Recent innovations in computer-human interfaces -- including tangible interfaces, ubiquitous computing, and virtual reality -- have greatly expanded the realm of possible applications for computers. Employing these interfaces, computers can respond to people's natural actions within an environment, such as building with blocks, playing with 3D puzzles, or dancing on a stage. These innovations also make it possible for more than one person to interact with a computer at a time, paving the way for more collaborative group activities. Furthermore, these alternative approaches to computer-human interaction can make computers more accessible to people who may have difficulty with the more traditional interfaces.

This effort takes these recent innovations and applies them to an area of great national importance: math and science education. The Principal Investigator's ongoing research work -- supported by an NSF CAREER grant -- has demonstrated that tangible interfaces can enhance the educational experience of playing with mathematical puzzles in a group. With the proposed effort, undergraduate computer science students will learn how to design and develop applications using innovative approaches to computer-human interaction. They will then have the opportunity to apply these skills by collaborating with education students in another course, producing novel educational applications. The resulting applications will be installed in three public facilities: Stony Brook's Center for Excellence in Learning and Teaching, the New York Hall of Science, and the Goudreau Museum of Mathematics in Art and Science. There, students will have the opportunity to participate in ongoing research by evaluating the efficacy of their educational applications.

A multidisciplinary team from Brooklyn College (CUNY) and Stony Brook University (SUNY) offers expertise in computer science, multimedia, educational technology, educational assessment, and math and science education. This combined research curriculum development effort will yield the following benefits:

- The courses taught during the proposed period will impact a broad range of students: computer science and education students (many of whom are already working in our public schools), from both the inner-city (Brooklyn College) and suburban regions (Stony Brook), with a wide variety of ethnic backgrounds. Students at both colleges are primarily from the middle or lower economic classes. Internships at nearby math and science museums will give students in the program the opportunity to participate in research while earning extra money that they so desperately need.

- Computer science students will (a) learn about state-of-the-art research advances in the area of computer-human interfaces, (b) apply these technologies to educational applications while collaborating with educators, and (c) participate in research examining the results of their efforts.

- Students and teachers concentrating in math/science education will (a) learn how recent research advances in the area of computer-human interfaces can be used to enhance education, (b) collaborate with computer science students to produce novel educational applications, and (c) evaluate their applications in real-world settings.

- Student projects, installed at the Center for Excellence in Learning and Teaching, the New York Hall of Science, and the Goudreau Museum of Mathematics in Art and Science, will provide learning opportunities and inspiration to a wider audience including both students and educators. Two workshops, held at the Center for Excellence in Learning and Teaching, will help to further disseminate the findings of this project among the community of educators.

- Children in grades K-12, both in Brooklyn and Long Island, may also reap the benefits of this technology in their classrooms, where teachers (who have taken the proposed courses) present their own educational applications employing innovative computer interfaces.

- A new textbook, with supplementary materials available online, will enable others to teach these courses at their institutions. Educational applications utilizing innovative computer interfaces may then become the tools of an even greater pool of educators and students.