Greater Birmingham Mathematics Partnership
Phase I and Phase II Research

GBMP
Greater Birmingham Mathematics Partnership

UAB
University of Alabama at Birmingham

Description and Goals of Phase I

Grassroots Origin

- The Greater Birmingham Mathematics Partnership (GBMP) began with a group of eight local teachers who had studied Piaget's theory of how children learn
- Birmingham Constructivist Teachers Network (Network) formed in 1990
- Sponsored annual conferences with nationally-known speakers drawing up to 500 teachers each conference
- Network grew and became GBMP, made up of Birmingham-Southern College (BSC), University of Alabama at Birmingham (UAB), Mathematics Education Collaborative (MEC) and diverse local school districts in Birmingham area
- GBMP was awarded NSF-MSP grants in 2004 (Phase I), 2008 (Noyce Supplement), and 2009 (Phase II)

Goals of GBMP

1. Increase the effectiveness and leadership of middle school mathematics teachers within GBMP school systems
2. Bring teachers to high implementation of inquiry-based pedagogy
3. Unite GBMP stakeholders in support of mathematics education programs that are high quality and effective
4. Increase mathematics achievement of all middle school students in GBMP schools, and reduce discrepancies

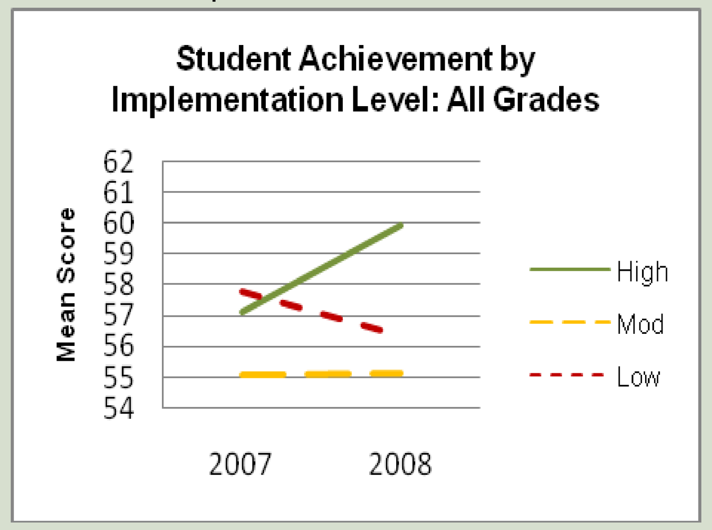
Major Activities Supporting Goals

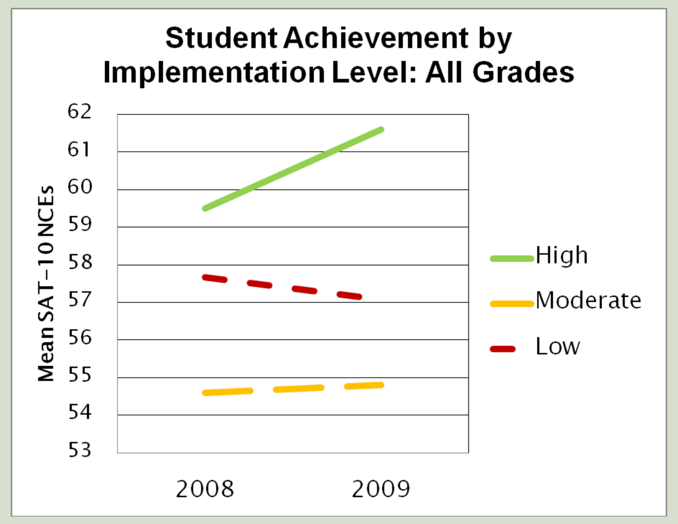
- Intensive summer mathematics content courses and academic year follow-up
- IHE course redesign and development, new "mathematical reasoning" track in mathematics major, and new middle school mathematics certification
- Mathematics Support Teams (MSTs) in schools
- Sessions for administrators and outreach to community – Community Mathematics Nights

Successes of Phase I

Gains in Student Achievement

- Each grade in a school classified as High, Medium, or Low Implementing
- Normal curve equivalents on SAT-10 mathematics portion
- Data available on about 25,000 students
- Gains occurred regardless of socio-economic status
- Consistent results across time



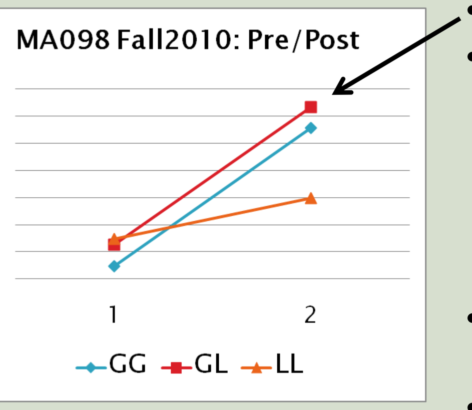


- *High* implementing means 100% of teachers at that grade level took at least one GBMP summer course, and RTOP scores at that grade level were at least 12.5 out of 20 points (RTOP=Reformed Teaching Observation Protocol)

Gains in Teacher Content Knowledge and Disposition

- CKTM-Patterns and CKTM-Geometry modifications of Learning Mathematics for Teaching Project's tests: 3 point mean score increase pre- to post – medium effect size, and 5-point longitudinal mean increase!
- Positive changes in teachers' beliefs about mathematics (CEA behavioral checklist)

IHE Course Redesign



(See handout for details.)

- Course redesign is based on evidence of what works.
- UAB courses taken by pre-service teachers redesigned as IBL:
  - Introduction to Algebraic Reasoning (MA313) – *elem. & middle*
  - Geometric and Proportional Reasoning (MA314) – *elem. & middle*
  - Numerical Reasoning (MA316) – *middle*
  - Integrating Mathematical Ideas (MA411) – *middle*
  - Euclidean Geometry (MA472) – *middle and high*
- Entry-level UAB courses redesigned to be blended (CAI+IBL):
  - Basic Algebra (MA098 – non-credit) and Finite Mathematics (MA110)
- BSC courses: Teaching Mathematics; Mathematical Reasoning for Teachers

GBMP Definition of Effective Teaching in Mathematics

Teach challenging courses and curriculum

- **Deepening understanding of big mathematical ideas**
  - Example: Introduce a mathematical idea by posing open-ended problems that motivate it.
- **Productive disposition**
  - Example: Help students develop persistence, resourcefulness, and confidence.
- **Inquiry and reflection**
  - Example: Encourage students to think critically about mathematical ideas and solutions.
- **Communication**
  - Example: Value the role of communication in developing an intellectual community in the classroom.

GBMP Theory of Action

Conditions	Activities	Outcomes
• Teacher commitment to summer courses and PLCs • Community support (CMNs) • Administrator commitment • Data collection •Performance assessments •State assessments •PLC observations •Classroom observations • IBL curriculum available	• Summer content courses • Mathematics Support Team (MST) training •Facilitation •IBL instruction methods •PLC rehearsal •Coaching • Community Math Nights • Administrator sessions •IBL observation	• Increased teacher content knowledge of mathematics • Gains in student learning • Performance-based • State assessments • Greater implementation of IBL pedagogy in classroom • More productive professional reflection

GBMP Publications and References

Mayer, J., Cochran, R., Mullins, B., Dominick, A., Clark, F., Fulmore, J. (2011) Perspectives on Deepening Teachers' Mathematics Content Knowledge: The Case of the Greater Birmingham Mathematics Partnership. In E. M. Gordon, D. J. Heck, K. A. Malzahn, J. D. Pasley, & I. R. Weiss (Eds.), *Deepening teachers' mathematics and science content knowledge: Lessons from NSF Math and Science Partnerships*.

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Lessons Learned and Challenges from Phase I

Barriers to implementation identified by teachers

- Lack of curricular materials aligned with inquiry-based pedagogy
- Lack of understanding of how to implement inquiry in their course of study
- Administrators who do not actively support inquiry
- Concerns that parents would react negatively to change
- Pressure to cover material associated with high stakes testing

If fundamental internal barriers are not removed, addressing teacher content knowledge is not sufficient

- Only about 12% of grades were classified as High Implementing
- Reformed pedagogy and increased content knowledge makes for more effective teaching, but…
- It is difficult to make high implementation happen, and it takes time and collegial support

Shifting the collaborative professional culture is critical to making institutional change within a school

Noyce Program

Created a cadre of Master Teachers

- Cohort of 16 middle school (grades 5-8) teachers in high-needs schools
  - 100% retention for 3 years
- 5 without masters degrees -- all have masters degrees now
- Bi-weekly seminar on pedagogy and mathematics (collaborated with MST program)
  - Test site for NSF-funded program "Learning and Teaching Geometry"
  - Essentials of coaching mathematics teachers
  - Focused mathematics problem sets
- Leadership role in schools: CMNs, PLCs

Challenges Addressed in Phase II

Challenge: Bring implementation of reformed teaching practice to scale in an entire school, on all grade levels

Response

- Require commitment from school principal and at least 75% of mathematics teachers at each grade level
- All committed teachers take at least two intensive content knowledge courses
- All committed teachers participate in Professional Learning Communities (PLCs)
- Observe (via RTOP) at baseline, and periodically thereafter, teachers in classrooms
- Provide periodic aligned assessments (Balanced Assessment) at grade level to be used by teachers (in addition to standardized testing)
- Provide administrators with tools/skills to observe and evaluate reformed teaching

Challenge: Establish strong statistical correlation among high implementation of reformed teaching practice, effective PLCs, and gains in student achievement across diverse populations

Response

- Enlist a smaller number of entire schools across diverse populations
- Encourage and guide change in teacher practice through PLCs
- Intensify efforts to help PLCs become more effective
- Via RTOP observation, verify significant change in teacher practice
- Determine correlation among high implementation of reformed practice, effective implementation of PLCs, and gains on standardized and aligned assessments.

Results to Date in Phase II

Gains in Teacher Content Knowledge, Disposition, and Practice

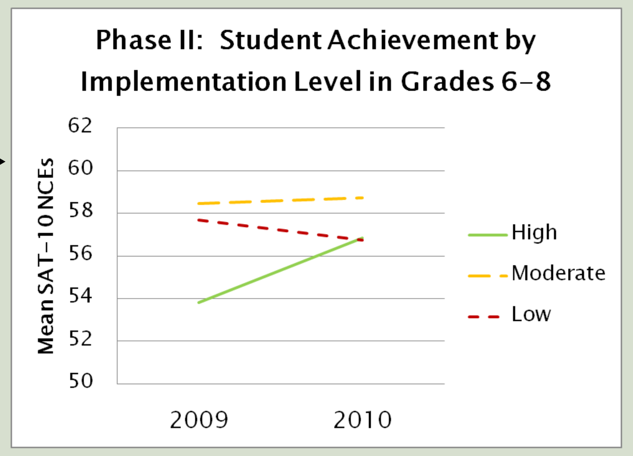
- Continued evidence of significant gains on CKTM-Patterns and CKTM-Geometry tests by teachers in Phase II and positive changes in beliefs about learning mathematics
- High levels of participation in PLCs
- Evidence of effectiveness of PLCs: Preliminary analysis of qualitative notes from PLC observations indicates improvement, especially at schools with PLC "coaching"
- Significant gains in implementation of reformed teaching practice
  - Linear regression analysis: (N=175 observations Year 1 and Year 2 combined)
    - Statistically significant relationship between the number of courses taken by teachers (predictor variable) and their total RTOP score (dependent variable)
  - The greatest variance in RTOP scores occurs at 3 and 4+ courses
  - Other predictor variables included in the regression were school and CKTM post score. Neither explained a significant amount of variance in RTOP score

Self-Report versus Observation of Instructional Practice

- Teachers self-report a much higher level of implementation of inquiry-based instruction than is evidenced by observations with RTOP
- Compared MSTs' (N=20) self-reported rankings to researcher rankings
  - Based on a combination of observer qualitative notes, RTOP scores, and sample classroom assignments
  - Survey instrument: Professional Development and Instructional Practice (American Institutes for Research)
  - The statistical relationship (Cohen's Kappa) between the researchers' ratings and MSTs' ratings was generally close to 0
    - Range Kappa = -0.145 to 0.308; IQR Kappa = -0.06 to 0.082; Median Kappa = 0.013
  - In many cases, the researchers' ratings were 2 or more levels away from the MSTs' own ratings

Gains in Student Achievement

- Significant gains in student achievement throughout all grade levels in a school from one year to the next
  - As measured by standardized tests
  - As measured by Balanced Assessment task performance
    - Multivariate ANOVA: Time effect = pre (beginning of school year) to post (end of school year)
    - Treatment effect = High+Mod vs Low
    - 6th & 7th grades: significant Time and Treatment effects
    - 8th grade: significant Time, but no Treatment, effect



Who is GBMP (at Meeting)?

School District Partners

Birmingham City	Jefferson County
Fairfield	Homewood
Hoover	Shelby County
Trussville	Tarrant

University of Alabama at Birmingham
Birmingham Southern College

John Mayer – UAB Mathematics – Principal Investigator
Ann Dominick– UAB School of Education– Project Co-Director
Bernadette Mullins – BSC Mathematics – Co-PI
Patrick Chappell– Homewood City Schools – Curriculum Supervisor – Co-PI
Sherry Parrish – UAB School of Education – Mathematics Coach
William Bond – UAB Mathematics – Data Coordinator
Linda Ramsey – Comprehensive Evaluation Services - Evaluator

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