**Greater Birmingham Mathematics Partnership Phase I and Phase II Research**

**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 Constructivism 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 2020 (Phase II).

**Goals of GBMP**
1. Increase the effectiveness and leadership of middle school mathematics teachers within GBMP schools.
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.

**Gains in Student Achievement**
- Each grade in a school classified as High, Medium, or Low Implementing.
- Normal curve equivalents on SAT.
- Significant gains in implementation of reformed teaching practice.
- BSC courses: Teaching Mathematics; Mathematical Reasoning for Teachers.
- Other predictor variables included in the regression were school and CKTM post score. Neither explained a significant amount of variance in RTOP score.

**Student Achievement**
- Activities: Summer content courses; Mathematics Support Team (MST) training; Facilitation; IBL; Instruction methods; Coaching; CKTM pedagogy in classroom.
- Outcomes: Improved teacher content knowledge of mathematics; Gains in student learning; Performance-based; State assessments; Greater implementation of CKTM pedagogy in classroom; More productive professional reflection.

**GBMP Definitions of Effective Teaching in Mathematics**
- **Teaching 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**
  - Teacher commitment to summer courses and PLCs.
  - Community support (CMNs).
  - Administrator commitment.
  - Data collection.
  - Performance assessments.
  - State assessments.
  - PLC observations.
  - Classroom observations.
  - IBL curriculum availability.
- **Activities**
  - Summer content courses.
  - Mathematics Support Team (MST) training.
  - Facilitation.
  - IBL; Instruction methods.
  - Coaching.
  - Community Math Nights.
  - Administrator sessions.
  - IBL observation.
- **Outcomes**
  - Increased teacher content knowledge of mathematics.
  - Gains in student learning.
  - Performance-based.
  - State assessments.
  - Greater implementation of CKTM pedagogy in classroom.

**Successes of Phase I**

**Lessons learned and Challenges from Phase I**
- **Barriers to implementation identified by teachers**
  - Lack of curriculum 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.

- **Fundamental internal barriers are not removed, addressing, teachers content knowledge is not sufficient**
  - Only about 12% of classes 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 teachers (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.
- Social and educational 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.
- **Establish stable strong statistical correlation among high implementation of reformed teaching practice, effective PLCs, and gains in student achievement across diverse populations.**

**Gains in Teacher Content Knowledge, Disposition, and Practice**
- Continued evidence of significant gains on CKTM- 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 quantitative outcomes from PLC observations indicates improvement, especially at schools with PLC “coaching”.
- Significant gains in implementation of reformed teaching practice.
- Linear regression analysis (N=113; observatory 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. Never 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 scores, RTOP scores, and sample classroom assignments.
  - Survey instrument: Professional Development and Instructional Practice (American Institute for Research).
  - The statistical relationship (Cohen’s Kappa) between the researchers’ rankings and MSTs rankings was generally close to 0.
  - Range Kappa = -0.145 to 0.308. IQR Kappa = 0.06 to 0.892. Median Kappa = 0.013.
  - In many cases, the researchers’ rankings were 2 or more levels away from the MSTs’ own rankings.

**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
  - Ann Dornick – UAB School of Education – Project Co-Director
  - Birmingham County
  - Hoover
  - Shelby County
  - Patrick Chappell – UAB School of Education – Mathematics Coach
  - University of Alabama at Birmingham
  - William Bond – UAB Mathematics – Data Coordinator

- **Birmingham Southern College**
  - Linda Ramsey – Comprehensive Evaluation Services – Evaluator

- **GBMP is supported by (Noyce Supplement) & CAREER, and local foundations: McNeil Family Foundation,
  Birmingham Community Foundation, Hugh Kaul Foundation, Alabama Power, Protective Life, and more.**