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FINAL REPORT
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Group Recommendation #1

Specific Recommendation:

Require every student who does not have an IEP for mathematics to take mathematics each of the four years of high school.

Research Rationale for how this change will help kids:

Elaine McEwan (The Principal's Guide to Raising Math Achievement. Thousand Oaks, CA: Corwin Press. 2000) identified a number of practices for raising and maintaining high school mathematics achievement. Among these was the practice of offering all students, regardless of ability level or prerequisite learning, the opportunity to take four years of high school math. She suggested that students be able to choose from the following courses: algebra I, algebra II, geometry, trigonometry, probability and statistics, linear algebra, mathematical analysis, advanced placement calculus. As an example, she noted that studies have found that one of the great stumbling blocks for calculus students has been their inadequate mastery of trigonometry. The trigonometry course that is offered must go beyond the "solution of triangles." It must include the study of trigonometric functions as functions, analytically and graphically, including exercise in proving identities and solving trigonometric equations.

- Students who took only Algebra I and Geometry, in high school, were no better prepared for success in college algebra than those students who took basic math courses.
- Student success rates in college algebra increased with each year of high school mathematics completed beyond the basic three-year core.

  "Rising to the Challenge: Are High School Graduates Prepared for College and Work?"
  http://www.achieve.org/dstore.nsf/Lookup/pollreport/$file/pollreport.pdf

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Implementation Steps for Recommendation #1	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
Develop a Board policy establishing a requirement for all high school students (except those with IEP's for mathematics) to be enrolled in mathematics all four years of high school.	Director, Student Achievement		Fall, 2006 for entering freshmen	

Group Recommendation #2

Specific Recommendation:

Decrease class sizes for mathematics instruction to a maximum of 25 students and preferably 20 or fewer.

Research Rationale for how this change will help kids:

In 1985 Tennessee's legislature asked for a longitudinal education experiment, known as Project STAR (Student Teacher Achievement Ratio) to learn about the effects of small classes (1:15 versus 1:25 teacher-student ratios) on student outcomes in grades K-3. Strict experimental controls and protocols were applied. The findings clearly favored the 1:15 ratios. STAR spawned two major studies: the Lasting Benefits Study, which tracks students to assess the extent and duration of early benefits of a 1:15 ratio, and Project Challenge, a policy application of 1:15 in Tennessee's poorest counties. Both studies provide positive support for early 1:15 schooling.

A 1987-88 teacher-observation study in classes of 15 and 25 students and a 1991-97 longitudinal 1:15 initiative in Burke County, N.C., provide positive results similar to those found in STAR.

Although statistical significance explains the probability that some findings would be a chance event, the "effect size" describes how much of a standard deviation the means of the groups are apart. The effect size can estimate the "educational significance" of some statistically significant research finding. An effect size of .35 or so is worth considering, especially if it is cumulative. Classes with a 1:15 teacher-student ratio and projects based on small classes typically get an effect size .3 to .7 or so when compared to larger groupings.

With newer evaluation and research designs, more sensitive outcome measures and better analytic models, current class-size studies are producing small-class effect sizes similar to those found in STAR. These results should warrant attention from practitioners and policymakers. Their consistency across sites is one type of replication: Similar studies get similar results.

A meta-analysis dealt with the impact of class size on student achievement. By combining 77 studies, which yielded 725 comparisons of achievement in classes of different sizes, they were able to spot trends that did not show up clearly in every study. An important outcome of the Glass/Smith meta-analysis was the finding that the greatest gains in achievement occurred among students who were taught in classes of 15 students or less. Glass and Smith summarized their findings in these words:

> As class size increases, achievement decreases. A pupil, who would score at about the 63rd percentile on a national test when taught individually, would score at about the 37th percentile (when taught) in a class of 40 pupils. The difference in being taught in a class of 20 versus a class of 40 is an advantage of ten percentile ranks.
>
> (Glass, G.V and Smith, M.L. (1979). Meta-analysis of research on the relationship of class-size and achievement. *Educational Evaluation and Policy Analysis*, *1*, 2-16)

Whitmore and Krueger tracked the SAT and ACT scores of the Tennessee students when they graduated from high school and established that the students enrolled in small classes during their first four years of education had higher average test scores than students enrolled in regular-size classes during those early grades. Whitmore and Krueger's most significant finding was that black students tended to advance further up the distribution of test scores than did white students, while they were enrolled in small classes and later when they returned to regular-size classes. "We found that black students in small classes from K to 3 had a dramatically increased probability of subsequently taking the ACT or SAT," Whitmore said. "The black-white gap is reduced by 60 percent, which is huge." In addition, Whitmore noted, reducing that gap "appears to be a contributing factor in income, health, crime and other outcomes. "Though it seems intuitive that smaller classes are naturally better, the conventional wisdom among economists and educators has been that more resources, including small classes, don't really matter and don't help test scores." Whitmore and Krueger believe their research offers evidence that small classes, though they add cost to school budgets, not only matter, but they specifically address the black-white achievement gap.

> (Krueger, A.B., & Whitmore, D.M. (2001). *Would Smaller Classes Help Close the Black-White Achievement Gap?* Princeton, NJ: Princeton University)

The majority of studies indicate that there is little difference in student achievement for classes in the size range of 25 to 40 pupils. However, some evidence suggests that advantages may exist for smaller classes in this range for mathematics in the early years of schooling. For classes with fewer students than 25, marked increases were seen in student achievement, student attitudes toward mathematics, and teacher attitudes. These increases were inversely proportional to the class size. Reductions to only 20 students were associated with significant increases in student performance. These increases are especially strong in urban areas with students from low-income households. One study suggests that reduced class size is necessary for some changes to occur, but not sufficient, for the desired achievement changes. Additional changes in instruction are needed to optimize the possibilities made available by the reduced teacher-student ratio. (ASCD, 1998)

In 1999, the U.S. Department of Education reported, "Studies have consistently identified a positive relationship between reduced class size and improved student performance." Similar conclusions have been reached by the National Assessment on Educational Progress, the Economic Policy Institute, RAND, the Educational Testing Service, the American Institute of Research, and many other respected organizations.

Florida has passed a constitutional amendment which calls for limiting classroom size, to be fully implemented by the year 2010. The amendment specifies 18 students per classroom for kindergarten through third grade; 22 students per classroom for fourth through eighth grades; and high school classrooms capped at 25 students.

Reducing class size is most successful for students in primary grades and for those who are either economically disadvantaged and/or come from ethnic minorities. Tennessee's Project Star showed that students in their first year of reduced-sized classes performed four percentile points higher on standardized tests than those in regular-sized classes, with or without an aide. In subsequent years, the increase in achievement averaged one percentage point a year higher for those children in reduced-sized classes. By the end of fifth grade, students in the control group were about half a school year (five months) ahead of students from larger classes in all subjects. For black students in the smaller classes, their advantage over children in regular-sized classes was a little greater, at seven to 10 percentile points higher.

Data from Indiana, Nevada, New York, Minnesota, Maryland, and Iowa provide additional information. Various studies in these states identified the following potential benefits of class size reduction: some achievement gains, greater individualized attention to students, increased teacher knowledge of the students, improved identification of special needs, fewer discipline problems, faster and more in-depth coverage of content, greater teacher/parent communication, reduction in classroom stress, and greater enjoyment of teaching. Some studies report students receiving better grades, taking more advanced classes, and increased likelihood of taking the SAT or ACT. Teachers and parents tend to report positive reactions to reduced class size, even when achievement data fails to support it.

A key finding of the Education Commission of the States' summary on class size reduction is that effectiveness "depends on whether teachers adapt their teaching methods to take advantage of small classes and have more focused time with students." (p. 5) Data are mixed in this area. While teachers in smaller classes do tend to give more individual attention and provide more manipulatives, traditional teaching practices are, by far, still the most common. For example, students in both types of math classes were likely to spend the majority of their time practicing computation.

> Boniface, Russell and Nancy Protheroe, "Class Size Reduction: Using What's Been Learned to Inform Educational Decisions," The Informed Educator Series, Education Research Service, Arlington, VA, 2002. (As summarized in Effective Schools Research Abstracts Volume 17, Issue 3)

While results of individual studies are always questionable, the different studies taken as a whole suggest several conclusions as to what we now know about small classes:

- "When planned thoughtfully and funded adequately, small classes in the early grades generate substantial gains for students, and those extra gains are greater the longer students are exposed to those classes.
- "Extra gains from small classes in the early grades are larger when the class has fewer than 20 students.
- "Extra gains from small classes in the early grades occur in a variety of academic disciplines and for both traditional measures of student achievement and other indicators of student success.
- "Students whose classes are small in the early grades retain their gains in standard size classrooms and in the upper grades, middle school, and high school.
- "All types of students gain from small classes in the early grades, but gains are greater for students who have traditionally been disadvantaged in education.
- "Initial results indicate that students who have traditionally been disadvantaged in education carry greater small-class, early grade gains forward into the upper grades and beyond.
- "The extra gains associated with small classes in the early grades seem to apply equally to boys and girls.
- "Evidence for the possible advantages of small classes in the upper grades and high school is inconclusive." (p. 20)

> Biddle, Bruce J. and David C. Berliner, "Small Class Size and Its Effects," Educational Leadership 59, 5 (February 2002): 12-23. (As summarized in Effective Schools Research Abstracts Volume 16, Issue 9)

Researchers have found that small schools and small classes contribute to higher academic achievement than do large schools and large classes.

> Danielson, Charlotte, Enhancing Student Achievement: A Framework for School Improvement. Association for Supervision and Curriculum Development, Alexandria, VA, 2002. (As summarized in Effective Schools Research Abstracts Volume 17, Issue 9)

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Implementation Steps for Recommendation #2	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
Write and approve board policy that all mathematics classes be capped at 25 students.	Director, Student Achievement Support	Florida Class Size Amendment; Kentucky School Boards Association	Fall, 2006	
Fund additional staff needed to support policy	Superintendent and Board of Education		Fall, 2006	
Notify building principals of staffing allocations based upon capacity for mathematics classes	Directors, Elementary School Services, Middle School Services, & High School Services		Fall, 2006	
Employ mathematics teachers to meet capacity requirement limitations	Building principals, superintendent, Board of Education		Fall, 2006	
Training of teachers to reduce class size for maximum effectiveness of instruction	District Math Specialists, Elementary Math Specialists		Fall, 2006	

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Group Recommendation #3

<u>Specific Recommendation:</u>

Increase class time for mathematics to a mandated minimum time of 60 minutes per day. Provide students who have scored below grade level in math an extra half hour of instruction daily (from 60 to 90 minutes daily). At the high school level, have mathematics instruction daily for all students.

<u>Research Rationale for how this change will help kids:</u>

Two of the most powerful predictors of student achievement in all large-scale assessments have been increased time on mathematics and the taking of advanced coursework

> Secada, W. (1992)Race, ethnicity, social class, language and achievement in mathematics. In D. Grouws (Ed.), *Handbook of research in mathematics teaching and learning.*

ASCD (1998) reported in its mathematics curriculum study that there should be:

- Time for student investigations, reflection, and communication about the mathematical tasks at hand.
- Time for teachers to probe the depth of student understanding through planned developmental activities, observations, and conversations with individual students.
- Time for students to connect the mathematics they are studying with applications of that mathematics in their daily lives and other topics in the curriculum.

Research findings related to these categories of educational time include the following:

- There is little relationship between allotted time and student achievement. While it is obvious that time must be set aside for children to learn any specific subject matter, simply increasing time without attention to what occurs during that time will have little impact.
- There is a small positive relationship between time-on-task and achievement.
- The largest correlation occurs when academic learning time and achievement are compared.
- There is no consistent relationship between the amount of time set aside for instruction and the actual time in which students are actually engaged in learning; most studies indicate the actual engaged learning time is less than half the school day.
- Factors that have the greatest impact on engaged learning time include good classroom management skills on the part of the teacher and

appropriate curriculum adapted to the needs of individual students.

- Develop school policies that protect instructional time and prohibit needless non-instructional interruptions.
- Plan lessons to accommodate the learning styles and instructional levels of students in your classroom.

http://web.wested.org/online_pubs/timeandlearning/3_research.html
http://www.nwrel.org/scpd/sirs/4/cu8.html

The Bloomberg administration and the New York City teachers' union reached a tentative contract (3 Oct. 2005). The deal provides a substantial increase in instructional time for the city's nearly 1.1 million public school children, including two extra days of class at the start of the school year and 50 minutes a week of tutoring, test preparation or other instruction for struggling students in groups of 10 or fewer.

Estrin, James. October 4, 2005. *The New York Times.*

Teachers must provide classroom time for the in-depth study of major concepts in mathematics. The typical forty-three minute class period does not support the time necessary to explore topics in-depth or from multiple perspectives. Short-segmented class periods often prevent students from achieving the flow and continuity of thinking that is so critical in making sense of mathematics.

Sizer, Theodore. 1992. *Horace's School: Redesign of the American High School.* Boston: Houghton Mifflin Co.

Stigler, J.W. and Hiebert, J. (1999). The Teaching Gap: Best Ideas From the World's Teachers for Improving Education in the Classroom. New York: Free Press.

Adelman, N.E., Haslam, M.B., & Pringle, B.A.. (1996, October). *The uses of time for teaching and learning*. (Vol 1: Findings and Conclusions.) Washington, DC: Policy Studies Associates, Inc.

Aronson, J.Z. (1995, February). *Stop the clock: Ending the tyranny of time in education.* San Francisco: Far West Laboratory.

Hossler, C., Stage, F., & Gallagher, K. (1988, March). *The relationship of increased instructional time to student achievement*. Policy Bulletin: Consortium on Educational Policy Studies.

Nelson, S. (1990). *Instructional time as a factor in increasing student achievement*. Portland, OR: Northwest Regional Educational Laboratory.

The research generally supports the positive impact of increasing the amount of student instructional time. For example, Walberg found a positive relationship between increased instructional time and learning in 97 percent of 130 studies.

Walberg, H.J. (1997). Uncompetitive American schools: Causes and cures. In *Brookings papers on educational policy*. Washington, DC: The Brookings Institute.

- There is little or no relationship between allocated time and student achievement.
- There is some relationship between engaged time and achievement.
- There is a larger relationship between academic learning time and achievement.

Aronson, J., Zimmerman, J., & Carlos, L. (1998). *Improving student achievement by extending school: Is it just a matter of time?* WestEd

Another review concludes that the "combination of additional time with effective teaching strategies and curricula designed to engage students is a powerful tool for enhancing academic performance."

Moore, MT., & Funkhouser, J. (1990, January). *More time to learn: Extended time strategies for chapter 1 students*. Washington, DC: Decision Resources Corp.

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Implementation Steps for Recommendation #3	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
Develop an administrative directive mandating a minimum of 60 minutes of instruction daily for all students enrolled in grades K-8 and all high school students enrolled in a mathematics class	Superintendent and Director, Student Achievement Support		Fall, 2006	
Develop master schedules accommodating required minimum instructional time for mathematics	Principals and counselors			
Teachers trained in effective use of best practice instruction for the full allotted time	District Math Specialists and Elementary School Math Specialists	Appalachian Rural Systemic Initiative (ARSI)	Fall, 2006	
Monitoring through review of lesson plans and classroom observations	PSA's, Middle School Instructional Coaches, and High School Academic Deans		Fall, 2006	
Teacher Training in Peer Assessment Model	Peers (Elementary, Middle, High) and District Professional Development Office	Phi Delta Kappa; Peer Assessment Model	Fall, 2006	

Group Recommendation #4

<u>Specific Recommendation:</u>

Employ a "math specialist" for each elementary school to assist all teachers teaching math (some without much math background).

<u>Research Rationale for how this change will help kids:</u>

The National Council of Teachers of Mathematics recommends mathematics specialists for elementary schools. As former NCTM President Johnny Lott stated, "we do know that students typically have better test results when taught by teachers who have more mathematics knowledge. The specialist notion may not be the sole answer, but it should help with the problem of having teachers who are afraid of mathematics or unsure in their knowledge of mathematics." The feelings and anxieties that students harbor as a result of insecure teachers, or teachers who fear mathematics, can and do affect their performance on tests.

> Croizet, J., & Claire, T. (1998). Extending the concept of stereotype threat to social class: The intellectual underperformance of students from low socioeconomic backgrounds. Personality and Social Psychology Bulletin, 6, 588-594.
>
> Shih, M., Pittinsky, T. L., & Ambady, N. (1999). Stereotype susceptibility: Identify salience and shifts in quantitative performance. *Psychological Science, 10* 80-83.
>
> Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of African-Americans. Journal of Personality and Social Psychology, 69, 797-811.

Research published by Ma Ling concluded that U. S. elementary school teachers of mathematics lacked the procedural and conceptual knowledge of mathematics ("profound understanding of fundamental mathematics") found among Chinese teachers. She recommended intensive, on-going professional development of elementary school teachers with specialization in mathematics.

> Ling, Ma. (1999). Knowing and teaching elementary mathematics: Teachers' understanding of fundamental mathematics in China and the United States. Mahwah, NJ: Lawrence Erlbaum Associates.

The Committee on Mathematics Achievement working on behalf of Kentucky HB 193 is recommending that professional development programs be established to prepare mathematics specialists for elementary schools across Kentucky.

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Implementation Steps for Recommendation #4	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
Advertise, interview and employ mathematics specialists for elementary schools	Elementary school principals, Human Resources, superintendent, Board		Fall, 2006	
Provide on-going professional development for elementary mathematics specialists	District math specialists	Resources through House Bill 193, AMSP, UK (Kim Zeidler)	Fall, 2006	
		House Bill 193		
		Appalachian Math Science Partnership (AMSP); UK: Appalachian Rural Systemic Initiative (ARSI)		

Group Recommendation #5

<u>Specific Recommendation:</u>

Develop and provide professional development experiences for administrators (principals, PSAs, etc.) to assist them in evaluating mathematics programs and make them aware of resources currently available to improve mathematics programs.

<u>Research Rationale for how this change will help kids:</u>

Teachers and principals are responsible for the achievement of all students and consequences for lack of student success fall not only on students, but also on their teachers and principals.

Payne, R. K. (1998) *A framework for understanding poverty*. Baytown, TX: RFT Publishing

Edmonds, R. R., & Frederiksen, J. R. (1978). *Search for effective schools: The identification and analysis of city schools that are instructionally effective for poor children.* Cambridge, MA: Harvard University Center for Urban Studies.

Tye, K. A. (1992). Restructuring our schools: Beyond the rhetoric. *Phi Delta Kappan, 74*(1), 8-14.

Administrators and policy makers need not only to ensure that there are appropriately prepared teachers for all levels of instruction, but they need to recognize high quality instruction when they see it.

Cuevas, G., & Driscoll, M. (Eds.) (1993). *Reaching all students with mathematics.* Reston, VA: National Council of Teachers of Mathematics.

Haycock, K. (1998, Fall). Informal mathematics and science education, *ENC Focus, 5*(2).

In order for teachers to engage in the kind of professional development that is needed (study groups, examining student work, action research, coaching and mentoring, etc.), teachers need administrator support, including time to work with colleagues and access to resources (such as research and outside expertise).

Darling-Hammond, Linda (1994) National Standards and assessments: Will they improve education? *American Journal of Education, 102*(4), 478-510.

Garet, M. S., Porter, A. C., Desimone, L., & Birman, B. F. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*(4), 915-945.

Loucks-Horsley, Susan, Hewson, Peter W., Love, Nancy, & Stiles, Katherine E. (1998). *Designing professional development for teachers of science and mathematics.* Thousand Oaks, CA: Corwin Press.

Newmann, F. M., & Wehlage, G. G. (1995) *Successful school restructuring: A report to the public and educators.* Madison, WI: Center on Organization and Restructuring of Schools.

Sparks, D., & Hirsh, S. (1997). *A new vision for staff development.* Alexandria, VA: Association for Supervision and Curriculum Development.

In order to develop a self-renewing school, teachers need caring relationships with their colleagues, mentors, and school leaders; high expectations on the part of school leaders; and opportunities and time for collegial decision making and planning. Consistency across the school in discipline, pedagogy, and content creates clear, high expectations for all students. Principals are key to the success of any school but are especially important in schools focused on eliminating the achievement gap. Effective principals are strong instructional leaders who focus on teaching and learning.

Diero, J. (1996). *Teaching with heart: Making healthy connections with students.* Thousand Oaks, CA: Corwin Press.

Palmer, P. (1998). *The courage to teach: Exploring the inner landscape of a teacher's life.* San Francisco, CA: Jossey-Bass.

Since the beginning of research about principals' impact on student results, studies have shown that principals who are knowledgeable about and actively involved with their school's instructional program have higher-achieving students than principals who manage only the noninstructional aspects of their schools.

Coyle, L. and Witcher, A. (1992). "Transforming the Idea Into Action: Policies and Practices to Enhance School Effectiveness." *Urban Education*, 26(4) pp. 390-400.

Cotton, K. (2003). *Principals and student achievement: What the research says*. Alexandria, VA: Association for Supervision and Curriculum Development.

A key factor in the effective implementation of changes to a school program is the principal's commitment to and leadership of the process. Principals who are strong, connected, insightful organizational and instructional leaders succeed in setting the tone for full collaborative support from staff.

Haynes, Norris M., "Lessons Learned," *Journal of Education for Students Placed at Risk 3*, 1 (1998): 87-99. (As summarized in Effective Schools Research Abstracts Volume 13, Issue 1)

Perhaps the most significant conclusion drawn from the literature review was that successful leadership can play a highly significant role in improving student learning. In fact, the researchers found that, based on the research findings, leadership is second only to classroom instruction among all school-related factors that contribute to what students learn at school. Furthermore, the leadership effects are usually largest where and when they are needed most.

What were the common core practices that effective leaders used to impact student learning in the school?

Setting directions. Evidence suggests that setting directions for the organization accounts for the largest proportion of a leader's impact. Often cited as helping set direction were the following leadership practices: identifying and articulating a vision; fostering the acceptance of group goals; and creating high performance expectations. Monitoring organizational performance and promoting effective communication throughout the organization also helped develop shared organizational purposes.

Developing people. The review found that, in both school and non-school organizations, the leader's efforts in developing people had a substantial effect. Some of the specific leadership practices that were found to be effective included offering intellectual stimulation, and providing individual support, as well as appropriate models of best practices and beliefs considered fundamental to the organization.

Redesigning the organization. Organizational conditions, systems, and culture often blunt an organization's effectiveness. When this happens, educators become worn down and discouraged. Successful educational leaders develop their schools and districts so that they support and sustain high performance by administrators, teachers, and students. Some specific domains in which effective leaders redesign their organizations included strengthening school and district cultures, modifying organizational structures, and building collaborative processes.

> Leithwood, Kenneth, Karen Seashore Louis, Stephen Anderson, and Kyle Wahlstrom, How Leadership Influences Student Learning: A Review of Research. Center for Applied Research and Educational Improvement, Minneapolis, MN, and Ontario Institute for Studies in Education, Toronto, Ontario, Canada, 2004. (As summarized in Effective Schools Research Abstracts Volume 19, Issue 7)

The researchers define these two leadership concepts as follows:

• Transformational leadership "provides intellectual direction and aims at innovating within the organization." (p. 371)

• "Shared instructional leadership involves the active collaboration of principal and teachers on curriculum, instruction, and assessment. Within this model, the principal seeks out the ideas, insights, and expertise of teachers in these areas and works with teachers for school improvement." (p. 371)

In the schools within the study, principals provided strong instructional leadership while they facilitated leadership by the teachers, whom they regarded as professionals and full partners in furthering high quality teaching and learning. "In all but one of the schools, teachers...also functioned as instructional leaders." (p. 387)

The researchers found that in schools with integrated leadership (both transformational and shared instructional leadership), school performance, pedagogical quality, and authentic achievement of students were higher. Attributing this to a higher degree of engagement and collaboration between teachers and principal, the researchers found that schools with integrated leadership maintained a concerted focus on curriculum, instruction, and assessment which is central to student learning and achievement. In contrast, "where leadership is low, by definition, schools lack the collaborative effort of principal and teachers around matters of curriculum, instruction, and assessment. Without such mutual engagement to challenge and excite students about learning, particularly in poor urban schools that may have become accustomed to failure, weak student performance is likely to be the norm." (p. 388) Akin to other research findings, Marks and Printy recognized that prior achievement or learning experiences of a student have the potential to affect school effects. Nonetheless, statistically significant differences in student performance between integrated and low-leadership schools were found.

> Marks, Helen M. and Susan M. Printy, "Principal Leadership and School Performance: An Integration of Transformational and Instructional Leadership," *Education Administration Quarterly 30*, 3 (August 2003): 370-397. (As summarized in Effective Schools Research Abstracts Volume 18, Issue 5)

Learning in context. The most effective principal learning occurs in a team of learners meeting together to examine real district problems and develop solutions. This type of learning is the most effective because of its situational nature-it applies directly to local circumstances and is shared between principal colleagues. This approach fosters a cooperative environment where all participants are working for the common success for all students. It not only improves the organization, but develops principals' skills and abilities to work through problems effectively. Modeled with the district's principals, it also serves as a training tool so that principals can use the same approach with their staffs.

> Fullan, Michael, "The Change Leader," *Educational Leadership 59*, 8 (May 2002): 16-21. (As summarized in Effective Schools Research Abstracts Volume 17, Issue 3)

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Community School District 2 has about 22,000 students in 45 schools. Over an 11-year period, the district "has amassed a strong record of successful school improvement in a diverse urban setting. Test scores have risen, and a remarkable professional spirit has developed among the teachers, principals, and central office staff." (p. 599) Teaching and learning is the central focus throughout the district. Principals and senior administrators "exhibit an exceptionally high level of detailed knowledge about the craft of teaching." (p. 599) Several key concepts have created this culture of learning.

The principal's main responsibility is to establish and maintain a "culture of learning" wherein issues concerning "teaching and learning pervade the social life and interpersonal relations of those working in the school." (p. 600) To do this, the principal must understand the district's instructional program well in order to actively guide teachers.

Principals' Conferences and Institutes. A system of monthly conferences and specialized training institutes ensures that building leaders share a common core of commitment, principles, and practices. The sole focus of these conferences and institutes is teaching and learning; management issues are dealt with in other settings. Some conferences are held in schools where principals can visit classrooms to observe teaching and review student work.

Support and Study Groups. Support and study groups run by the superintendent and deputies help principals build interdependent learning cultures in their schools. These groups are especially important for new principals and principals from schools engaged in extensive improvement efforts. One such group specifically designed for new principals, meets monthly and focuses on instructional leadership, including effective teaching techniques, strategies for assessing student learning, assessing teacher performance, and use of professional development personnel.

Fink, Elaine and Lauren B. Resnick, "Developing Principals as Instructional Leaders," Phi Delta Kappan 82, 8 (April 2001): 598-606. (As summarized in Effective Schools Research Abstracts Volume 16, Issue 1)

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Implementation Steps for Recommendation #5	Person Responsible for Completing Steps	Possible Resources?	Start Date	End Date
Provide a mathematics component to each summer's professional development program for administrators	District mathematics specialists; Director, Student Achievement	UK (Kim Zeidler's staff)	Summer, 2006	
Include mathematics professional development within each monthly meeting of PSA's, middle school curriculum coaches and high school academic deans	District mathematics specialists; Director, Student Achievement	UK (Kim Zeidler's staff)	Fall, 2006	
Include mathematics professional development within monthly meetings of building principals as part of their leadership training	School Directors (Elementary, Middle, High)	UK (Kim Zeidler's staff)	Fall, 2006	

Group Recommendation #6

<u>Specific Recommendation:</u>

Fully fund the use of technology to support mathematics instruction.

<u>Research Rationale for how this change will help kids:</u>

Environments that allow students to approach mathematics in many ways – with manipulatives, technological tools, and hands-on activities – engage students' multiple intelligences. Technology should be used to explore mathematical ideas, model mathematical situations, analyze data, calculate numerical results, and solve problems.

> Armstrong, T. (1998). *Awakening genius in the classroom.* Alexandria, VA: Association for Supervision and Curriculum Development.
>
> Jensen, E. (1998). *Teaching with the brain in mind.* Alexandria, VA: Association for Supervision and Curriculum Development.
> Marzano, R.J., Pickering, D.J., & Pollock, J.E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

Technology allows teachers to teach some traditional topics in a new way as well as teach new topics that are not accessible to students without the technology. For example, fraction calculators permit students to choose a common factor to reduce improper fractions to simplest form; graphing calculators allow students to look at where a quadratic function crosses the x-axis as another way to solve a quadratic function; graphing calculators show students connections between algebra and analytic geometry.
Sensor probes can be used to obtain real-time data. The Internet permits students to obtain real data from all over the world for comparison. Employing such sets of data makes the mathematics used come alive.

> Cradler, J. (n.d.). *Summary of current research and evaluation findings on technology in education.* Retrieved from the WestEd Web site: http://www.wested.org/techpolicy/refind.html.
>
> Wellburn, E. (1996, May). *The status of technology in the education system: A literature review.* Retrieved from Community Learning Network Web site: http://www.cln.org/lists/nuggets/EdTech_report.html.

Calculator-use research concludes that when calculators were used in a variety of ways, students performed as well as, or better than, those who used paper-and-pencil methods. Internationally, as students' in-class calculator use increased, so did their level of performance on mathematics assessments. Students using calculators:

- Have higher math achievement than non-calculator users even when they can choose any tool desired
- Do better on mental computation than non-calculator users
- Experience more varied concepts and computations
- Have improved attitudes toward mathematics
- Do not become overly reliant on calculators

Graphing calculators can reduce the need to manipulate algebraic expressions or equations, yet studies show that students who learn in a technological environment with a related algebra curriculum perform better on standard algebra manipulations as well as modeling and problem solving. For benefits to occur, the technology's power needs to be used to enable student exploration and to promote generalizations.

Demana, F., & Waits, B. (1990). Enhancing mathematics teaching and learning through technology. In T. Cooney & C. Hirsch (Eds.), *Teaching and learning mathematics in the 1990s* (pp. 212-222). Reston, VA: National Council of Teachers of Mathematics.

Hembree, R., & Dessart, D. (1986). Effects of hand held calculators in pre-college mathematics education: A meta-analysis. *Journal for Research in Mathematics Education, 17*, 83-89.

Groves, S., & Stacey, K. (1998). Calculators in primary mathematics: Exploring number before teaching algorithms. In L. J. Morrow (Ed.), *The teaching and learning of algorithms in school mathematics. 1998 yearbook.* Reston, VA: National Council of Teachers of Mathematics.

Kelley, M. (1985). The effect of the use of hand-held calculator on the development of problem-solving strategies. *Dissertation Abstracts International*, *41*, 3751A.

Leinhardt, G., Zaslavsky, O., & Stein, M.K. (1990). Functions, graphs, and graphing: Tasks, learning, and teaching. *Review of Educational Research*, *60*(1), 1-64.

Moschkovich, J., & Schoenfield, A.H. (1993). Aspects of understanding: On multiple perspectives and representation of linear relations and connections among them. In T.A. Romber, E. Fennema, &T.P. Carpenter (Eds.), *Integrating research on the graphical representation of functions* (pp. 69-100). Hillsdale, NJ: Lawrence Erlbaum.

Wheatley, C. (1980). Calculator use and problem-solving performance. *Journal for Research in Mathematics Education, 11*, 323-333.

A meta-analysis of non-graphing calculator studies led to the conclusion that calculators improved student learning. Research on the use of graphing calculators indicates no negative effect on computational skills with a positive effect on conceptual knowledge and graphing capabilities.

Grouws, D.; and Cebulla, K. "Improving Student Achievement in Mathematics, Part I: Research Findings" http://www.ericse.org.

Access to computer technology consistently shows value added in measured student achievement for low-SES students.

Barton, Paul E. Parsing the Achievement Gap: Baselines for Tracking Progress. Policy Information Center, Educational Testing Service, Princeton, NJ, 2003. (As summarized in Effective Schools Research Abstracts Volume 18, Issue 5)

2020 VISION: *"Changing the Face of Education in Fayette County"*

WORK GROUP: *Numeracy*
FINAL REPORT

October 31, 2005

Implementation Steps for Recommendation #6	**Person Responsible for Completing Steps**	**Possible Resources?**	**Start Date**	**End Date**
Add replacement cycle of calculators for K-12 to district budget	Chief Financial Officer, district mathematics specialists		Fall, 2006	
Provide a budget to support instructional technology (upgraded hardware, software, Navigators, projection systems, etc.) to each school's mathematics program	Chief Financial Officer, district mathematics specialists		Fall, 2006	
Teacher training in the use of appropriate best practice models	District Technology Resource Teachers		Fall, 2006	

Group Recommendation #7

Specific Recommendation:

Provide mathematics program improvement reviews based on the following criteria. Plot math test scores for the past five years on a line of best fit for each school in Fayette County. Identify schools as A) performing satisfactorily if they have a math score of at least 85 and the trend line is positive by at least 5 points, B) performing adequately if they have a math score of at least 85 or the trend line is positive by at least 5 points, or C) performing unsatisfactorily if they have a math score less than 85 or if the trend line is negative. Implement specific actions based upon the school's classification.

Research Rationale for how this change will help kids:

Extensive research has been conducted on changes in school practices that have resulted from recommendations from outside evaluators to schools. These have demonstrated that teachers have increased their best practices instruction and student achievement results have improved.

DuFour, R., & Eaker, R. (1998). *Professional learning communities at work: Best practices for enhancing student achievement.* Bloomington, IN: National Educational Service.

English, F. (1999). *Deciding what to teach and test: Developing, aligning, and auditing the curriculum.* Thousand Oaks, CA: Corwin Press.

Frase, L., English, F., & Posten, W.K. (Eds.) (2000). *The curriculum management audit: Improving school quality*. Lanham, Maryland: The Scarecrow Press.

Love, N. (2002). *Using data/getting results: A practical guide for school improvement in mathematics and science.* Norwood, MA: Christopher-Gordon Publishers.

These studies have found that gains in student achievement can best be met by examining more than just standardized test results. A wide variety of data must be collected and analyzed to: 1) know where the students and teachers are initially in the program (baseline); and, 2) establish priorities that can lead to improvement with comparisons of data to show change.

When teachers have access to data that is generated as a result of curriculum audits or similar processes and use this data as discussion points within professional communities, they are then able to take collective responsibility for student learning to produce school-wide gains in academic achievement.

Louis, K. S., Marks, H. M., & Kruse, S. (1996). *Teacher's professional community in restructuring schools*. American Educational Research Journal, *33*(4), 757-798.

The author of a study states that school accountability mechanisms-whether of the bureaucratic or professional variety-will be successful in improving the functioning of school organizations to the extent that they are able to:

o Generate and focus attention on information relevant to teaching and learning and to changes in that information as it is continually fed back into and through the system. To change what happens in the classroom, valuable information exchanges must occur at both the school and individual teacher level.

o Motivate educators and others to augment or change strategies in response to this information. The individual motivation of the teacher may well come into conflict with the norms the school is attempting to change when it comes to teacher practices.

o Build knowledge and skills for interpreting and applying new information in the short run and establish mechanisms for continued learning.

o Allocate resources where they are most needed. Any model of school improvement must address this critical question: To what extent does the accountability system encourage allocation of resources to foster student learning? In this context, resources include human skills and available time.

O'Day, Jennifer A., "Complexity, Accountability and School Improvement," Harvard Educational Review 72, 3 (Fall 2002): 293-329. (As summarized in Effective Schools Research Abstracts Volume 17, Issue 4)

According to these researchers, a complete accountability system must include at least four basic components:

* information about an organization's performance,

* standards for judging the quality or degree of success of the organization's performance,

* significant organizational consequences (rewards and sanctions) for success and failure in meeting specified standards,

* an agent or constituency that receives information on organizational performance, judges the extent to which the standards have been met, and distributes rewards and sanctions.

"External agencies can make . . . substantive contributions by offering concrete examples of high standards for student performance in specific curricular areas, approaches to assessment that demand high performance, and reliable ways of evaluating student performance on assessments." (p. 63)

Newmann, Fred M., M. Bruce King, and Mark Rigdon, "Accountability and School Performance: Implications from Restructuring Schools," Harvard Educational Review 67, 1 (Spring 1997): 41-74. (As summarized in Effective Schools Research Abstracts Volume 12, Issue 2)

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Implementation Steps for Recommendation #7	Person Responsible for Completing Steps	Possible Resources	Start Date	End Date
Implement MPIR according to school classification A_1) Use the MPIR Scoring Guide to do a self-evaluation of the mathematics program – possibly along with a self-study of the MPIR book – to examine possible areas to continue gains A_2) Conduct a self-study, led by outside consultant, based upon the ASCD MPIR book B) Conduct a MPIR using a team made up preferably of outside consultants. Select 1-2 recommendations to implement in Year 1; continue with the implementation of the next highest priority recommendation in Year 2. C) Conduct a MPIR using outside consultants. Select 1-2 recommendations to implement during Year 1; continue with the implementation of the next highest priority recommendation in Year 2.		MPIR trained staff; ASCD publication on MPIR's, Ron Pelfrey, Sheila Vice	Fall, 2006	
Monitor effects on student achievement annually.	District assessment coordinator		Spring, 2007	
Add one short-term and one long-term recommendation to school improvement plan and monitor the implementation of those recommendations.	Principals; District Assessment Coordinator		Fall, 2006	