

Research Interests of Serigne Gningue

Lehman College

Dr. Serigne Gningue's scholarship and teaching can best be summarized by the search for equity in mathematics learning, through the teaching of mathematics content and methods, and through professional development beginning with preservice teacher preparation and extending to the development of experienced teachers. He began his career more than 18 years ago, teaching mathematics to middle school students. As his career in teaching developed, he participated in the design of programs meant to address the needs of gifted students and to create avenues for average students in urban settings to further develop their talents. The success of the implementation of the program at his school prompted his school district to have him design the curriculum for an Advanced Mathematics/Science Summer Institute for three years (1996-1998). His role as the curriculum planner and staff developer (training, working, and sharing with teachers of the Institute) set the foundations of his belief that the work he now does as a teacher educator has far reaching implications on the performance and success of school children, even more so than most people believe. Such experiences also made him realize the importance of promoting the use of methods that develop students' critical thinking ability through problem solving, in particular, the development of more effective methods of teaching algebraic concepts to students well before the onset of the high school years.

In the article he co-authored with Lisa Evered (*Developing Mathematical Thinking Using Codes and Ciphers*, 2001), they illustrated an example of how and why teachers must engage their students in non-routine problem solving activities that enrich their mathematical experiences to persuade them that mathematics can be both fun and serious at the same time. In his dissertation (*The Use of Manipulatives in Middle School Algebra: An Application of Dienes' Variability Principles*), and then through a series of articles accepted for publications in the *New York State Mathematics Teacher Journal* and the *International Journal "For the Learning of Mathematics,"* he described how Dienes' and Bruner's theories of mathematics teaching and learning can be applied to introduce algebra to middle school students.

His search for equity in mathematics learning prompted an investigation of a model about ways of developing avenues for mathematical talent in the New York City public schools and in urban settings in general. The grant-supported project focused on one particular middle school whose principal believed in giving opportunities to all of his students, most of whom were minorities or coming from low income families, to learn advanced mathematics. The high school mathematics career of selected students from the middle school who graduated between 1995 and 1999 are analyzed and described. Results obtained strengthen his belief to promote the idea that algebra can and should be taught to all students as a course in 8th grade, and his commitment to support children in urban settings who are historically underrepresented in mathematics and science.

In his current work as Lehman College's Coordinator of the graduate program in Mathematics Education, he has been coordinating the recruitment of mathematics teachers through the Teaching Opportunity Program (TOP), a CUNY scholarship program that recruits and trains change of career people to teach mathematics and science in New York City. His work also focuses on developing coursework, ensuring professional development of teachers through the New York City Mathematics Project (NYCMP), through the Professional Development School (PDS), and mentoring and supervising the large number of new teachers Lehman College has been getting each year through the TOPS and FELLOWS programs.

These experiences have enhanced his teaching and his ability to design effective learning experiences for Lehman's students, and have led to publications and presentations on the creation of PDSs, and on the effectiveness of training teachers to integrate technology in the teaching of mathematics concepts.

For Dr. Gningue, technology and the pedagogical changes resulting from its introduction to the curriculum have a decisive impact on our understanding of what should be included in the mathematics curriculum. For him, mathematics educators have the arduous task of keeping up with the advances and incorporating them into activities and lessons, and of influencing decision makers to invest in computing technology and in the training of teachers, especially in urban settings. That's why Dr. Gningue developed a course that looks at the issue in technology education and that uses technology as a means to develop concepts or to enhance the mathematics we teach.

Dr. Gningue's experience working with middle school students, and the large number of studies that have shown an inequitable distribution of course taking among high school students that favor racial/ethnic groups other than Blacks/Hispanics have been the driving force behind his current work. He wants to contribute to the elimination of the achievement gap in high school between majority and minority students. He is developing and testing a manipulatives-based algebra curriculum for use in urban sixth and seventh grades to enable the introduction of algebra as a course in 8th grade. Blacks and Hispanics, mostly schooled in large urban public school districts which are more difficult to run and manage, often feel the consequences of their districts' lack of qualified teachers and inadequate resources and articulation for offering an algebra course to all its students before ninth grade. In contrast, the more affluent suburban districts usually offer an algebra course in eighth grade to all its students. According to Dorsey et al. (1994), the key to narrowing the differences of achievement between majority and minority students resides at the middle school level. The earlier students in middle school take their first-year algebra, the higher their overall mathematics proficiency by the time they reach Grade 12. Results from his grant-funded study, which analyzed the high school mathematical career of selected middle school students who were offered an algebra course in eighth grade, confirm such findings. The results have also led to a second funded study whose goal is to investigate the effectiveness of a program he designed which offers first-year algebra to average eighth grade students. The project (1) offers a manipulatives- and problem solving-based algebra after-school program for average and below-average Grade 7 students, (2) provides staff development in both

Mathematics Teaching-Research Journal On-Line

A peer-reviewed scholarly journal

Editors: Bronislaw Czarnocha (Hostos Community College)

Vrunda Prabhu (Bronx Community College)

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City University of New York

Volume 2

Date March 5 2007

content and pedagogy in the teaching of algebra in Grade 7 to middle school mathematics teachers, (3) places participating students into accelerated Regents-level eighth grade mathematics classes the following year, and (4) tracks participating students' mathematics career in high school. He expects results to perhaps enable him to determine whether providing average seventh grade students with a carefully designed environment for developmental trajectories of learning from the concrete, visual instances of algebraic concepts to their abstract and formal expressions (through an application of Dienes' and Bruner's learning theories) will develop their "intuitive" assumptions about the unfamiliar notation system into algebraic proficiency. The culmination of this project should result in a publication of algebra textbooks for use in the middle grades.

In his pursuit of equity in mathematics learning in the city of New York, Dr. Gningue has also participated in the New York City Department of Education Mathematics Advisory Panel chaired by Dr. Uri Treisman, Professor of Mathematics at the University of Texas and Director of the Charles A. Dana Center who was appointed by Chancellor Klein. The goal of the Panel was to provide advice and to support the City's ongoing mathematics initiative. He continues to be committed to preparing urban teachers who teach in ways that reflect a commitment to the well-being and learning of all students, by engaging teachers in activities that help them understand how school children differ in their approaches to learning, how to create instructional opportunities that are adapted to diverse learners, how to use a variety of instructional strategies that encourage students' development of critical thinking, problem solving, and performance skills.