

Transforming East Alabama Mathematics

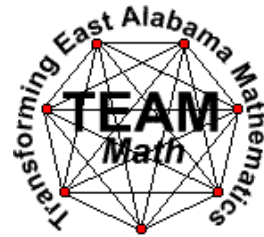
The East Alabama Partnership for the Improvement of Mathematics Education

ANNUAL TEAM-MATH PARTNERSHIP
CONFERENCE PRE-SESSION

The Mathematical Education of Teachers

*Teacher Preparation Programs and Other Special Initiatives to Improve Mathematics
Education Offered by Institutions of Higher Learning*

Abstracts and Program



KELLOGG CONFERENCE CENTRE

TUSKEGEE UNIVERSITY

September 11, 2009

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PROGRAM

9:00AM – 9:30AM Registration Registration Desk

9:30AM – 10:00AM Opening and Continental Breakfast Ballroom A

10:15AM – 2:15PM Concurrent Presentations

Session I: *Issues in Elementary Teacher Education* Meeting Room A

Moderator: Judy Welch, Wetumpka Elementary School

10:15AM *Integrating Language, Culture and Mathematics: A Longitudinal Study of Bilingual Elementary Teachers' Growth*
Sylvia Celedón-Pattichis, University of New Mexico; Sandra I. Musanti
Universidad Nacional de General San Martín and Mary E. Marshall
Albuquerque Public Schools

11:00AM *Multicultural Literature as a Context for Mathematical Problem Solving: Parents and Children Learning Together – A Facilitator Workshop for Teachers*
Marilyn E. Strutchens, Auburn University

11:45AM *Lunch* Ballroom A

12:45PM *Preparing to Engage Students in Problem Solving*
Dorothy Ann Assad, Austin Peay State University

1:30PM *Inclusion of Inquiry-Based Group Work with Computer-Assisted Instruction Significantly Improves University Student Achievement in Finite Mathematics*
Joshua H. Argo, University of Alabama at Birmingham

Session II: *Promoting Problem Solving at the Middle Grades* Meeting Room B

Moderator: Bradley Bearden, Dadeville High School

10:15AM *Focus on Problem Solving for Teachers*
S. Kathy Westbrook, University of West Georgia

11:00AM *What Can We Learn from Research to Improve Teacher Preparation Programs in Mathematics Education? The Case of Project ISMAC*
Victor L. Brunaud-Vega, Eileen Murray, Kanita Ducloux and Dorothy White,
University of Georgia

11:45AM *Lunch* Ballroom A

12:45PM *A Mathematician and Mathematics Educator Collaborate in the Preparation of Prospective Middle Grades Teachers*
Jacob T. Klerlein and Donald A. Nelson, Middle Tennessee State University

1:30PM *Project Delta2: Improving Mathematics Instruction through Collaboration and Coaching*
Angela T. Barlow and Shannon Harmon, The University of Mississippi

Session III: Issues in Secondary Teacher Education Meeting Room D

Moderator: Anna Wan Brice, Auburn University

10:15AM *Alignment of Preservice and Inservice Teacher Preparation in Secondary Mathematics: Closing the “Theory-Practice Gap”*
W. Gary Martin, Auburn University

11:00AM *Gaining Teaching Experience in a History of Mathematics Course*
Angela Hodge, North Dakota State University

11:45AM *Lunch* Ballroom A

12:45PM *Enhancing Mathematics Pedagogy through Cooperation Between Mathematics and Mathematics Education*
Roozbeh Vakil and Bishnu Naraine, St-Cloud State University

1:30PM *Research Experience for Secondary Mathematics Teachers*
Saad El-Zanati and Cynthia Langrall, Illinois State University; Ryan Bunge, Normal Community High School; Wendy O’Hanlon, Illinois Central College

Session IV: Using Technology in Teacher Education Meeting Room E

Moderator: Nancee Garcia, Auburn High School

10:15AM *Project CRAFTeD: Remote Lesson Study and its Impact on Preservice Teachers’ Technology Pedagogical Content Knowledge*
Michael Todd Edwards, Miami University

11:00AM *The TEAM-Math Malone Family Foundation Technology Initiative: Improving Grades 6-12 Mathematics Education in East Alabama Using Technology*
W. Gary Martin, Lisa Ross and Mary Johnson, Auburn University

11:45AM *Lunch* Ballroom A

12:45PM *Impacts on Classroom Instruction as a Result of Training for Technology Integration in Middle and Secondary Science and Mathematics*
Joy Black, University of West Georgia

1:30PM *Exploring the Effectiveness of Different Approaches to Teaching Finite Mathematics*
Mary Alice Smeal, Sandra Walker, Jamye Carter, Carolyn Simmons-Johnson, and Lisa James, Alabama State University

2:30PM – 3:00PM *Sharing Back / Wrap-Up / Evaluation* Ballroom A

Title: *Integrating Language, Culture and Mathematics: A Longitudinal Study of Bilingual Elementary Teachers' Growth*

- Presenters:** 1) Sylvia Celedón-Pattichis, Department of Language, Literacy & Sociocultural Studies, University of New Mexico, Albuquerque, NM
- 2) Sandra Musanti, Escuela de Humanidades y el Centro de Estudios Interdisciplinarios en Educación, Cultura y Sociedad (CEIECS), Universidad Nacional de General San Martín, Buenos Aires, Argentina
- 3) Mary E. Marshall, Albuquerque Public Schools, Albuquerque, NM

Outline of Presentation: The Center for the Mathematics Education of Latinos/as (CEMELA), a National Science Foundation-funded project, is a collaboration involving four universities—University of Arizona, University of California at Santa Cruz, University of Illinois at Chicago, and the University of New Mexico (visit <http://cemela.math.arizona.edu>). CEMELA focuses on the unique integration of linguistic, cultural, and sociopolitical issues facing Latino/a students and communities in mathematics classrooms.

Purpose of the Study

The ongoing longitudinal study addresses research in teaching and teacher education and student learning. Bilingual teachers and the authors engaged in joint practice and ongoing conversations about Latina/o students' thinking, problem solving, issues of language, and adaptation of instruction to meet students' needs. This study contributes to comprehending teacher change. Specifically, the study explores (a) the impact of professional conversations and student work analysis on enriching teachers' understanding of teaching mathematics to Latina/o students and (b) issues of language and culture with which teachers grapple while engaged in reflecting on students' thinking about mathematics.

Theoretical Framework

Research on teacher growth has explained that teachers develop understanding of their practice as they deepen their comprehension of student learning (Franke, Fennema, Carpenter, Ansell, & Behrend, 1998). Current discussions about teachers' professional development highlight the potential of generating learning communities in which teachers strengthen their content knowledge and instructional practices by engaging in active reflection and analysis of student work (Kazemi & Franke, 2003). Moreover, in the area of mathematics education, research has shown the connections between teacher knowledge and the decisions teachers make in relation to their mathematics instruction (Aguirre & Speer, 2000). It has also demonstrated the role of language and teacher talk in Latina/o student learning in the area of mathematics (Khisty & Chval, 2002). Understanding how students solve problems, how their thinking develops, and how language impacts learning can foster teacher understanding of how instruction can promote mathematical learning. This study describes the highlights of a professional development initiative in which three elementary bilingual teachers engage in learning about cognitive guided instruction (CGI; Carpenter, Fennema, Franke, Levi, & Empson, 1999) and the importance of problem solving in mathematics learning (see Table 1). This approach argues that even in the early grades children should be afforded repeated opportunities to solve a variety of word problems and communicate their thinking about their solutions.

Table 1 goes here

Methodology

This qualitative study describes a 4-year collaboration involving three elementary bilingual teachers and the authors. The school, located in the southwest of the United States, has predominately Hispanic students who are of Mexican descent (over 85%). All teachers teach their curriculum in Spanish 90% of the time.

Following the CGI framework (Carpenter et al., 1999), a central premise that guides our approach to professional development is to foster teachers' understanding of the relevance of problem solving in mathematics education. Underlying this premise is the centrality of promoting "learning for understanding" and the need to form teachers who know how to help students

- (a) connect knowledge they are learning to what they already know,
- (b) construct a coherent structure for the knowledge they are acquiring rather than learning a collection of isolated bits of information and disconnected skills,
- (c) engage students in inquiry and problem solving, and
- (d) take responsibility for validating their ideas and procedures. (Carpenter et al., 2004, p. 5)

Another premise of our approach is that "professional development opportunities should engage teachers in what teachers do" (Crockett, 2002). Therefore, teachers are offered varied opportunities to

- reflect on their practice,
- discuss activities and their daily work,
- design lessons appropriate for students' needs and grade level, and
- reflect on student work.

Recently, researchers have promoted the use of student work as a tool to engage teachers in reflection on students' learning and thinking (Ball & Cohen, 1999; Kazemi & Franke, 2004; Little, 2005). Student work is an important catalyst for teachers to reflect on mathematical problem solving. This reflection can take place in different ways. For instance, in this study teachers discuss video clips of students working on problem solving, and they have opportunities during in-class support to reflect on different pieces of student work produced in their own classrooms.

Professional development opportunities included as part of this project were

- (a) Two summer institutes (SIs) during the summers of 2005 and 2006,
- (b) a teacher study group, and
- (c) sustained in-class support.

The SIs involved two intensive weeks of class during June, for which participating teachers received academic credit. The purpose of the SIs was to deepen teachers' understanding of mathematical problem solving and the impact of issues of language and culture in mathematics teaching and learning.

The teacher study group (TSG) took place during the second year of the study. The TSG focused on learning about CGI, understanding how students develop mathematical thinking, and supporting teachers who were interested in implementing CGI in their classrooms. The group of teachers met with the university researchers three times per semester for 2 hours each time.

In-class support has involved weekly visits by the university researchers to each teacher's class. These visits have consisted of the following:

- observation of mathematics lessons,
- participation in or modeling of CGI problem-solving lessons,
- discussion of different ways to implement problem-solving activities,
- providing resources to supplement mathematics curriculum, and

- offering time for debriefing conversations to discuss classroom events related to mathematics instruction.

Providing teachers with the opportunity to collaborate with researchers in the classroom is central to our belief that teachers should be afforded opportunities to learn from and within the teaching context (Ball & Cohen, 1999).

In addition, data collection included detailed field notes and videotapes of each of the problem-solving lessons in each class, audio-recording of the debriefing sessions, and two interviews with each teacher to explore their beliefs and knowledge regarding issues of language, culture, and mathematics.

Using the principles of grounded theory (Strauss & Corbin, 1998), the researchers coded interviews with teachers, debriefing-session transcripts, field notes, and videotapes of classroom observations. This process involved chunking the data into meaningful units and then coding selected statements or interactions using words or phrases that specifically addressed the research questions (Erlandson, Harris, Skipper, & Allen, 1993). For example, teacher interviews were coded with particular attention to issues related to the following three issues:

- integrating problem solving into their curriculum,
- supporting second language learners in communicating their mathematical thinking, and
- adapting the curriculum to meet their students' needs.

We used TAMS[□] Analyzer, a computer-based qualitative research tool, to code all data. Transcripts were coded by at least two members of the research team to establish reliability (Miles & Huberman, 1994). Differences in interpretation were discussed until agreement was reached. The TAMS[□] Analyzer tool allowed us to search across transcripts to establish recurring patterns, or themes, related to the integration of problem solving into the curriculum and to supporting second language learners in communicating their mathematical thinking. Each theme was triangulated across data from three participants, and across data of various forms (i.e., classroom observations, field notes, teacher interviews) (Erlandson et al., 1993).

Findings

Through this approach to professional development, teachers developed increasing understanding of how students' pictorial representations and verbalizations of their solutions to problems provides them with insight into students' thinking about mathematical problems. In addition, their instruction became progressively more informed with the importance of introducing specific mathematical language while encouraging students' oral or written representation of their reasoning. All teachers emphasized the importance of teaching mathematics concepts in the students' native language, which, in this case, is Spanish (Cummins, 1986, 2001). Ongoing reflection, collegial conversations with researchers, and a focus on analysis of student work contributed to teachers' understanding that when students had access to explanations and representations of their peers, students appropriated additional problem-solving strategies to add to their toolkits. They also found that careful scaffolding in oral and written communication and their expectation that students would always need to explain their thinking helped students to develop the mathematical process skills fundamental to success in reform mathematics (National Council of Teachers of Mathematics, 2000).

Table 1. Selected CGI Problem Types (English Version)

Problem Structure	Problem
Join Result Unknown	a. María has 6 candies. Her sister gives her 6 more candies. How many candies does María have now?
Separate Result Unknown	b. Corina had 14 cookies. She ate 6 of them. How many cookies does Corina have left?
Join Change Unknown	c. Karla wants to buy a toy plane that costs 11 dollars. Right now, she has only 7 dollars. How many more dollars does Karla need so that she can buy the toy plane?
Multiplication	d. Antonia has 4 bags of marbles. There are 5 marbles in each bag. How many marbles does Antonia have altogether?
Partitive Division	e. Marcos had 15 marbles. He shared the marbles with 3 friends so that each friend got the same number of marbles. How many marbles did each friend get? (Marcos did not keep any marbles for himself.)
Measurement Division	f. Diego had 10 cookies, and some little bags. He wants to put 2 cookies in each bag to give to his friends. How many bags can he make?
Compare	g. Mario has 12 toy cars. His sister Rebecca has 9 toy cars. How many more toy cars does Mario have than Rebecca?

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Title: *Multicultural Literature as a Context for Mathematical Problem Solving: Parents and Children Learning Together – A Facilitator Workshop for Teachers*

Presenter: Marilyn E. Strutchens, Department of Curriculum & Teaching, Auburn University, Auburn, AL

Outline of Presentation: One of the workshops that we include for professional development that serves two purposes is the Multicultural Literature as a Context for Mathematical Problem Solving: Children and Parents Learning Together Workshop for Teacher Facilitators. This workshop is designed to enhance teachers' skills in using literature as a context for mathematical problem solving with parents and their children. The workshop enables teachers to introduce parents and children to a variety of cultures while learning mathematical problem solving skills, to provide families with the opportunities to work collaboratively to solve mathematical problems, to allow families to reflect on the processes used to solve problems, and to provide families with the opportunity to openly discuss literature in terms of personal and literary connections. The workshop also addresses organization and management of the parent/child sessions.

During the workshop, teachers receive the modules to be used during the six sessions with parents and children. After receiving training teachers who attend the workshop receive a stipend. They are expected to run six 1 1/2 hour sessions that will meet once a week for six weeks with parents and their children. The teachers receive a facilitator fee for each of the parent/child sessions.

This work has been both challenging and engaging because of the myriad of barriers and obstacles that exist in terms of parental involvement in many schools. Since 1995, Dr. Strutchens has provided professional development for over 318 teachers to serve as facilitators of the program, and over 51 schools in East Alabama alone have implemented the program. In this session, we will discuss the professional development provided during the sessions, data collected related to the program, and different ways that teachers use the materials beyond the program.

Title: *Preparing to Engage Students in Problem Solving*

Presenter: Dorothy Ann Assad, Department of Mathematics, Austin Peay State University, Clarksville, Tennessee

Outline of Presentation: Few elementary teachers have had deep experiences in mathematical problem solving in their own educations. Teachers often lack confidence in their problem solving skills or they lack content knowledge beyond the skill level. Furthermore, because they primarily rely on algorithms rather than conceptual knowledge, they lack confidence in their ability to do mathematics. When preservice teachers are enrolled in fast-track programs such as post-baccalaureate certification, the problem is often compounded by courses designed for expediency rather than depth. For example, preservice K-6 teachers in the Master of Arts in Teaching (MAT) program at Austin Peay State University are required to take only one pedagogy course, while undergraduate preservice teachers take two such courses as well as three content courses. Assigned to develop the pedagogy course for MAT students, I have implemented and expanded on a model that I have used with both preservice and inservice teachers in a variety of settings. There are four components of this model.

1. Classroom problems solving experiences.
2. Investigation of the mathematics underlying problem solutions.
3. Teaching a unit to a small group of elementary students.
4. Designing and implementing a problem solving lesson in a K-6 classroom.

Classroom Problem Solving Experiences. Throughout the class, students engage in a set of problem solving experiences. Many of these are based on counting problems, but topics such as proportional reasoning, measurement, and probability are also explored. The criteria for selection of problems is that they should

- engage students in significant mathematics;
- extend the content knowledge of students; and
- have multiple entry points, multiple solutions, or multiple paths to the solution.

Students are encouraged to use a variety of strategies and to work cooperatively with others. Throughout each problem solving experience, students record their solutions and share their strategies and representations with the class. Each student is required to keep a problem solving journal in which problem solutions are recorded along with reflections on the experience.

Investigation of the Mathematics Underlying Problem Solutions. Through classroom discussions, reading professional literature, and individual investigation, students deepen their content knowledge. For example, when two groups of students have solutions that look different, the class might investigate how to determine whether or not the solutions are equivalent. While one student may find a recursive pattern, another may find a generalization for the pattern. The class discussion might lead students to understand how the two patterns are connected. While solving a geometry problem, students might make connections to the theorems they learned in high school geometry.

Teaching a Unit to a Small Group of Elementary Students. Each student teaches a short unit to a group of four or five children in a local elementary school in fourth or fifth grade. I provide the outline of the unit. Before teaching the unit, each student studies it carefully, working the problems, preparing materials, and discussing possible teaching strategies with other students.

One goal of this experience is to help students see that problem solving can be integrated throughout the curriculum. Therefore, the unit is designed so that it aligns with the content in the district curriculum guide, but the content is taught through problem solving rather than through textbook exercises and worksheets. The preservice teachers submit daily reflections on their experiences as well as assess the progress of each child in the group. The small number of students in the group allows for attention to individual needs and for accommodation to those needs. Because the preservice teachers continually interact with each other, each lesson provides the opportunity to share teaching experiences and to suggest refinements to the unit.

Designing and Implementing a Problem Solving Lesson in a K-6 Classroom. Late in the semester, each student is required to design a lesson that incorporates one of the problems recorded in his or her journal. The student works with me and with a local elementary teacher to adapt the problem to the appropriate grade level and to develop appropriate materials and assessment strategies. The lesson must be approved by me as well as by the classroom teacher. After teaching the lesson, the student reflects on the best aspects on the lesson as well as areas that need improvement. He or she submits the work of three students in the classroom and uses a rubric or scoring guide to assess the work, reflecting on whether or not each child met the stated objectives for the lesson. The classroom teacher evaluates the lesson as well. Often, during the planning session of the lesson, the classroom teacher expresses doubt as to the ability of the children to solve the problem. However, the evaluations indicate that the teachers are usually surprised at how much the problem engages their students and how successful the students are at finding and explaining solutions.

This model is only part of the pedagogy course. Students are actively engaged in learning new teaching strategies, working with manipulatives, and reading current literature and research. However, the problem solving is the part of the class that seems to make the most impression on students. This gives them a view of teaching that is different from their own experiences, but it also provides some evidence of the impact and the effectiveness of employing problem solving as a teaching strategy.

In this presentation, I will share this model, along with sample problems, student solutions and comments, children's solutions, and assessment instruments used by my students. My students begin the class with few problem solving skills or with little confidence. At the end of the semester, they have acquired more sophisticated strategies, they display considerably more content knowledge and more confidence, and they are beginning to be able to provide similar experiences for students. Although I have used this model in many teaching settings with similar results, I will highlight the work of my MAT students. I believe employing this model helps students acquire problem solving skills that they can use throughout their teaching careers.

Title: *Inclusion of Inquiry-Based Group Work with Computer-Assisted Instruction Significantly Improves University Student Achievement in Finite Mathematics*

Presenter: Joshua H. Argo, Department of Mathematics, University of Alabama at Birmingham, Birmingham, AL

Outline of Presentation: Abstract: What is the effect of incorporating inquiry-based group work sessions in a Finite Mathematics course in which the primary pedagogy is computer-assisted instruction? Our research at the University of Alabama at Birmingham (UAB), a major state university, investigates in a randomized quasi-experimental study the relative effects of combining computer-assisted instruction with inquiry-based group work sessions, traditional summary lectures of material to be covered in the computer-based part, and the latter combined with regular in-class quizzing on lecture material. Our initial results show that a group work session with individually written reports and regular feedback statistically significantly improves students' ability in problem identification, showing evidence of problem-solving, and quality of explanation of reasoning leading to the solution in comparison to the traditional summary lecture of material and the combination of lecture with in-class quizzing. Our secondary results continue to show that a class comprised of computer-assisted instruction with inquiry based group work sessions shows an improvement in the areas of problem identification, showing evidence of problem solving, and quality of explanation of reasoning leading to the solution. Although we see a significant difference in the comparison of classes with respect to pre and post measures, the students' grades and accuracy on pre- and post-testing show no significant difference. This Finite Mathematics course is generally taken by most pre-elementary teachers as mathematics credit. By improving their ability to identify the problem, explain their thinking and reason an explanation to the solution, they can better explain math concepts to their students and aide their students in developing essential mathematical concepts.

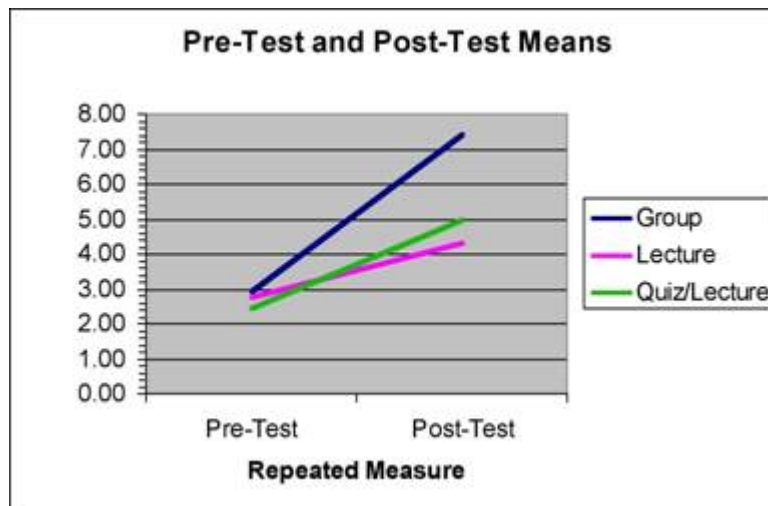


Figure. The Pre- and Post-Tests consisted of three problems, each scored on a rubric which awarded on each problem 0-1 point for Problem Identification, 0-1-2 points for Evidence of Problem-Solving, and 0-1-2 points for Explanation, for a total of 15 points possible on the test.

This research is supported by the National Science Foundation, Math/Science Partnership Program, through a \$10 million award to the Greater Birmingham Mathematics Partnership (GBMP). GBMP is a targeted partnership among 9 school districts in the Birmingham area, the University of Alabama at Birmingham, Birmingham Southern College, and the Mathematics Education Collaborative of Bellingham, WA.

Title: *Focus on Problem Solving for Teachers*

Presenter: S. Kathy Westbrook, Department of Mathematics University of West Georgia, Carrollton, GA

Outline of Presentation: The focus of this pre-conference session will be to describe the goals, funding, and results of a one-day middle and high school mathematics teacher workshop sponsored by the Department of Mathematics and Statistics of the University of South Alabama and the Alabama Space Grant Consortium.

On June 17, 2009, approximately 40 teachers attended a one-day workshop on “Teaching problem solving in mathematics.” The goal of the workshop was to instruct and encourage teachers in a variety of problem solving techniques using unusual and exciting questions that are not found in the middle or high school curriculum. The targeted participants were middle and high school mathematics teachers. The purpose of the workshop was to introduce teachers to the concept of math circles, reinforce problem solving in the classroom, and provide examples of some of the problems used to extend student thinking.

The 2009 summer workshop for teachers resulted from the successful weekly meetings of the Mobile Mathematics Circle which introduces students to mathematics as a creative thinking tool through problem solving. High school students (and a few of their teachers) engage in problems from many areas, including number, game, and graph theory and combinatorics. The weekly hour and a half meeting of the Mathematics Circle is guided by professional mathematicians. Some meetings are conducted by invited distinguished mathematicians brought in specially to work with the students in the Mathematics Circle.

The Mathematics Circle is designed to teach mathematics as a thinking tool more than as a computational tool. As such it will benefit students, whose studies lead them into any problem solving discipline, including fields as far removed from mathematics as economics, chemistry, engineering, or even business. The mission of the Mobile Mathematics Circle is to introduce students to mathematics as a creative thinking tool through problem solving. The student who will contribute to the nation's space exploration efforts must learn early to grapple with problems where work is required even to understand the question and where the hardest part of a solution may well be to identify or even create an appropriate mathematical technique. The Mobile Mathematics Circle will help students take their first serious mathematical steps. From the website of the Mobile Mathematics Circle (<http://gauss.usouthal.edu/~mathcircle/sc/>).

The weekly meetings of a mathematics circle are more structured than those of the typical math club. A specific topic is chosen for each session. The relevant theory serves as a basis for solving problems grouped around a common theme. Thus, students receive systematic training in mathematical problem solving. They are provided with the tools and exposed to the necessary techniques, but most importantly, they are given the opportunity to apply these with imagination and originality both during the Circle meetings working with others and at home attacking homework problems on their own. The students learn that solving a good problem is not a five minute affair, but one that could last hours or even days, requiring both intense concentration and enthusiasm.

The Core goals of the project are:

- 1) To increase the knowledge and conceptual understanding of students in mathematics. To help students develop analytical thinking skills.
- 2) To help students develop creative thinking and problem solving skills.
- 3) To excite the minds and spirits of young students to pursue further study in mathematics and science.
- 4) To provide enrichment in mathematical topics to stimulate interest in mathematics and help prepare students for future study of mathematics.
- 5) To end the isolation of young students by bringing them together to discuss, argue and collaborate.
- 6) To offer guidance from working mathematicians.
- 7) To educate students regarding careers in mathematics and science

The Mobile Mathematics Circle is sponsored by the Department of Mathematics and Statistics, University of South Alabama, Alabama Space Grant Consortium and Alabama EPSCoR. Alabama Space Grant offered under NASA training grant. The Alabama Space Grant Consortium (ASGC) includes universities, with space - related research activities, seven affiliates and the US Space & Rocket Center. Several other small colleges and schools in Alabama are affiliated with Space Grant Activities through the NASA Experimental Program to Stimulate Competitive Research program (EPSCoR). The mission of Alabama EPSCoR is to foster the growth of research capacity and capability in the state of Alabama in order to make the institutions of higher education more competitive for federal funding.

Title: *What Can We Learn from Research to Improve Teacher Preparation Programs in Mathematics Education? The Case of Project ISMAC*

- Presenters:**
- 1) Victor L. Brunaud-Vega, Department of Mathematics Education, University of Georgia, Athens, GA
 - 2) Eileen Murray, Department of Mathematics Education, University of Georgia, Athens, GA
 - 3) Kanita Ducloux, Department of Mathematics Education, University of Georgia, Athens, GA
 - 4) Dorothy White, Department of Mathematics Education, University of Georgia, Athens, GA

Outline of Presentation: As mathematics teacher educators, we see professional development as a way to help improve mathematics teacher preparation by using field-based research to better understand the needs of our future teachers. Our presentation will summarize the preliminary findings of Project ISMAC (Improving Students' Mathematical Achievement through a Professional Learning Community), a school-based professional development project designed to help teachers improve the quality of their mathematics instruction by building a mathematics education community within their school.

Although the project is built on the assumption that teachers are constantly seeking for ways to improve their teaching, responding to the societal demands, including the implementation of a standards-based curriculum, requires that teachers first experience for themselves new ways of teaching and learning mathematics. Teachers also need to improve their content knowledge of the subject, their attitude towards mathematics, and their pedagogical resources. Consequently, our project was designed to help teachers increasing their mathematical content and pedagogical knowledge, while building a mathematics education community (Murray, White, & Brunaud-Vega, 2009).

The site for this experience was College Middle School, a small urban school.

One of the main goals of ISMAC was the examination of how professional learning communities of mathematics teachers are developed, how they operate, and what kinds of impacts they have on mathematics teaching and learning in a small, urban middle school. In this school the classroom teachers instruct five mathematics classes of 20 – 25 students and are provided with one period for planning. Over the course of the year, we realized that there were existing grade-level communities within the school and that most of the professional interaction concerning the teaching of mathematics occurred during the shared planning time. For this reason, we decided to focus on those meetings. Although we participated on the shared planning meetings for the three grade levels of this school, our research concentrated on the 7th grade teachers of mathematics, to observe how the teachers' discourse transformed and the implications of that change for purposes of improving professional development and preparing preservice

teachers for the classroom. During the 2008-2009 school year, we attended and facilitated 14 planning and collaborative meetings with these teachers. During the meetings we audio-recorded the conversations and wrote field notes.

The preliminary analysis of our data was based on the categories developed by Brown, Arbaugh, Allen, and Koe (2000), who identified three ways teachers address issues related to mathematics content during common planning time: (1) Scope and Sequence; (2) Talking about

Tasks; and (3) Working through Tasks. They define *Scope and Sequence* as the time teachers spend discussing mathematics topics taught and the order in which they are taught. *Talking about Tasks* refers to the time teachers spend discussing specific tasks or activities that were or would be used in instruction. *Working through Tasks* is the time teachers spend actually working through a task as a student would. We used this framework to develop our own ideas about shared planning. Looking for a better description of what we saw in the shared planning meetings, we identified two ways to describe teachers' thinking while they plan: focusing on their teaching or focusing on their students' learning. When the planning was focused on the teaching, the emphasis was on the unit pacing and the presentation of the lesson, the district curriculum maps, topics on upcoming assessments, and official instructional materials (i.e. textbook, unit, and page number). Most of the shared planning meetings we attended during the first semester of the project were centered on the teaching. Our initial intervention consisted in asking teachers to predict which of their students would struggle with the activities they had planned and why. Then teachers were encouraged to anticipate possible reactions of different types of learners and, consequently, we discussed ways to adapt the selected mathematical tasks to their classes' needs. The teachers' focus moved towards the learners, so they started to think about what their actual students needed to learn and planned lessons accordingly. An additional effect of this shift was the teachers' increasing disposition to try new instructional approaches.

Considerable research has illuminated important aspects of teachers' mathematics beliefs, attitudes, and knowledge and their effects (Swars et al., 2009). However, few studies have pay attention to the effects of collaborative professional work among teachers of mathematics, although research shows that collaboration can certainly help facilitate teacher change (Briscoe & Peters, 1997). Teacher collaboration should include active learning in which teachers engage in activities such as observing other classes, collaborative planning, and reviewing student work together, characteristics that have a positive relationship "to changes in teachers' knowledge and skills and changes in practice" (Graham, 2007, p. 6). Our research will increase the understanding about collaborative planning in mathematics education.

Parts of our findings were used as part of the discussions in one course about mathematics methods for early childhood education. We talked about the effects of working through mathematical tasks while trying to anticipate students' difficulties as well as the idea of working collaboratively as a characteristic of professionalism. These conversations were very useful for preservice teachers since we think that field-based research can inform teacher preparation in mathematics as a way to anticipate the challenges that prospective teacher will face in their schools.

Title: *A Mathematician and Mathematics Educator Collaborate in the Preparation of Prospective Middle Grades Teachers*

Presenter: 1) Jacob T. Klerlein, Department of Mathematical Sciences, Middle Tennessee State University, Murfreesboro, TN

2) Donald A. Nelson, Department of Mathematical Sciences, Middle Tennessee State University, Murfreesboro, TN

Outline of Presentation: We will begin by providing a very brief description of MTSU including characteristics of the student body, the institution's historical role in the preparation of teachers, and a brief synopsis of degree options for prospective teachers. Recognizing the identified need to prepare qualified teachers of middle grades mathematics, two years ago colleagues at MTSU examined enrollment data and found less than ten students had a 4-8 major with a mathematics concentration. To address this shortage of prospective middle grades mathematics teachers our colleagues sought and were awarded federal funds to address this need. Hence, MTSU received the Teachers Now grant. We will next provide background information about the Teachers Now grant program, i.e. the program is a federal grant intended to:

- provide scholarships to entice and support students who major in 4-8 education with a concentration in mathematics or science
- develop relevant mathematics, science, and education courses for these students
- support field experiences for these students with exemplary mentor teachers in the local county school system

The bulk of the presentation will focus on our developing and team teaching a course in discrete mathematics for middle grades teachers. The goals of our work included the desire to support students as they developed significant understandings of the course topics, to provide a setting where students 'formally' and informally presented their original mathematical activity to their classmates and teachers, to engage students in thinking about how knowledge of these topics would support teaching middle grades mathematics thereby supporting their developing Mathematics Knowledge for Teaching (MKT), and to provide opportunities for prospective teachers to engage middle grades students in activities requiring discrete mathematics.

We will then describe the topics of the course and our associated pedagogical choices to support student learning. The topics included sets, logic, counting techniques, probability theory and graph theory. Pedagogically, in addition to coherent lectures provided by Dr. Nelson, we provided opportunities for student group work during class, allowed for a range of homework exercises and problems to be completed, required pairs of students to present solutions of instructor-written problems during class, and facilitated field experiences in local middle grades mathematics classes. During the presentation, we will briefly share samples of instructor-written problems and student impressions of these pedagogical choices.

Next, we will describe important elements of our collaboration and how these may be integrated in the practice of other colleagues. Some individuals may assume collaborations between mathematicians and mathematics educators typically involve those identified in the later group as being more sensitive to students' needs and less likely to demand intellectual rigor than those who are identified as mathematicians. Having invested valuable hours planning and articulating

our goals for student learning and also because we each attended every class meeting (with rare exception), we were able to achieve a significant blending of these seemingly dichotomous roles.

For example, when Don read the feedback Jake provided students after their presentations and

listened to the questions Jake posed for students during class, he was confident to expect Jake would demand mathematical rigor from the students' activity. Similarly, witnessing Don's increased effort to draw on student thinking and deviate from 'classical' lecture driven pedagogy, Jake knew he would be able to focus less on promoting productive student affective experience since his collaborator was also working to be attentive to these needs.

As a final aspect of the presentation, we will share some of what we each learned during and from our collaboration as well as anecdotal evidence of students' impressions of our collaboration and how it influenced their learning of mathematics and MKT. Lastly, we will use this information to suggest important considerations for others who intend to collaborate with colleagues in the preparation of future or current mathematics teachers.

Title: *Project Delta2: Improving Mathematics Instruction through Collaboration and Coaching*

Presenter: 1) Angela T. Barlow, Department of Curriculum & Instruction, The University of Mississippi, University, MS

2) Shannon Harmon, Department of Curriculum & Instruction, The University of Mississippi, University, MS

Outline of Presentation:

Session Goal

- To describe the benefits of the coaching model utilized in Project DELTA2's Summer Institute.

Project Overview

Project DELTA2 (*Developing Effective Leadership and Teaching Alternatives 2*) is funded through a Math Science Partnership (MSP) Grant and based at The University of Mississippi. Project DELTA2 works with middle grades mathematics teachers with a primary goal of enhancing teacher content knowledge. In addition, Project DELTA2 supports teachers in developing the mathematical knowledge of their students. Key features include the following:

- summer institutes focusing on content development;
- school-year follow-ups that include project instructors teaching in participants' classrooms while participants observe;
- web-based resources, including access to podcasts addressing topics from the middle-grades curriculum; and
- technology for the classroom.

Partnering with the Boys & Girls Club

Following the first year of the project, we recognized that while we may have been developing participants' content knowledge we were not facilitating the belief that participants could utilize the instructional strategies being modeled in their own classrooms. During the development of the second project grant, an opportunity to partner with the Boys & Girls Club (BGC) arose, providing an avenue for demonstrating these techniques with students. Each summer since, students from the BGC have visited the summer institute, completing mathematical tasks under the direction of either project instructors or participants. Participants utilize a structured observation guide to facilitate discussion of the students' work.

Collaboration and Coaching

This summer marked the first time that we had 4 groups of teachers participating in the summer institute, based on their varying numbers of years of participation. Participants range from being in their first year of the project (Year 1 participants) to those in their fourth year (Year 4 participants). The presence of the 4 groups marked the unique opportunity for collaboration and coaching in working with students from the BGC. Year 3 participants were paired to form instructional teams which were given mathematical tasks selected by the project instructor to utilize with the students. Each task was considered to be a worthwhile mathematical

task as it required a high level of cognitive demand (Stein & Smith, 1998). Instructional teams utilized the Teaching Through a Lesson Protocol (TTLP) (Smith, Bill & Hughes, 2008) to plan

the implementation of the task. The goal was to maintain the high level of cognitive demand throughout implementation.

Meanwhile, Year 4 participants were paired to form coaching teams. Information and videos from West and Staub (2003) provided the foundation for developing their coaching skills. Each Year 4 coaching pair was paired with a Year 3 instructional pair. Coaching pairs met with instructional pairs twice prior to the lesson (pre-conferences). All coaching pairs and instructional pairs watched the lessons being implemented. Coaching and instructional pairs met following their particular lessons for debriefing (post-conference).

Benefits of the Summer Institute Coaching Model

A variety of benefits were recognized and discussed by instructors and participants. The following benefits were noted.

- The TTLP forced participants to think deeply about the task and its implementation, considering aspects of the lesson that would normally not be considered in the planning process.
- The coaches were beneficial in helping participants think about the mathematical goals of the task, potential student solutions, questions to ask, and how to launch the lesson.
- Through this experience, participants recognized the need to ask better questions and to plan these ahead of time. They also noted the need for strategies such as think-pair-share as a means of engaging all students in thinking.
- Through task implementation, participants realized the importance of allowing time for lesson summaries.
- Participants noticed that when implementing high-level tasks, students do not always respond in a way that you may have anticipated. It is important, though, to recognize the mathematics that students bring to the task and allow this to guide the work.
- One key to maintaining the high-level of cognitive demand during implementation is to “stop-and-go.” By this, participants meant that rather than stand by a group and try to answer all of their questions (and thereby diminishing the cognitive demand of the task) they should stop, listen, refocus the students’ attention by posing a question, and then go.
- Participants saw that students of all ability levels will engage in mathematical tasks if they are accessible and of interest to the students.
- Participants noted that students find reward in success with challenging tasks. Similar reward is not found when the students are successful with a task that is not challenging. Project instructors reflected on the components of the model that helped it be successful.

The following components were noted.

- Selecting the tasks ahead of time allowed for participants to focus on implementation, which was the intent of the model.
- By sequencing the tasks throughout the institute, participants were able to witness the importance of developing a concept over time, an idea that they had previously had difficulty understanding.
- The coaches brought an aspect to the model that had been much needed in the previous year. Coaches provided the in-depth, one-on-one conversations needed to facilitate moving participants through the planning and implementation process.

- With their coaches, participants had the opportunity to reflect on their own instructional practices. These were separate from whole-group discussions where participants focused on the students, their engagement in the tasks, and the mathematical understandings/misunderstandings as evidenced in their work.

Conclusion

To improve student achievement, it is not enough for teachers to deepen their own personal understanding of mathematics. They must also gain skill in implementing tasks that will allow their students to gain a deep understanding of mathematics. We believe our Summer Institute Coaching Model provides participants with a unique opportunity to do just that. By providing a safe, supportive environment participants have the opportunity to practice implementing cognitively-demanding tasks, reflecting on aspects of planning that are not typically considered during the planning process. Future work is needed, however, to verify that the skills gained in the summer institute will transfer into the classroom.

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Title: *Alignment of Preservice and Inservice Teacher Preparation in Secondary Mathematics: Closing the “Theory-Practice Gap”*

Presenter: W. Gary Martin, Auburn University, Auburn University, Auburn, AL

Outline of Presentation: TEAM-Math is a partnership of Auburn University, Tuskegee University, and 14 school districts with the common goal of transforming mathematics teaching and learning in east Alabama. In reaching its goals, the partnership focuses on five main areas of activity: curriculum alignment, teacher leader development, professional development, teacher preparation, and stakeholder outreach. As the partnership has progressed, the efforts to impact inservice mathematics teachers through partnership activities have increasingly intersected with the goals of the secondary mathematics preservice teacher program at Auburn University, with important consequences for both preservice and inservice mathematics teachers.

Prior to the establishment of TEAM-Math, preservice teachers were generally placed with teachers who were qualified and willing to direct their laboratory and student teaching experiences, with little else to recommend them. This often resulted in a “theory-practice” gap in which the instructional practices advocated in the teacher preparation program, which are based on national standards and research on mathematics teaching and learning as exemplified in *Principles and Standards for School Mathematics* (NCTM, 2000) and other publications, conflict with the views of secondary mathematics classroom teachers, which may be focused on coping with the practical necessities of education (cf. Parker, 2007). Such teachers may dismiss the students’ academic preparation as “ivory tower” with little relevance to the realities of the classroom. In contrast, most students are now placed with TEAM-Math teacher leaders or other teachers who have been active in the partnership. Thus, the prospective teachers not only hear about and experience pedagogical preparation rooted in mathematics education research and best practices, they also see these same principles in action as they participate in the field-based component of the program. Rather than experiencing a “theory-practice” gap, they now see these two components of the program as mutually reinforcing.

Likewise, as our preservice students graduate from the Auburn University program, they frequently choose employment in schools that are committed to the partnership, just as those schools actively seek out our graduates. This provides further narrowing of the aforementioned “gap” as these new teachers are supported in their development of practices advocated in their teacher preparation. Indeed, their more-experienced colleagues may look at them as a potential source of new ideas and the “latest” information. Thus, school practice not only tends to reinforce the theoretical training received by the new teachers, but that theory also informs the instructional practices at the school.

Title: *Gaining Teaching Experience in a History of Mathematics Course*

Presenter: Angela Hodge, Department of Mathematics and Teacher Education, North Dakota State University, Fargo, ND

Outline of Presentation: A history of mathematics course can offer students insights about how mathematics developed over time; however, I propose that it is also a class where the integration of teaching both mathematics and pedagogy occur naturally. If offered at a university, a history of mathematics course is one that is often taken by a wide range of majors. This course is often seen as a way for engineers or others completing a minor in mathematics to meet their elective requirement. However, for pre-service secondary mathematics teachers (PSMTs) the course serves a specific purpose outlined in Committee on Undergraduate Programs in Mathematics (2004) *Curriculum Guide*.

Prospective secondary mathematics teachers need to know the history of the subjects they will teach. It gives them a better appreciation for the struggle that goes into mathematical advances. It enables them to identify conceptual difficulties and to see how they were overcome. And it enriches their own understanding of the mathematics they will teach and the role it has played in human history. (p. 56)

In addition, I argue that this course can serve as a way for pre-service teachers to gain additional teaching experience before entering the classroom. I have three main goals for this presentation: (a) to share how I provided the PSMTs with opportunities to teach their peers in the history of mathematics course, (b) to discuss assignments that were modified for PSMTs so that the assignments were relevant to teaching secondary mathematics, and (c) to engage the audience in discussions on how other classes could use similar techniques.

Course overview

The purpose of this particular history of mathematics course was to help students develop their own historical perspectives on the development of mathematics so that they gain increased understanding of how mathematics has come to play such a prominent role in our lives. The history of mathematics course that will be discussed in this presentation was taught to a group of 20 students at a mid-sized public university. In this group, there were a variety of majors: (a) mathematics education, (b) mathematics (c) engineering, (d) computer science, and (e) physics. On the first day of class, the students were placed into four groups, each consisting of three to four students. The students were randomly assigned to the groups, but they had the option to switch groups if they wished after the first two weeks. All students chose to remain in their original groups. These groups were a key component to the success of the portion of the class where the students were provided with the opportunity to teach their peers and learn in an inquiry-based (Rudolph, 2005) manner.

Teaching component

From a situative perspective (Lave & Wenger, 1991) of learning, students learn best when they are actively engaged in the learning process. For pre-service teachers, this extends to the fact that they learn to teach best by being put into situations that closely resemble what it is they will do in the future. I wanted the pre-service teachers to get a feel for what it is like to be a student in a classroom that is taught in the manner that they are taught in their education classes, per recommendation of the National Council of Teachers of Mathematics (NCTM, 2000) to teach. In addition, I wanted all of the students to gain experience pulling important topics from mathematics textbooks and presenting it in a way that others can understand. This is stated with

the caveat that presenting/teaching does not have to be telling. To address these issues, I decided that instead of lecturing to the students on the content of the history of mathematics textbook

readings, I would have the students take turns presenting the material to the class. There are many lessons to be learned in the success of this component to the course. In this presentation, I will provide details on what went well, what could have gone better, and what I did to make sure this did not get monotonous over the course of the semester.

Lesson project

Although the teaching portion of the class was the most relevant and consistent part of the class that was geared towards PSMTs, I also allowed for modifications of some of the assignments to better fit their needs. For example, in the past students have been required to submit summary papers of the readings at two different points during the semester. They do not have to obtain information beyond the text, but they are to show in these papers that they understand the reading material for the course. To make the modification fair, all students were given the option of submitting this paper in the form of an extended lesson plan that could be used at the secondary level in a mathematics course. If students chose to design a lesson plan, they were still required to demonstrate that they understood the material in the reading. This often included a brief summary of how the lesson incorporated at theme from the readings. Both the benefits and drawbacks of this assignment will be discussed in this presentation.

Discussion

The modifications to this course allowed pre-service teachers experience three important areas: (a) teaching and (b) planning, and (c) learning in an inquiry-based fashion. This presentation will allow mathematics educators and mathematicians to come together to discuss how similar ideas can be implement at other universities. In addition, the ideas discussed will contribute to the on-going conversations regarding the preparation of PSMTs.

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Title: *Enhancing Mathematics Pedagogy through Cooperation Between Mathematics and Mathematics Education*

Presenters: 1) Roozbeh Vakil, Mathematics Department, St-Cloud State University,
St-Cloud, MN

2) Bishnu Naraine, Mathematics Department, St-Cloud State University,
St- Cloud, MN

Outline of Presentation:

Abstract: Although there is good evidence that team teaching in higher education would improve teacher preparation programs, there is not enough collaboration between college faculty for this purpose in general and between mathematics faculty in particular. In this report, a mathematics and a mathematics education faculty collaborated to team teach a methods course in mathematics. Team teaching evinced positive effects on student learning and cooperation between faculty.

Full Description: There is often an unnecessary tension between mathematics and mathematics education faculty in math departments. A cooperation of this type has the potential to ease this tension. Mathematics educators will become more sensitive to the concerns of mathematicians and mathematicians will get hands-on experience with alternative approaches to teaching. The profession of teaching is half science and half art. The scientific half can be well documented and be available to everyone, but the other half is hidden in the everyday practice of teaching. It is this aspect of teaching which is so difficult to fully document.

A mathematics and a mathematics education faculty joined to team teach a methods course in mathematics. Team teaching gave us the opportunity to look at the mathematics activities through the lens of higher mathematics courses. With two different professional backgrounds, we approached each activity through a variety of teaching methods. Multiple approaches to the same problem enriched students' understanding of mathematics; moreover, each approach provided the opportunity to discuss the pedagogical aspects of learning. This setting not only provided the opportunity for a deeper and more flexible knowledge of the content and the pedagogical considerations, but also made students more aware of the necessity of the curriculum beyond calculus. Students' portfolios reveal important facts about the effect of team teaching and course design on their learning, attitude toward learning, the way to engage in a mathematical conversation, and the importance of pedagogy in learning mathematics.

Title: *Research Experience for Secondary Mathematics Teachers*

- Presenters:**
- 1) Saad El-Zanati, Department of Mathematics, Illinois State University, Normal IL
 - 2) Cynthia Langrall, Department of Mathematics, Illinois State University, Normal IL
 - 3) Ryan Bunge, Department of Mathematics, Normal Community High School, Normal IL
 - 4) Wendy O'Hanlon, Department of Mathematics, Illinois Central College, East Peoria, IL

Outline of Presentation: We will report on two NSF funded programs that involve preservice (and inservice) secondary mathematics teachers in undergraduate mathematics research. One of the programs, the Teacher Scholar Program (TSP), is a yearlong capstone research experience. The second is a Research Experiences for Undergraduates Site (REU) for both preservice and inservice teachers. Both programs are collaborative efforts between mathematicians and mathematics educators to provide teachers authentic mathematical experiences. The experience of doing mathematics has caused a change in our teachers' views of the nature of mathematics and subsequently their beliefs about teaching and learning.

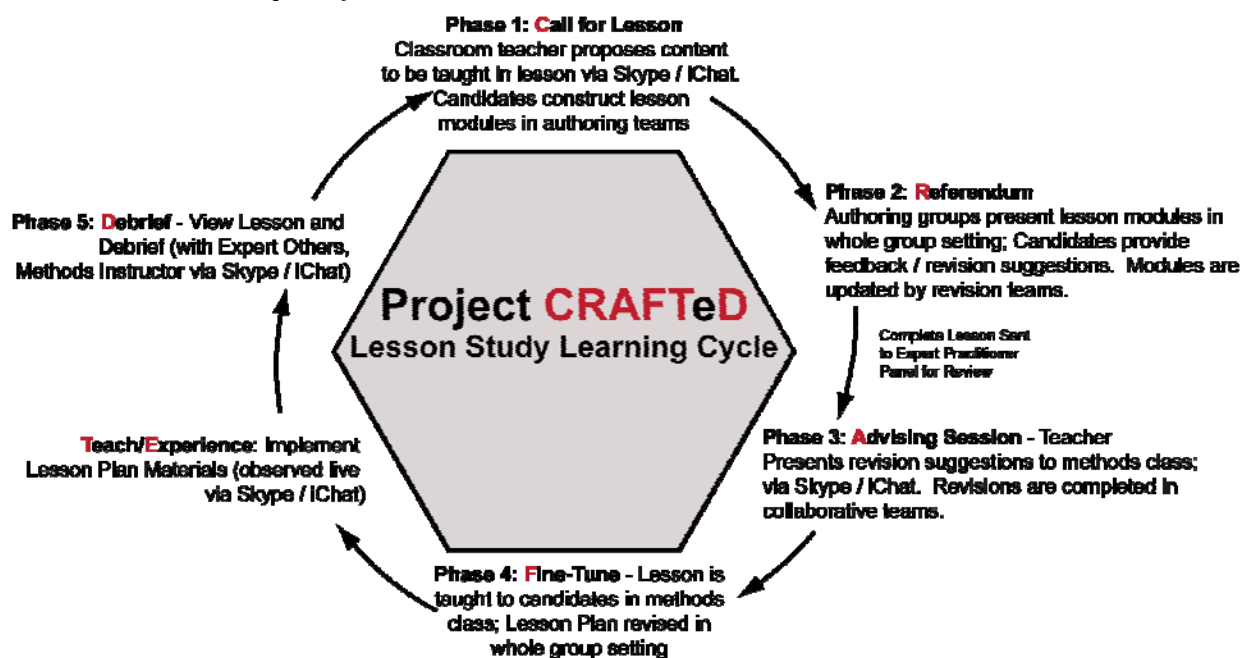
The session will present problems and activities that can be used to prompt mathematics research by secondary mathematics teachers. These problems are accessible to high school students, but can be extended into interesting, challenging, and original mathematics. The development of deep and connected knowledge of high school mathematics allows teachers to provide tasks that challenge and instill curiosity into future generations. In addition to the mathematical component of REU and TSP, we will discuss the educational topics that were connected to these mathematical experiences. For instance, we conducted an investigation of how high school students develop mathematical generalizations, and the role that representations played in this process. In conclusion, we will present data that characterize the changes in our students beliefs and then provide an opportunity for the audience to discuss the role of authentic mathematical experiences in the preparation of mathematics teachers.

Title: *Project CRAFTeD: Remote Lesson Study and its Impact on Preservice Teachers' Technology Pedagogical Content Knowledge*

Presenter: Michael Todd Edwards, Department of Teacher Education, Miami University, Oxford, OH

Outline of Presentation: Too often, efforts to prepare undergraduates for professional roles as classroom teachers are problematic. In this talk we describe the CRAFTeD model, a modified lesson study framework that includes on-line consultation sessions with classroom teachers and university faculty in remote venues. We provide findings from a semester-long project that successfully used the model to develop, revise, and implement high-quality teaching materials collaboratively with classroom teachers and university faculty. We posit that the model may be used to prepare undergraduates for any professional role involving client/consultant relationships.

The proposed talk is important because it explores a model by which university teacher training programs can more purposefully link university teacher training programs to school settings where teacher candidates will ultimately work. Too often, the teaching methodologies advocated by methods instructors in teacher preparation programs are not readily observed in actual classroom settings. This disconnect has become more pronounced in the age of high-stakes standardized testing. While university methods instructors laud the merits of student-led inquiry, exploration, and discovery-based teaching methods, secondary mathematics teachers in too many schools “set aside” such teaching in favor of instruction directly focused on student preparation for high-stakes, multiple choice state tests (Seeley, 2006). In an age in which testing dominates the landscape of too many classrooms, it becomes increasingly difficult to provide teachers-in-training with models of high-quality mathematics instruction in secondary school environments. The study, Project CRAFTeD: Remote Lesson Study and Its Impact on Preservice Teachers' Technology Pedagogical Content Knowledge, looks to remedy this situation by providing preservice teachers with opportunities to collaborate with exemplary high school mathematics teachers by means of inexpensive, readily available web-based conferencing services and strategic face-to-face visits throughout the semester. The collaborative, revision process is illustrated with the following model - a three-week cycle implemented in 5 phases in the university methods classroom.



Through an analysis of teaching materials (e.g. lesson plans and activities), comments in several lesson study reflection papers, and a technology pedagogical content knowledge pretest / posttest, the pedagogical and content-specific development of preservice teachers was explored as they engaged in lesson study activities.

The gains in the technology pedagogical content knowledge (TPCK) of preservice teachers' was significant as they are provided with opportunities to construct lessons and collaborate with an exemplary secondary school mathematics teacher then reflect on their instructional decisions as they observed their lessons being taught by the teacher in his own classroom (at a local High School 60 miles from the university site). Teacher candidates' content knowledge was strengthened as they constructed authentic activities for students; pedagogical knowledge - particularly notions of what comprises a "good" lesson - were also impacted during the collaboration.

In end-of-semester course evaluations, study participants (i.e. preservice mathematics teacher candidates) provided many comments regarding the emphasis on revision and lesson planning. Of particular interest were student quotes related to the peer revision process implemented throughout the study. Each of the twenty-seven study participants made positive note of "peer review" or "writing" in course evaluations. Comments such as the following were typical.

One area in which I have experienced significant growth during this semester is revising teaching materials. Ever since high school, I have always spent too much time perfecting my drafts of papers and projects to avoid the revision process. My perfectionism leads me to not want to change my work because I feel attached to it and am generally pleased with it the way it is. Throughout the semester, however, I have come to see how silly this way of thinking is. Even if you believe something is perfect, there is always some change you can make to improve it. I have also learned that there is nothing wrong with revising things; in fact, it is wrong for teachers to not revise materials. It is unfair to the students and the

teacher to work with insufficient or mediocre material, so it is essential to revise and improve at all opportunities. Revision is a significant part of the professional development process.

The extent to which students connected their revision work to their future careers as teachers was noteworthy, particularly for those who have yet to student teach.

Before I came into this class, I did not realize just how big of a part revision plays in a teacher's everyday life. Every day, as a teacher, I should be revising and making changes to lessons. Lessons can always be improved! It is a continuous process. My original stance was that my first year of teaching was going to be the toughest because I would be planning out the whole year and creating lessons. I thought that the following years would be much easier because I could just use all the previously created materials. This is not the case. While teaching will be easier to a degree as I gain experience, I will still be responsible for revising materials over and over again.

Perhaps most rewarding are comments that indicated that the writing process empowered future teachers to seek their own answers to both pedagogical and content-oriented questions.

We cannot hide behind our textbooks and professors forever. Here shortly we will all be making our way out into the world and people are going to expect us to have our own answers and because of this class I feel confident that I can stand up for my ideas in a professional and intelligent way.

In past coursework, preservice teachers have constructed lesson plans and activities for hypothetical students. Without the ability to implement the lessons they construct, preservice teachers soon question the relevance of their university training with respect to their ultimate effectiveness as classroom teachers in school-based settings. The opportunity to revise and implement lessons in authentic settings provided preservice teachers with motivation to construct higher-quality instructional materials. A worthwhile by-product of such activity is heightened content, pedagogical, and technological knowledge of teachers-in-training.

Title: *The TEAM-Math Malone Family Foundation Technology Initiative: Improving Grades 6-12 Mathematics Education in East Alabama Using Technology*

- Presenters:**
- 1) W. Gary Martin, Department of Curriculum and Teaching Auburn University, Auburn, AL
 - 2) Lisa Ross, Department of Curriculum and Teaching, Auburn University, Auburn, AL
 - 3) Mary Johnson, Department of Curriculum and Teaching, Auburn University, Auburn, AL

Outline of Presentation: TEAM-Math--a partnership of Auburn University, Tuskegee University, and 14 school districts in east Alabama—received a grant from the Malone Family Foundation to enhance secondary mathematics teachers’ use of technology as a means of increasing student learning of mathematics. Schools were given an opportunity to join in the project, based on the level of teacher commitment to participate in project activities and administrator support. Through the project, teachers received both technology resources and professional development on how to use those resources. Teachers attended a series of up to six half-day workshops focusing on a range of technological tools, including graphing calculators, including Computer-Based Laboratories (CBL); spreadsheets; Geometers Sketchpad (GSP), an interactive geometry software package; and Fathom, an interactive statistics software package. Teachers were able to select from a menu of sessions at the introductory, intermediate, and advanced levels. Some sessions were also differentiated by grade or subject. In addition to teachers receiving individual copies of the tools on which they had received training, schools were also provided with classroom sets of calculators and site licenses for the software. Over 75 teachers completed the program. Evaluations of the program were very positive, and particularly emphasized the importance of both providing the technological resources and the professional development needed to use those resources.

Title: *Impacts on Classroom Instruction as a Result of Training for Technology Integration in Middle and Secondary Science and Mathematics*

Presenter: Joy Black, Department of Mathematics, University of West Georgia, Carrollton, GA

Outline of Presentation: The National Science Education Standards (National Research Council, 1995) and the standards from the National Council of Teachers of Mathematics (2000) promote the learning of content through inquiry. Based on these, the Georgia Performance Standards (GPS) for Science incorporate Co-Requisites for Content and Characteristics of Science Standards and the Math Georgia Performance Standards (GPS) incorporate both Content and Process Skills Standards. For these disciplines, teachers should integrate both types of standards throughout K-12 and in all courses should engage students in problem solving investigations that help them apply what is learned to real world situations. The National Science Teachers Association (NSTA), the National Council of Teachers of Mathematics (NCTM), and the Georgia affiliates (GSTA and GCTM) of both, support these efforts in published position statements, recommendations and conference themes. Throughout the standards and in the literature of the aforementioned organizations, technology is described as a set of tools which facilitate this type of learning. On their website, NCTM states, “Technology and science are tightly interwoven...” and “...calculators and computers are reshaping the mathematical landscape.” They add, “...students who are scientifically literate have the knowledge and understanding of scientific concepts and processes required for participation in a Digital Age society.” NSTA, in position statements, says that “...computers and computer based laboratory devices should be used to permit students to collect and analyze data as scientists do, and to perform observations over long periods of time enabling experiments that otherwise would be impractical.” Use of technology enhances student inquiry by enabling students to collect data at more frequent intervals, over longer time periods, and often that is not possible within the context of school laboratories. The pooling of data and the sharing with other investigators help students to behave as real science and math investigators.

Mark Millar reports in the *Science Teacher* (2005) that use of data acquisition systems encourages higher order thinking and the improvement of concept mastery. Consequently, experiences in science and math should involve students in collecting and processing data, including direct use of instruments and standard diagnostic tests as well as technology assisted data collection, using computers, calculators, and sensors. An article by Heller Associates (2006) states that only 27% of teachers self report being “very familiar” with connecting graphing calculators to motion detectors, computers, or graphing calculators. Teachers must have confidence before they will use them themselves or with students.

With funding provided through an Improving Teacher Quality Grant, middle and secondary teachers were involved in a one week course with follow up during the 2009-2010 academic school year. Guided by collaborating faculty from the College of Education and the Mathematics Department and a technology consultant, participants were engaged in hands on investigations involving technology to investigate problem scenarios requiring the application of concepts from both math and science GPS. Goals from the project included participants gaining expertise and confidence in the use of technology, specifically computers, graphing calculators,

and sensors, and improving their ability to design and implement inquiry based instruction that guides students in the use of technology as they do meaningful problem solving.

This presentation will first address the need for training teachers for the integration of technology in middle and secondary science and mathematics. Second, information will be provided on the types of activities participants were involved in during the workshop. Third, data collected both pre- and post-workshop will indicate participant attitudes about technology along with their understanding of the math and/or science standards. In addition any changes within each of these contexts will be included. Last, implemented use of technology will be substantiated through classroom observations involving the participants.

Title: *Exploring the Effectiveness of Different Approaches to Teaching Finite Mathematics*

- Presenter:**
- 1) Mary Alice Smeal, Department of Mathematics and Science, Alabama State University, Montgomery, AL
 - 2) Sandra Walker, Department of Mathematics and Science, Alabama State University, Montgomery, AL
 - 3) Carolyn Simmons-Johnson, Department of Mathematics and Science, Alabama State University, Montgomery, AL
 - 3) Jamye Carter, Department of Mathematics and Science, Alabama State University, Montgomery, AL
 - 4) Lisa James, Assessment and Instructional Development, Alabama State University, Montgomery, AL

Outline of Presentation:

Introduction

Traditionally, mathematics has been taught using a very direct approach where the teacher explains the procedure to solve a problem and the students use pencil and paper to solve the problem. However, a variety of approaches to mathematics have surfaced from a number of different directions. The National Council of Teachers of Mathematics (2000) has encouraged teachers to incorporate a more student-centered approach as well as utilizing technology. The American Mathematical Association of Two-Year Colleges (1996) standards also suggested that technology is an essential part of reform curricula, specifically software and graphing calculators. Also, in attempts to include more students at the university level, many universities are offering distance learning as an option. Numerous research projects (McCoy, 1996; McDonald, Vasquez, & Caverly, 2002; Narum, 2008; Stella & Foshay, 2002; Su, 2008; Taylor, 2008) have explored a variety of methods for teaching basic mathematics and science courses at the university level.

The purpose of the study was to examine the effectiveness of three teaching methods on student achievement in undergraduate finite mathematics classes at Alabama State University. The three teaching methods stressed traditional teaching methods, the incorporation of graphing calculators, and distance learning, respectively. The research project examined each teacher's style and compared achievement outcomes.

Methodology

Quantitative research was chosen as the methodology for this study. All of the instructors of finite mathematics at Alabama State University participated in a research project to explore the effectiveness of different teaching approaches for finite mathematics. The participants were all of the students at Alabama State University enrolled in finite mathematics during the 2008-2009 school year. Undergraduate students randomly registered for finite mathematics without knowledge that instructors utilized different methodologies with the exception of distance learning. All students registering for finite mathematics using distance learning did so with full knowledge that all lectures, homework, and testing occurred online. The honors sections were excluded from the study.

The study contained one control group and two experimental groups. The control group was taught traditionally and did not emphasize solving mathematical procedures using graphing calculators. The second group met in a traditional classroom but was extensively exposed to the

use of graphing calculators to aid in improving the students' comprehension. For the control group and the graphing calculator group, no lectures or testing procedures were conducted through distance learning online. The third group viewed instructional lectures on the internet and completed all assignments and assessments via the internet. Three instructors emphasized

the traditional method, two instructors included an emphasis on graphing calculators, and one instructor utilized a distance learning approach.

Each instructor administered a pretest the first week of class and a posttest the last week of class. The pretest and posttest, designed by the Alabama State University Testing Center, contained 28 multiple-choice questions that covered the basic objectives of the finite mathematics course. All students in the three groups had the option of using a graphing calculator when taking both the pretest and the posttest.

Results and Conclusions

The results from the pretest and posttest were analyzed using analytical software. Only data from students who took both the pretest and posttest were included. Approximately 25% of all students who register for finite mathematics do not complete the course for a variety of reasons. A total of 181 non-honors students completed the pretest and posttest, with 114 students falling in the control group, 60 students in the graphing calculator group, and seven in the distance learning group. The difference among the experimental and control students on the pretest scores was significant ($p < .001$), and the difference among the experimental and control students on the posttest scores was significant ($p < .001$) as well. The means for the pretest scores were 10.62, 8.90, and 10.29 respectively (Figure 1). The means for the posttest scores were 15.38, 21.32, and 20.86 respectively (Figure 2). The greatest improvement from the pretest to the posttest came in the graphing calculator group—an increase of 12.42 in the mean. The control group had an increase of 4.76, and the distance learning had an increase of 10.57.

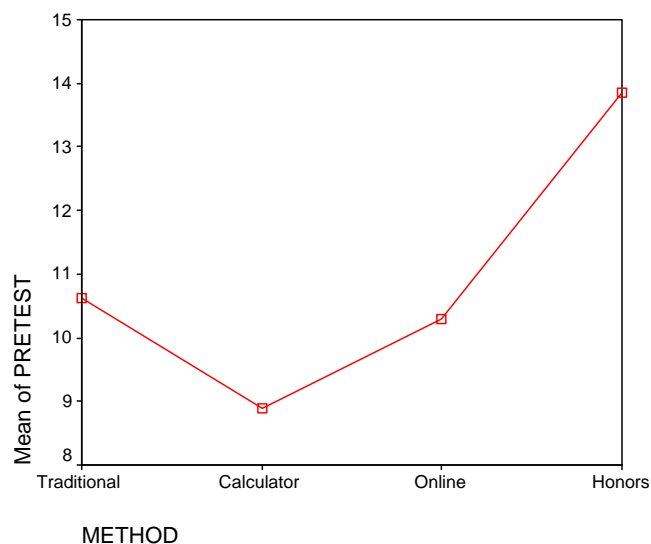


Figure 1

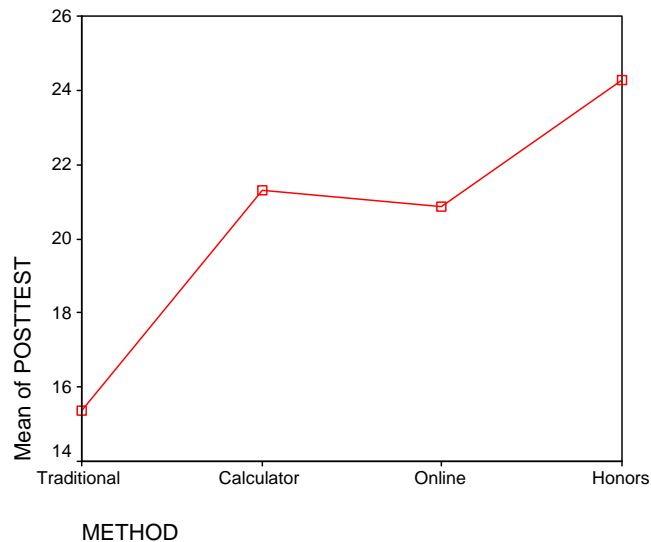


Figure 2

The results showed that both the graphing calculator and distance learning groups had significantly higher gains than the control group. The results were not in agreement with a similar study (Wynegar & Fenster, 2009). A number of factors may have influenced the dramatic difference. Some of the factors included that a large portion of the participants were remedial in mathematics skills, there was no university attendance policy, and a significant portion of the student held a low efficacy in mathematics. The results for this data suggested that students that were taught conceptually using graphing calculators or using distance learning showed more improvement. However, implied or generalized conclusions require more extensive research.

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Biographical Sketches of Presenters

Dr. Dorothy Ann Assad has a B.S. degree from Tennessee Technological University, an M.A. degree from Murray State University, and a Ph.D. from Southern Illinois University at Carbondale. She was in business for more than ten years and I have been a mathematics teacher for more than 20 years. She taught high school mathematics, computer science, and physics for 12 years. For six years, she was director of the Columbus Regional Mathematics Collaborative at Columbus State University in Columbus, Georgia. As director, she planned an implemented grant-sponsored professional development projects as well as taught mathematics education classes. For two years, she taught mathematics, mathematics education, and science education classes at Lane College, a historically black college in Jackson, Tennessee. she is presently an assistant professor in the mathematics department at Austin Peay State University in Clarksville, Tennessee.

Mr. Josh Argo is a senior at the University of Alabama at Birmingham seeking a BS degree in Mathematics. Josh's research assistantship is supported by an NSF Research Experience for Undergraduates in Evaluation supplement to GBMP. He is also a part of the Mathematics Honors Program. He will graduate in December, 2009. Upon graduating with his Bachelor's degree, he plans to attend Graduate School at UAB to obtain a Master's degree in Education. His career plan is to teach high school mathematics.

Dr. Angela Barlow is an Associate Professor of Mathematics Education at The University of Mississippi. Dr. Barlow works with K-12 teachers, both pre-service and in-service, in developing their understanding of the mathematics they teach as well as in establishing standards-based classrooms. Her research interests focus on developing teacher beliefs that align with standards-based instruction.

Mr. Bradley Maverick Bearden graduated Magna Cum Laude from Lagrange High School. Bradley then enrolled at Auburn University seeking a degree Secondary Mathematics Education. While at Auburn University, he gained teaching experience with the Mathematics Department as an undergraduate teaching assistant and also with the Athletic Department as a tutor. As a freshmen, Bradley became involved with A.M.E.S. (Auburn Mathematics Education Society), later serving as president and web master for the club. In addition, he worked with TEAM-Math during Summer Institute 07'. Bradley had the privilege of serving as Graduation Marshall for the College of Education at Fall Commencement 07'. He also graduated From Auburn University Magna Cum Laude, being inducted into the Phi Kappa Phi honor society and having a perfect 4.0 GPA in Mathematics. After graduation, Mr. Bearden returned to teach at Dadeville High School, where he had completed his internship. During his first year of teaching, he received the Alabama Power New Teacher Award for \$1000. Mr. Bearden has continued to work with Team-Math and has recently been inducted into the TEAM Math Teacher Leader Academy. As a TLA Fellow, he is working on his Masters in Secondary Mathematics Education at Auburn University.

Dr. Joy Black's educational background includes BS and MA degrees in mathematics education from the University of Alabama as well as a PhD in mathematics education from Auburn University in 2007. Her professional career began as a teacher in Alabama and continued for twenty-seven years at the secondary level. Subjects taught during this part of her professional career included all subjects from sixth grade mathematics to AP Calculus. While completing her degree at Auburn, she was afforded the opportunities of working with on Illuminations and the

Team-Math Partnership. At present she is employed within the Mathematics Department at the University of West Georgia where she teaches mathematics content courses for elementary and middle school preservice teachers. In addition, through the PRISM grant at the University of West Georgia, she has provided inservice on specific mathematics areas for teachers in Carroll County.

Mrs. Anna Wan Brice is a mathematics education doctoral student at Auburn University, Auburn, Alabama. In working with TEAM-Math (Transforming East Alabama Mathematics), she has presented at Quarterly meetings and Summer Institute 2009. Prior to attending Auburn University, Anna Wan Brice was a fully credentialed (NCLB highly qualified) high school mathematics teacher in California from 2004 - 2009 specializing in geometry. Her undergraduate degree was in Liberal Studies Teaching and Learning, specializing in elementary education. Her full math credential is in secondary mathematics with CSET (California Subject Examination for Teachers) 1, 2, and 3 complete. Included in her full credential is a two year BTSA (Beginning Teacher Support and Assessment) complete and a CLAD (Cross-cultural Language and Academic Development) certification.

Mr. Victor L. Brunaud-Vega is a doctoral student in the Department of Mathematics Education at the University of Georgia. He has a Bachelor in Education degree from the Universidad Católica Cardenal Raúl Silva Henríquez (Santiago de Chile) and a M.Ed. from the University of Georgia. His research interests include effective professional development, teacher education for diverse classrooms, and teaching mathematics for social justice in elementary and middle grades.

Mr. Ryan Bunge was selected the Outstanding Senior in Mathematics Education at Illinois State University in 2005. He has taught at Avon High School in western Illinois and recently joined the mathematics faculty at Normal Community High School in Normal, Illinois. Mr. Bunge has participated in the ISU REU Program for the last three years. He is the author of four mathematics research articles (one submitted and three forthcoming).

Dr. Jamye Witherspoon Carter, an Associate Professor of Mathematics at Alabama State University, currently serves on numerous committees, both university-wide and departmental. Dr. Carter and her co-author, Dr. Betty Noye Freeman published the text Finite Mathematics: A Conceptual Approach in 2002. Also, Dr. Carter and her co-authors Dr. Janet St. Clair and Ms. Sybil St.Clair published a chapter in the NCTM publication Mathematics for Every Student Responding to Diversity Grades 9-12 in 2009. She has presented at several professional workshops and enjoys serving as the University Supervisor for the Mathematics Education Teacher Candidates in the College of Education.

Dr. Sylvia Celedón-Pattichis is associate professor in the Department of Language, Literacy, and Sociocultural Studies and Co-PI of the Center for the Mathematics Education of Latinos/as. Her research interests include linguistic and cultural influences on the teaching and learning of mathematics with Latina/o students learning English as a second language.

Dr. Kanita K. DuCloux received her PhD in Mathematics Education at the University of Georgia in August, 2009, an EdS (1999) in Mathematics Education from State University of West Georgia, a masters degree (1990) in mathematics from Clemson University and a BA (1987) in mathematics from Wittenberg University. She taught mathematics at Miles College, a historically black college in Alabama, for a year before beginning an 11-year career teaching

secondary mathematics. She has taught and continues to teach mathematics education courses at The University of Georgia as well as serving as a supervisor for student teachers. Her current interests include preparing preservice teachers to mathematics in grades 6-12, addressing issues of equity and assessment in mathematics education, and improving mathematics education in grades PK-16.

Dr. Michael Todd Edwards is an Assistant Professor of Mathematics Education at Miami University in Oxford, Ohio. Edwards' scholarly interests center around the teaching and learning of mathematics with technology, specifically graphing calculators, computer algebra systems, and dynamic geometry tools. More recently, he has begun to explore freely-available videoconferencing software (e.g. Skype) as a means to enhance the preparation of preservice teachers. He is interested in potential of on-line collaboration tools to bring together university faculty, teacher candidates, and practicing teachers in the development, revision, and implementation of high-quality curriculum materials with learners in school classrooms.

Dr. Saad El-Zanati received his PhD in mathematics from Auburn University in 1991. He is the author of over fifty research articles. In 2002, he was awarded the *Hall Medal* of the *Institute for Combinatorics and its Applications*. This is an international prize awarded in recognition of extensive quality research in mid-career. He currently holds two grants from the National Science Foundation: *A Model Teacher-Scholar Program in Secondary Mathematics* and *REU Site: Mathematics Research Experience for pre-Service and for In-Service Teachers*. He has an extensive record of collaborations with mathematics educators and of work with pre-service teachers on undergraduate research.

Mrs. Nancee Garcia is a mathematics teacher at Auburn High School. She has been teaching geometry and algebra for six years. She has her bachelor's and master's degrees in mathematics education from Auburn University and is currently working on her PhD in mathematics education in the TEAM-Math Teacher Leader Academy Fellowship program. She serves as the TEAM-Math teacher leader at Auburn High School and has served as a summer institute presenter and has also worked on the curriculum committee. Mrs. Garcia frequently works with pre-service teachers in laboratory experiences and internships.

Ms. Shannon Harmon is pursuing her doctoral degree in elementary education at The University of Mississippi where she also works with K-12 teachers, both pre-service and in-service. Her research, derived from her own personal experiences as a K-12 teacher, focuses on strengthening teachers' mathematical content knowledge as they learn to implement the appropriate methodologies in their classrooms.

Dr. Angela Hodge is an assistant professor in the Departments of Mathematics and Teacher Education at North Dakota State University. She teaches mathematics courses at both the undergraduate and graduate levels. She is interested in pre-service teacher education and the role of mathematics coursework in the process of learning to teach secondary mathematics.

Mrs. Mary Johnson has been the Assistant Project Manager of TEAM-Math since Fall 2005. She has also been teaching the Math for Elementary Education courses for the Department of Mathematics and Statistics at Auburn University. Prior to moving to Auburn, she was Associate Professor in the Mathematics Department at Santa Fe Community College in Gainesville, FL. She earned her M.S. in Education from N. C. State University in Raleigh. She has taught mathematics from middle school to the college level.

Dr. Jacob T. Klerlein matriculated at The University of Georgia where he earned the doctorate in mathematics education. He next accepted a two-year visiting faculty position at the Indiana University School of Education at Indianapolis, and has since held a faculty position in the department of mathematical sciences at Middle Tennessee State University (MTSU) for two years. He teaches mathematics content courses for prospective teachers, mathematics education courses for practicing teachers in the department's Master's of Science in Teaching program, and coordinates the mathematics and mathematics education aspects of MTSU's Teachers Now grant program. He has also taught middle grades and high school mathematics in North Carolina for five years

Dr. Cynthia Langrall received her PhD in mathematics education from the University of Maryland in 1993. She is the director of the PhD program in mathematics education at Illinois State University. She has also served as associate director of mathematics of the Center for mathematics, Science, and Technology at ISU. She has served as mathematics education consultant for several school districts and as external evaluator for a number of NSF funded projects, including the Show-Me Center project in Missouri.

Dr. Mary Marshall is an instructional mathematics coach with Albuquerque Public Schools and was a doctoral fellow of the Center for the Mathematics Education of Latinos/as. Her dissertation focused on how second grade students communicate their mathematical thinking when they have had access to CGI problem solving activities since kindergarten.

Dr. W. Gary Martin is a Leischuck Endowed Professor for Critical Needs in Education in the Department of Curriculum and Teaching in the College of Education. He teaches a range of undergraduate and graduate courses in mathematics education and is the director of the TEAM-Math project, an NSF-funded partnership of Auburn University, Tuskegee University, and 14 school districts with the common goal of transforming mathematics teaching and learning in east Alabama. Before coming to Auburn, Dr. Martin served as the Director of Research for the National Council of Teachers of Mathematics, where he oversaw the development of *Principles and Standards for Schools Mathematics*, the organization's national standards for mathematics. In addition, he has been a faculty member at the University of Hawaii in the Curriculum Research and Development Group and at Northern Illinois University in the Department of Mathematical Sciences. Dr. Martin has an extensive list of publications and presentations. Most recently, he has chaired NCTM's High School Curriculum Project, which produced *Focus in High School Mathematics: Reasoning and Sense Making*.

Ms. Eileen Murray, Ph.D. student, is 5th year graduate student in mathematics education at the University of Georgia. Her assistantship has her working in an urban middle school supporting the mathematics teachers in their instruction. She taught high school in Atlanta for 5 years before coming to UGA and has masters degrees in mathematics and statistics. Eileen's scholarly interests focus on higher-order thinking in the mathematics classroom, especially in urban settings. She is interested in equity in education and how educators can help engage all students in rich mathematical discussions and investigations.

Dr. Sandra I. Musanti was a postdoctoral fellow of the Center for the Mathematics Education of Latinos/as and is a consultant for the Argentinean Ministry of Education and a visiting professor at the University of San Martin, Buenos Aires, Argentina. Her research interests include teacher education, teacher development and collaboration, and bilingual education.

Dr. Bishnu Naraine completed his PhD in Mathematics Education in 1989 at The Ohio State University. He is currently a Full Professor at St. Cloud State University, Minnesota. He has been at SCSU for 20+ years. Current interests include: teacher education and effective use of technology to enhance teaching and learning of mathematics.

Dr. Donald A. Nelson is a Professor of Mathematics in the Department of Mathematical Sciences at Middle Tennessee State University. He is a graph theorist who has taught nearly all aspects of post secondary mathematics for three decades at public and private universities.

Ms. Wendy O'Hanlon is pursuing her doctorate in mathematics education at Illinois State University. She completed her masters and bachelor degrees at ISU. She has taught high school in Central Illinois but has been a teaching mathematics and mathematics education courses for the last five years at Illinois Central College. She has been involved with both the TSP and the REU Program aiding in the collection, distribution, and analysis of data.

Mrs. Lisa Ross is the project manager of TEAM-Math (Transforming East Alabama Mathematics). She received her BS and Master's degrees in Applied Mathematics from Auburn University. She has taught mathematics at Auburn University and Southern Union State Community College. Lisa resides in Auburn, Alabama with her husband and teenage son.

Dr. Carolyn Simmons-Johnson is an Associate Professor of Mathematics in the Department of Mathematics and Computer Science at Alabama State University. She has been a faculty member at Alabama State University for about sixteen years. Dr. Johnson received her Ph. D. degree in Applied Mathematics from The University of Alabama, Tuscaloosa, Alabama. Currently, she is an undergraduate research adviser for the HBCU-UP Science, Technology, Engineering, and Mathematics (STEM) Program. She has mentored several undergraduate students who have presented their research at local and regional conferences. Dr. Johnson is a member of the Central Community Christian Church, Montgomery, Alabama, where she teaches Sunday School and serves as a trustee.

Dr. Mary Alice Smeal graduated from the University of North Alabama with a Masters of Arts in Mathematics Education in 1996. She taught secondary mathematics for the next ten years. In 2005, she moved to Montgomery, Alabama and entered graduate school at Auburn University in January, 2006. She worked as a graduated assistant during her tenure at Auburn University. Her responsibilities included supervising interns, serving as a liaison for Elmore County and Tallapoosa County in conjunction with TEAM-Math, and presenting for TEAM-Math at the summer institute and quarterly meetings. She earned her Ph.D. in Mathematics Education from Auburn University in December 2009. Dr Smeal is currently in her second year as an assistant professor in Mathematics at Alabama State University. She has been married to Jim Smeal for 30 years, and they have 4 children—James, Joseph, Chris, and Nathan.

Dr. Marilyn Elaine Strutchens is a Distinguished Professor of Mathematics Education in the Department of Curriculum and Teaching at Auburn University, Auburn, Alabama where she serves as coordinator for the secondary mathematics education program and co-director of TEAM-Math (Transforming East Alabama Mathematics). Moreover, Dr. Strutchens was the chair of the Research Committee for the National Council of Teachers of Mathematics (NCTM) for 2007-2008, and she is the series editor for the Association of Mathematics Teacher Educators' Second Monograph Series, 2007 - 2011. Dr. Strutchens served as co-editor for NCTM's 2007 yearbook, entitled *The Learning of Mathematics*: 69th NCTM Yearbook, authored

and co-authored several journal articles, and was the lead editor for the book *Changing the Faces of Mathematics: Perspectives on African Americans*. She is also known for her work in some of the NCTM's Interpretations of the Mathematics Assessment for the National Assessment of Educational Progress Monographs.

Dr. Rozzbeh Vakil completed his Ph. D. in Mathematics in 1992 at Kansas State University. He has taught at the University of Maine in Farmington, Maine and Benedict College, in Columbia South Carolina from 1992 to 2002. Currently, he is a Full Professor at St. Cloud State University, St. Cloud, Minnesota. His Current research interests are: teacher education and infinitesimal analysis.

Dr. Sandra B. Walker is a full professor at Alabama State University where she is chair of the Department of Mathematics and Science. She teaches Finite Mathematics as an online and on-campus course. She has been teaching mathematics at Alabama State University for 17 years. She was employed as a systems programmer, systems designer and systems engineer at IBM for 17.5 years before retiring and becoming an instructor at Alabama State University. Sandra received her Ph.D. from Auburn University in Mathematics Education; her Master of Science degree from Michigan State University in Applied Mathematics; and her Bachelor of Science degree in Applied Mathematics from Alabama State University. She has been married to her college sweetheart for 38 years. She has two children and two grandchildren. She is a minister of the Gospel of Jesus Christ.

Mrs. Judy Welch has been teaching first grade for 28 years. She was on the Blue Ribbon Committee that initiated the Alabama Mathematics, Science, and Technology Initiative (AMSTI). She continues as an AMSTI Trainer in both mathematics and science. In the Transforming East Alabama Mathematics (TEAM-Math) project she has served as District Teacher Leader, Presenter, and member of many committees. She is former President of the East Alabama Council of Teachers of Mathematics (EACTM). She is presently a member of the TEAM-Math Teacher Leader Academy and working toward a PhD in Elementary Education.

Dr. Kathy S. Westbrook returned to school (Auburn) following more than 17 years in the high school classroom and earned her masters in Applied Mathematics and a Ph.D. in mathematics education in 2005. As a graduate student, she was involved with TEAM-Math as the first project manager and worked several summers at the teacher professional development institutes. Dr. Westbrook spent one year as a visiting professor at Columbus State University before moving to Mobile to join the faculty at the University of South Alabama as an assistant professor. At USA, Dr. Westbrook has a joint appointment with the College of Education and the Mathematics/Statistics Department.

Dr. Dorothy Y. White is an Associate Professor of Mathematics Education at the University of Georgia. Her research focuses on equity in mathematics education by examining effective ways to increase the mathematical performance of students of color. In particular, she studies the development of professional learning communities in urban schools, alternative methods for the professional development of teachers, and the preparation of preservice teachers to work in culturally diverse mathematics classrooms. Dr. White is currently PI for Project ISMAC (Improving Students' Mathematics Achievement through a Professional Learning Community), a member of the NCTM Research Committee, and Editor for the Research, Reflection and Practice Department of the journal *Teaching Children Mathematics*.

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