementary School	53%	+3	50%	-4	50%	-6
Mountain View Core Knowledge School	69%	+19	81%	+27	60%	+4
Normandy Elementary	74%	+24	84%	+30	88%	+32
O'Dea Elementary	56%	+6	79%	+25	92%	+36
Parker Core Knowledge Charter School	77%	+27	93%	+37	73%	+17
Peak to Peak Charter School	78%	+28	82%	+28	85%	+29
Platte River Academy	60%	+10	83%	+29	76%	+20
Ridgeview Classical Schools	81%	+31	78%	+24	83%	+27
Rocky Mountain Academy	50%	0	80%	+26	76%	+20
Sanford Junior/Senior High School	35%	-15	62%	+8	65%	+9
Sierra Grande School	25%	-25	46%	-8	52%	-4
Swallows Charter Academy	94%	+44	71%	+17	83%	+27
The Classical Academy	81%	+31	79%	+25	90%	+34
The Pinnacle	44%	-6	43%	-11	46%	-10
Traut Core Knowledge School	95%	+45	96%	+42	95%	+39

Twin Peaks Charter School	67%	+17	66%	+8	89%	+33
Windsor Charter Academy	64%	+14	82%	+28	27%	-29
Woodrow Wilson Academy	43%	-7	70%	+16	76%	+20
Zach Elementary			73%	+19	80%	+24
State Average	50%		54%		56%	

APPENDIX AR – CORE KNOWLEDGE DATA, 7TH GRADE MATH

Colorado Core Knowledge Schools-7th Grade CSAP Math Scores

(Percentage of students at Proficient or Advanced)

(Numbers to the right of CSAP scores are the difference in percentage points from the state average)

School Name 2002 Points ↑/↓ **2003** Points ↑/↓ **2004** Points ↑/↓

Academy Charter School 53% +14 65% +24 44% +3

Academy of Charter Schools 42% +4 27% -14 48% +7

Aurora Academy 40% +1 24% -17 43% +2

Belle Creek Charter School 24% -17

Brighton Charter 11% -28 9% -32 18% -23

Bromley East Charter School 26% -13 34% -7 35% -6

Cesar Chavez Academy 37% -2 33% -8 82% +41

Cherry Creek Academy 45% +6 65% +24 78% +37

Cheyenne Mtn. Charter Academy 83% +52 77% +36 90% +49

Collegiate Academy 31% -8 35% -6 31% -10

Crown Pointe Charter School 39% 0 35% -6 68% +27

Elbert County Charter School 36% -3 68% +27 65% +24

Frontier Academy 29% -10 43% +2 46% +5

Frontier Charter Academy NA NA NA

Hotchkiss K-8 49% +10 49% +8 36% -5

James Irwin Charter Middle School 54% +13

Jefferson Academy Junior High 69% +30 50% +9 64% +23

Knowledge Quest Academy NA na

Liberty Common School 77% +38 62% +21 80% +39

Littleton Academy 73% +34 82% +41 92% +51

Littleton Prep Academy 43% +4 43% +2 30% -11

Colorado Core Knowledge Schools-7th Grade CSAP Math Scores

(Percentage of students at Proficient or Advanced)

(Numbers to the right of CSAP scores are the difference in percentage points from the state average)

Moffat Middle School NA NA NA

Monument Academy 64% +25 74% +33 78% +37

Mountain View Core Knowledge School 50% +11 48% +7 41% +0

Parker Core Knowledge Charter School 77% +38 82% +41 80% +39

Peak to Peak Charter School 55% +16 73% +32 70% +29

Platte River Academy 73% +34 60% +19 69% +28

Ridgeview Classical Schools 57% +18 60% +19 62% +21

Rocky Mountain Academy 50% +11 45% +4 NA

Sanford Junior/Senior High School 48% +9 29% -12 59% +18

Sierra Grande School 32% -7 28% -13 28% -13
Swallows Charter Academy 50% +11 65% +24 NA
The Classical Academy 70% +31 67% +26 63% +22
The Pinnacle 23% -16 36% -5 42% +1
Twin Peaks Charter School 74% +35 77% +36 57% +16
Windsor Charter Academy NA 63% +22 56% +15
Woodrow Wilson Academy NA NA
State Average 39% 41% 41%

APPENDIX AS – CORE KNOWLEDGE DATA, 7TH GRADE READING

School Name	2002	Points ↑/↓	2003	Points ↑/↓	2004	Points ↑/↓
Academy Charter School	71%	+12	80%	+19	68%	+7
Academy of Charter Schools	57%	-2	43%	-18	57%	-4
Aurora Academy	68	+9	60%	-1	50%	-11
Belle Creek Charter School					34%	-27
Brighton Charter School	31%	-28	36%	-25	29%	-32
Bromley East Charter School	60%	+1	76%	-15	55%	-6
Cesar Chavez Academy	63%	+4	78%	+17	85%	+24
Cherry Creek Academy	68%	+9	95%	+34	93%	+32
Cheyenne Mtn. Charter Academy	96%	+37	100%	+39	95%	+34
Collegiate Academy	63%	+4	70%	+9	46%	-15
Crown Pointe Charter School	56%	-3	65%	+4	72%	+11
Elbert County Charter School	73%	+14	81%	+20	77%	+16
Frontier Academy	54%	-5	58%	-3	67%	+6
Frontier Charter Academy	NA		NA		NA	
Hotchkiss K-8	71%	+12	62%	+1	62%	+1
James Irwin Charter Middle School					68%	+7

Jefferson Academy Junior High	79%	+20	77%	+16	79%	+18
Knowledge Quest Academy			NA		NA	
Liberty Common School	95%	+36	87%	+26	89%	+28
Littleton Academy	90%	+31	96%	+35	94%	+33
Littleton Prep Academy	78%	+19	77%	+16	60%	-1
Moffat Middle School	NA		NA		NA	
Monument Academy	85%	+26	78%	+17	88%	+27
Mountain View CK School	78%	+19	92%	+31	81%	+20
Parker Core Knowledge Charter School	91%	+32	95%	+34	95%	+34
Peak to Peak Charter School	81%	+22	87%	+26	89%	+28
Platte River Academy	73%	+14	77%	+16	88%	+27
Ridgeview Classical School	77%	+18	80%	+19	81%	+20
Rocky Mountain Academy	85%	+26	90%	+29	NA	
Sanford Jr./Sr. High School	55%	-4	45%	-16	63%	+2
Sierra Grande School	68%	+9	32%	-29	58%	-3
Swallows Charter Academy	88%	+29	85%	+24	NA	
The Classical Academy	88%	+29	85%	+24	82%	+21
The Pinnacle	45%	-14	59%	-2	70%	+9
Twin Peaks Charter School	93%	+34	92%	+31	74%	+13

Windsor Charter Academy	NA		92%	+31	94%	+33
Woodrow Wilson Academy			NA		NA	
State Average	59%		61%		61%	

APPENDIX AT – CORE KNOWLEDGE DATA, 7TH GRADE WRITING

School Name	2002	Points ↑/↓	2003	Points ↑/↓	2004	Points ↑/↓
Academy Charter School	64%	+14	77%	+24	60%	+8
Academy of Charter Schools	47%	-3	34%	-19	46%	-6
Aurora Academy	48	-2	56%	+3	59%	+7
Belle Creek Charter School					22%	-30
Brighton Charter School	20%	-30	14%	-39	29%	-23
Bromley East Charter School	45%	-5	65%	+12	44%	-8
Cesar Chavez Academy	53%	+3	76%	+23	76%	+24
Cherry Creek Academy	65%	+15	93%	+40	89%	+37
Cheyenne Mtn. Charter Academy	96%	+46	100%	+47	95%	+43
Collegiate Academy	61%	+11	58%	+5	40%	-12
Crown Pointe Charter School	39%	-11	43%	-10	80%	+28
Elbert County Charter School	68%	+18	77%	+24	77%	+25
Frontier Academy	52%	+2	54%	+1	61%	+9
Frontier Charter Academy	NA		NA		NA	
Hotchkiss K-8	56%	+6	51%	-2	49%	-3
James Irwin Charter Middle School					64%	+12
Jefferson Academy Junior High	66%	+16	61%	+8	71%	+19

Knowledge Quest Academy			NA		NA	
Liberty Common School	93%	+43	67%	+14	92%	+40
Littleton Academy	85%	+35	96%	+43	94%	+42
Littleton Prep Academy	67%	+17	68%	+15	51%	-1
Moffat Middle School	NA		NA		NA	
Monument Academy	72%	+22	72%	+19	76%	+24
Mountain View CK School	48%	-2	80%	+27	67%	+15
Parker Core Knowledge Charter School	86%	+36	91%	+38	91%	+39
Peak to Peak Charter School	74%	+24	87%	+34	82%	+30
Platte River Academy	86%	+36	65%	+12	77%	+25
Ridgeview Classical School	67%	+17	70%	+17	76%	+24
Rocky Mountain Academy	80%	+30	60%	+7	NA	
Sanford Jr./Sr. High School	34%	-16	38%	-15	56%	+4
Sierra Grande School	53%	+3	32%	-21	42%	-10
Swallows Charter Academy	94%	+44	80%	+27	NA	
The Classical Academy	76%	+26	69%	+16	84%	+32
The Pinnacle	43%	-7	48%	-5	64%	+12
Twin Peaks Charter School	93%	+43	81%	+28	72%	+20
Windsor Charter Academy			63%	+10	69%	+17

Woodrow Wilson Academy	60%	+10	NA		NA	
State Average	50%		53%		52%	

APPENDIX AU – CORE KNOWLEDGE DATA, 8TH GRADE MATH

School Name	2002	Points ↑/↓	2003	Points ↑/↓	2004	Points ↑/↓
Academy Charter School	41%	+2	53%	+15	53%	+12
Academy of Charter Schools	38%	-1	44%	+6	37%	-4
Aurora Academy	59%	+20	53%	+15	17%	-24
Belle Creek Charter School					NA	
Bromley East Charter School	28%	-11	41%	+3	39%	-2
Brighton Charter School	11%	-28	5%	-33	11%	-30
Cesar Chavez Academy	25%	-14	38%	0	72%	+31
Cherry Creek Academy	38%	-1	45%	+7	65%	+24
Cheyenne Mtn. Charter Academy	92%	+53	95%	+57	86%	+45
Collegiate Academy	65%	+26	63%	+25	24%	-17
Crown Pointe Charter School	45%	+6	71%	+33	29%	-12
Elbert County Charter School	24%	-15	52%	+14	55%	+14
Frontier Academy	29%	-10	30%	-8	34%	-7
Frontier Charter Academy	NA		NA		NA	
Hotchkiss K-8	22%	-17	23%	-15	34%	-7
James Irwin Charter Middle School					49%	+8
Jefferson Academy Junior High	60%	+21	54%	+16	54%	+13

Liberty Common School	83%	+44	76%	+38	69%	+28
Littleton Academy	78%	+39	77%	+39	89%	+48
Littleton Prep Academy	39%	0	26%	-12	22%	-19
Moffat Middle School	NA		NA		NA	
Monument Academy	63%	+24	50%	+12	50%	+9
Mountain View CK School	48%	+9	42%	+4	58%	+17
Parker Core Knowledge Charter School	75%	+36	76%	+38	73%	+32
Peak to Peak Charter School	63%	+24	44%	+6	66%	+25
Platte River Academy	71%	+32	60%	+22	64%	+23
Ridgeview Classical School	59%	+20	48%	+10	64%	+23
Rocky Mountain Academy			49%	+11	62%	+21
Sanford Junior/Senior High School	54%	+15	52%	+14	33%	-8
Sierra Grande School	8%	-31	38%	0	29%	-12
Swallows Charter Academy	NA		NA		NA	
The Classical Academy	68%	+29	61%	+23	55%	+14
The Pinnacle	26%	-13	31%	-7	34%	-7
Twin Peaks Charter School	71%	+32	67%	+29	66%	+25
Windsor Charter Academy			28%	-10	58%	+17
Woodrow Wilson Academy					NA	

State Average	39%		38%		41%	

APPENDIX AV – CORE KNOWLEDGE DATA, 8TH GRADE READING

School Name	2002	Points ↑/↓	2003	Points ↑/↓	2004	Points ↑/↓
Academy Charter School	83%	+18	81%	+15	78%	+14
Academy of Charter Schools	53%	-12	74%	+8	48%	-16
Aurora Academy	78%	+13	75%	+9	50%	-14
Belle Creek Charter School					NA	
Brighton Charter School	48%	-17	33%	+33	11%	-53
Bromley East Charter School	67%	+2	70%	+4	75%	+11
Cesar Chavez Academy	81%	+16	69%	+3	91%	+27
Cherry Creek Academy	74%	+9	91%	+25	91%	+27
Cheyenne Mtn. Charter Academy	100%	+35	100%	+34	100%	+36
Collegiate Academy	82%	+17	73%	+7	62%	-2
Crown Pointe Charter School	70%	+5	94%	+28	52%	-12
Elbert County Charter School	76%	+11	74%	+8	76%	+12
Frontier Academy	65%	0	70%	+4	63%	-1
Frontier Charter Academy	NA		NA		NA	
Hotchkiss K-8	72%	+7	62%	-4	74%	+10
James Irwin Charter Middle School					67%	+3
Jefferson Academy Junior High	78%	+13	79%	+13	79%	+15

Liberty Common School	96%	+31	100%	+34	90%	+26
Littleton Academy	93%	+28	93%	+27	98%	+34
Littleton Prep Academy	61%	-4	71%	+5	88%	+24
Moffat Middle School	NA		NA		NA	
Monument Academy	85%	+20	98%	+32	83%	+19
Mountain View CK School	96%	+31	79%	+13	92%	+28
Parker Core Knowledge Charter School	89%	+24	95%	+29	98%	+34
Peak to Peak Charter School	90%	+25	86%	+20	87%	+23
Platte River Academy	79%	+14	85%	+19	69%	+5
Ridgeview Classical School	88%	+23	91%	+25	91%	+27
Rocky Mountain Academy			83%	+17	90%	+26
Sanford Junior/Senior High School	54%	-11	78%	+12	48%	-16
Sierra Grande School	58%	-7	75%	+9	57%	-7
Swallows Charter Academy	NA		NA		NA	
The Classical Academy	90%	+25	87%	+21	81%	+17
The Pinnacle	56%	-9	50%	-16	61%	-3
Twin Peaks Charter School	92%	+27	96%	+30	89%	+25
Windsor Charter Academy			67%	+1	89%	+25
Woodrow Wilson Academy					NA	

State Average	65%		66%		64%	

APPENDIX AW – CORE KNOWLEDGE DATA, 8TH GRADE SCIENCE

School Name	2002	Points ↑/↓	2003	Points ↑/↓	2004	Points ↑/↓
Academy Charter School	54%	+4	49%	0	67%	+16
Academy of Charter Schools	36%	-14	35%	-14	41%	-10
Aurora Academy	68	+18	40	-9	22%	-29
Belle Creek Charter School					NA	
Brighton Charter School	28%		26%		16%	-35
Bromley East Charter School	44%		62%		57%	+6
Cesar Chavez Academy	63%	+13	69%	+20	94%	+43
Cherry Creek Academy	69%	+19	76%	+27	74%	+23
Cheyenne Mtn. Charter Academy	96%	+46	89%	+40	100%	+49
Collegiate Academy	53%	+3	43%	-6	43%	-8
Crown Pointe Charter School	65%	+15	88%	+39	38%	-13
Elbert County Charter School	24%	-26	57%	+8	48%	-3
Frontier Academy	51%	+1	58%	+9	40%	-11
Frontier Charter Academy	NA		NA		NA	
Hotchkiss K-8	50%	0	49%	0	40%	-11
James Irwin Charter Middle School					61%	+10
Jefferson Academy Junior High	64%	+14	59%	+10	66%	+15

Knowledge Quest					NA	
Liberty Common School	90%	+40	88%	+39	86%	+35
Littleton Academy	83%	+33	86%	+37	89%	+38
Littleton Prep Academy	50%	0	40%	-9	59%	+8
Moffat Middle School	NA		NA		NA	
Monument Academy	67%	+17	88%	+39	67%	+16
Mountain View CK School	70%	+20	68%	+19	67%	+16
Parker Core Knowledge Charter School	73%	+23	84%	+35	82%	+31
Peak to Peak Charter School	80%	+30	66%	+17	80%	+29
Platte River Academy	71%	+21	70%	+21	67%	+16
Ridgeview Classical Schools	76%	+26	73%	+24	86%	+35
Rocky Mountain Academy			72%	+23	57%	+6
Sanford Junior/Senior High School	49%	-1	56%	+7	38%	-13
Sierra Grande School	25%	-25	38%	-11	29%	-22
Swallows Charter Academy	NA		NA		NA	
The Classical Academy	70%	+20	59%	+10	66%	+15
The Pinnacle	31%	-19	30%	-19	38%	-13
Twin Peaks Charter School	75%	+25	62%	+13	74%	+23
Windsor Charter Academy			39%	-10	84%	+33

Woodrow Wilson Academy					NA	
State Average	50%		49%		51%	

APPENDIX AX – CORE KNOWLEDGE DATA, 8TH GRADE WRITING

School Name	2002	Points ↑/↓	2003	Points ↑/↓
Academy Charter School	59%	+9	70%	+21
Academy of Charter Schools	30%	-20	47%	-2
Aurora Academy	59%	+9	50%	+1
Boltz Junior High School	81%	+31	70%	+21
Cesar Chavez Academy	69%	+19	50%	+1
Cherry Creek Academy	69%	+19	67%	+18
Cheyenne Mtn. Charter Academy	100%	+50	100%	+51
Collegiate Academy	59%	+9	49%	0
Crown Pointe Charter School	70%	+20	71%	+22
Elbert County Charter School	43%	-7	74%	+25
Frontier Academy	49%	-1	58%	+9
Frontier Charter Academy	NA		NA	
Hotchkiss K-8	46%	-4	49%	0
Indian Peaks Charter	NA		NA	
Jefferson Academy Junior High	48%	-2	68%	+19
Liberty Common School	90%	+40	90%	+41
Littleton Academy	88%	+38	82%	+33

Littleton Prep Academy	50%	0	63%	+14
Moffat Middle School	NA		NA	
Monument Academy	70%	+20	75%	+26
Mountain View CK School	83%	+33	68%	+19
Parker Core Knowledge Charter School	75%	+25	89%	+40
Peak to Peak Charter School	77%	+27	69%	+20
Platte River Academy	63%	+13	70%	+21
Ridgeview Classical School	59%	+9	72%	+23
Rocky Mountain Academy			78%	+29
Sanford Junior/Senior High School	38%	-12	37%	-12
Sierra Grande School	33%	-17	44%	-5
Swallows Charter Academy	NA		NA	
The Classical Academy	82%	+32	72%	+23
The Pinnacle	32%	-18	27%	-12
Twin Peaks Charter School	77%	+27	93%	+44
Windsor Charter Academy			39%	-10
State Average	50%		49%	

APPENDIX AY – SAXON MATH OVERVIEW AND RESEARCH

Saxon Math Overview and Research

Saxon Math is unique because the entire program is based on introducing a topic to a student and then allowing the student to build upon that concept as they learn new ones. Topics are never dropped but are instead increased in complexity and practiced everyday, providing the time required for concepts to become totally familiar. This incremental approach to math differs from most traditional programs, which are "chapter-based." In these traditional texts, students are presented with and expected to learn an entire mathematical concept in one day. The homework for that day consists of twenty or thirty problems, all of which deal with that concept. The topic is then only reviewed prior to a test, if at all. Saxon textbooks, however, divide concepts into smaller, more easily grasped pieces called increments. A new increment is presented each day and students work only a few problems involving the new material. The remaining homework consists of practice problems involving concepts previously introduced. Thus, every assignment (and every test) is a cumulative review of all material covered up to that point.

In support of Saxon Math practices, review the article titled, –*Scientific Research Base for Saxon Math K-12, Foundational Research and Program Efficacy Studies*". This article (too large to attach) can be found at:
http://www.saxonpublishers.com/pdf/research/saxon_math_research.pdf.

APPENDIX AZ – ADDITIONAL STEM PROGRAMMING FINANCED THROUGH STEM ACADEMY

Challenger Learning Center Aerospace Science Center and Field Trip Destination for K-12 Students

STEM Academy will offer an award-winning Challenger Learning Center, in order to provide space education programs for schools, corporations, scouts, community groups and the general public. At the core of the Center is a state-of-the-art space simulator, which include an orbiting space station, and a Mission Control center modeled after NASA's Johnson Space Center. The program is part of the Challenger Center for Space Science Education, an international not-for-profit education organization founded in April 1986 by the families of the astronauts tragically lost during the Challenger space shuttle mission. The STEM Academy location is part of a growing network of more than 50 Challenger Learning Centers located throughout the United States, Canada and the United Kingdom and would serve groups throughout the Denver Metro Area.

STEM Career and Technical Education Classes (CTE)

STEM Academy is currently considering various programming options including the following classes that would be offered to all students in the South Metro area using business and industry partnerships, grant funding and students fees. Elective classes, such as web design, engineering design class, robotics etc. will be offered. Certification classes will be offered in partnerships with Colorado Community Colleges and Universities. The classes will be fee based and supplemented by business and industry partnerships. :

Academy of Science

Aviation Technology – College Credit Available

- Flight Simulator Training
- FAA Test Preparation
- Fundamentals of Flight
- Flight Operations
- Aviation Weather
- Performance and Navigation
- Integration of Pilot Knowledge and Skills
- Field Trips and Industry Guest Speakers Explore Careers in the Aviation and Aerospace Industry

Health Sciences – Partnership with the medical community – College Credit Available

- Medical Terminology
- Biomedical Engineering, Anatomy and Physiology
- Legal and Ethical Issues
- CPR/First Aid Certification

- Student Leadership – HOSA
- Certified Nursing Assistant Program (Includes Hospital Rotations)
- Healthcare Career Internships
- Field Trips and Guest Speakers

Academy of Engineering

Project Lead the Way Classes – College Credit Available through PLTW
High School Program: Pathway To Engineering™
Project Lead The Way (PLTW) offers a dynamic high school program that provides students with real-world learning and hands-on experience. This course will be offered as part of the optional Expanded Learning Time (ELT). Students interested in engineering, biomechanics, aeronautics, and other applied math and science arenas will discover PLTW is an exciting portal into these industries.

PLTW's premier high school program, Pathway To Engineering™, is a four-year course of study integrated into the students' core curriculum. The combination of traditional math and science courses with innovative Pathway To Engineering courses prepares students for college majors in engineering and E/T fields and offers them the opportunity to earn college credit while still in high school.

Pathway To Engineering™ courses engage high school students through a combination of activities-based, project based, and problem-based (APPB) learning. APPB learning not only creates an environment for applying engineering concepts to real problems, but also prepares students to:

- Solve problems
- Participate as part of a team
- Lead teams
- Speak to a public audience
- Conduct research
- Understand real-world impacts
- Analyze data
- Learn outside the classroom

The Logic Skills behind the Three-Tiered Approach.
This is a logical thought processes are built through APPB learning experiences in the program's three-tiered approach to coursework.

Tier One: Foundation

- Introduction to Engineering Design™—uses a design development process while enriching problem solving skills; students create and analyze models using specialized computer software.

- Principles Of Engineering™—explores technology systems and manufacturing processes; addresses the social and political consequences of technological change.
- Digital Electronics™—teaches applied logic through work with electronic circuitry, which students also construct and test for functionality.

Tier Two: Specialization Courses

- **Aerospace Engineering™**—expands horizons with Projects developed with NASA-aerodynamics, astronautics, space-life sciences, and systems engineering.
-
- **Biotechnical Engineering™—**hones more advanced skills in biology, physics, technology, and mathematics and applies them to real-world biotech fields.
-
- **Civil Engineering and Architecture™—**introduces students to the interdependent fields of civil engineering and architecture; students learn project planning, site planning, and building design.
-
- **Computer Integrated Manufacturing™—**enhances computer modeling skills by applying principles of robotics and automation to the creation of models of three-dimensional designs.
- **Tier Three: Capstone Course**

Academy of Technology and Math

Computer Certification Classes – College Credit Available

- Cad Design
- Information Technology
- Oracle Program
- Electronics Program: Prepares students for entry level professional positions as well as preparation for industry certifications in RFID and DHTI.
- A+ Certification
- Net+
- Security+

Media/Television Studio

Graphic Design Classes

- One or two year program college credit available through ACC
- Develop Drawing Skills
- Learn, understand and utilize:
  - Elements of art
  - Principles of Design

Use Industry Recognized Software:

- Adobe
- CS2,
- Illustrator
- Photoshop,
- In Design
- Color and Typography
- Create Presentations and Proposals
- Create a Professional Portfolio

Commercial Photography

- Basic Commercial Photography
- Digital Commercial Photography
- Comprehensive Basic and Advanced Photography
  - Work with Professional Photographers
  - Darkroom/Laboratory Training
  - Black and White/Color Principles
  - Create a Professional Portfolio
  - Utilize 35mm and Digital Format
  - Utilize 4x5 Large Format Film Cameras
  - Utilize Professional Studio Lighting
  - Photograph Customers
  - Photograph on-location Assignments

Teacher Cadet Program with an Emphasis in STEM Education

- Foundations of Education
- Learn about Teacher Certification
- Governance of Schools
- History of Education
- Field Experience in Classroom Settings
- Lesson Planning and Implementation
- Legal Issues in Education
- Independent Classroom Observations
- Create a Professional Portfolio

Students involved in this program will be offered opportunities to do their internships at STEM High and Middle Schools and with the STEM Academy ELT.

Academy of Auto Technology

Auto Technology – 1 Year Program College Credit Available through Arapahoe Community College

- Electrical System
- Brakes
- Suspension and Steering

- Four Wheel Alignment
- Engines
- Shop Safety

STEM Academy Expanded Learning After-school Classes and Activities

STEM Academy will offer a variety of STEM Education after-school classes and activities with experienced providers to elementary and middle school children. These classes will be fee-based. At STEM High an Expanded Learning Time, (ELT) a plethora of survey classes will be offered separate from the regular school day. According to Farbman and Kaplan (2005), students at the schools where ELT has been implemented in the Massachusetts 2020 Education Opportunity Project, spend 15 to 60 percent more time, 6 to 20 more hours per week, in school than their counterparts at schools in the surrounding or feeding districts. Schools take advantage of the additional time by expanding five categories of school activities: 1.) instructional time with APPB activities, 2.) enrichment and elective opportunities, 3.) planning and professional development, and 4.) tutoring and 5.) sports. (Appendices T, U and V)

The Expanded Learning Time (ELT) will be managed by STEM Academy. A Program Manager will oversee the ELT and will recruit additional volunteers, staff and form partnerships with community organizations to supplement programming and further extend the day. Staff members or community partner high tech volunteers, under the direction of highly qualified educators will teach enrichment classes and activities. School staff may also receive extra pay for the ELT. In some cases, community organizations may provide in-kind services thereby reducing the cost burden of these enhanced offerings at STEM High.