

TUFTS Education News

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Analúcia Schliemann

Algebra for Everyone

IT'S IOAM IN CANDACE CHICK'S 4TH GRADE CLASS AT THE Samuel Mason School in Roxbury, MA, and her students have money on their minds. As part of their bi-weekly visit from the Early Algebra Project, the students have been asked to graph the amount of money that two individuals, "Mike" and "Robin," have in their possession. To find the answers they are seeking, the students have been given a table listing the amount of money each person has and a graph to plot their findings. As the children commit their pencils to paper and some look quizzically at the graphs before them, it becomes clear that this assignment isn't just about money. It's about algebra, too.

The Early Algebra Project involves members of TERC, a non-profit education research and development organization, and professors and graduate students from the Tufts Department of Education. With the

support of a National Science Foundation (NSF) grant of just under one and a half million dollars, the project is aiming to show that early experience in algebra can help children from ages 8-10 learn concepts and develop tools that will aid their

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ANALÚCIA SCHLIEMANN

future work in mathematics. In addition, the project also hopes to inform teachers, researchers, parents, curriculum developers, policy makers and administrators about the positive benefits of early exposure to algebra.

While the project has focused much of its current work on a single school, Samuel Mason (after previous studies at the East Somerville Community School), project members believe their findings can be shared with a wide audience. Some of these findings include, as published in papers like "Algebra in Elementary School" and "Ten-Year-Old Students Solving Linear Equations," that kids age 8-10 can use algebraic notations effectively, that their use of these notations serves as an important tool to recognize general mathematical relations, and that children can develop and understand function graphs.

As part of their mission to spread the word, Principal Investigator David Carraher from TERC and education professors Analúcia Schliemann, who is also the co-principal investigator of the project, and Bárbara Brizuela have been busy. Together, they have a book in press (*Bringing Out the Algebraic Character of Arithmetic: From Children's Ideas to Classroom Practice*) and have collaborated on a series of papers. They have also committed their work to compact discs. These CD's contain every-

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Making History: The Tufts Project LOCAL Program

DANIEL COGAN-DREW, DIRECTOR OF THE Curriculum Resource Center (CRC), has seen a little bit of everything. As a humanities instructor for the Navy, he witnessed a group of officers rise to attention each time he entered a room. Through his work with Upward Bound, he observed the determination of students who were the first in their families to attend college. At Tufts, Cogan-Drew has witnessed another unique occurrence—the development of an innovative professional development program, Project LOCAL (Learning Our Community's American Lore).



Daniel Cogan-Drew (left) working with a student at the CRC.

Project LOCAL was created in 2004 with the help of a 3-year, \$914,000 grant from the U.S. Department of Education and the input of several education professionals, including Cogan-Drew, Department of Education Lecturer Steve Cohen, former Massachusetts Teacher of the Year Steven Levy, Calvin Carpenter of the Medford Public Schools, Joe Burke of the Somerville Public Schools, Robert McGreevey, a graduate student in American history at Brandeis University, and the Shore Educational Collaborative of Chelsea, MA. Together, this group has worked with school districts in Everett, Medford, Revere, Somerville, and Winthrop to address the teaching of history at the elementary and high school levels.

In many schools across the country, history is taught in the “traditional method.” In short, teachers focus on facts and dates that do little to spark student interest. Project LOCAL hopes to change this educational process by helping teachers and students become connected to the history of their local communities through a process dubbed “doing history.”

“The idea of ‘doing history’ really stems from the way historians approach their craft,” says Cogan-Drew, who is also an education graduate student. “It’s thinking about the practice of historians doing research, analyzing different perspectives, making connections, identifying themes and then presenting that work.” Cogan-Drew and his colleagues hope that students in each of the participating districts will adopt this method when approaching subjects of historical significance. Once they do, the Project LOCAL team believes they will be transformed into active, engaged learners. But first, the project is educating teachers on what “doing history” is and how it can be applied in the classroom.

Last fall, Project LOCAL welcomed its first twenty-five elementary and high school teachers into the program. The teachers were required to attend a series of professional development workshops which gave them a chance to share what they knew about “doing history” and hear what Tufts professors Evan Haefeli and David Guss, of the history and anthropology departments, respectively, had to say about their own process. During the workshops, the attendees visited historical sites, learned more about ongoing history projects (e.g., the “Lost Theatres of Somerville” project), reflected on the local history of their communities, discussed the role of local historians/historical societies, and received feedback from their fellow teachers.

The project’s work continued during the spring. The participating teachers were required to develop their own “doing history” projects to share with their students. During these exercises, the teachers were videotaped and, later, wrote about the experience. Both the video footage and text are currently being combined to form a series of videopapers. “One of the great advantages of the videopaper medium is that you can combine video and text,” says Cogan-Drew. “The teachers, when they convey the classroom reality, can write and reflect on what they see happening with their students’ learning and how this project might work for another teacher. We’ll be creating video-based teaching cases with each of the participating teachers, and as many as seventy-five cases will be produced over the three years of the project.” When the cases are completed, they will be added to the Project LOCAL website and will remain there for the next six years to be viewed by history teachers from the five districts.

Project LOCAL is developing a new set of programs for its fall 2005 class. By the end of the grant, the program will have worked with approximately 75% of the American history teachers in each district, thus impacting the education of an estimated 4,800 students (964 per district).

To learn more about Project LOCAL, contact Daniel Cogan-Drew at 617-627-4764 or go to <http://ase.tufts.edu/local/>.

Science Sense: New Tufts Program Works to Improve Science Education

JUDAH SCHWARTZ, A VISITING education professor, is as surprised as anyone to be occupying an office within Paige Hall, home of the Tufts Department of Education. Just a year and a half ago, he was settling into retirement from his professorship at the Harvard University Graduate School of Education. During this time, he spent his days pursuing his artistic interests, working on the *New York Times* crossword puzzle, and playing with his grandchildren. The retirement of Professor Schwartz came to an end due to an opportunity within the Department of Education. "I'm at Tufts because I'm a failed retiree," he says, laughing. "I was going to retire but it turned out that a science education position was open

at the university. Someone had taken the position but turned it down at the last minute and I offered to fill-in for a year. It was during the course of this year that I was asked to sit in on some meetings and to help put together a grant. The rest is history as they say."

The "rest" Professor Schwartz refers to covers quite a bit. Shortly after submitting the grant to the National Science Foundation (NSF), Schwartz and his colleagues—including Co-Principal Investigators Dr. Joan Connolly, superintendent of the Malden Public Schools, and Dr. Susan Doubler, project director at TERC—received some good news. The NSF, as part of their Math and Science Partnership (MSP) program, had awarded them a



Judah Schwartz

"As teachers get excited over the experiments, they explore other areas, ask questions, and take the questioning to different levels. That's what being a scientist means and that's what we want students to feel, know, and do!"

KAREN SONNER,

Fulcrum Institute student and teacher at the Merriam School in Acton



Fulcrum Institute students at work on an inquiry-based learning activity.

5-year grant of just under 5 million dollars to create the Fulcrum Institute at Tufts. The goal of the institute is to design a two-year graduate program of study for Massachusetts elementary and middle school science teachers who both wish to understand science more deeply and hope to promote inquiry-based learning in their classrooms and schools.

Once funding was in place, the institute began developing a set of online courses and face-to-face workshops for participating teachers, who gain graduate credit as they move through the program. Thirty-five teachers from schools in Acton, Boston, Lowell, Malden, and Natick enrolled in the institute in January and are currently taking its first course, which explores physics through the study of a glass of water. The swiftness in which the institute was able to launch the first online course was due in large part to the contributions of the TERC development team, who had previously undertaken pioneering work with Lesley University in developing the "Try Science" online course for teachers.

As participants in the first course, students are engaging in investigation and exploring how scientific inquiry supports the learning of teachers, students, and scientists. And while the course is featured online, much of the work for it takes place away from a computer.

"What I had forgotten, but was reminded of by the Fulcrum Institute ses-

sions, is that sometimes you have to allow further exploration on some experiments so that the students can wrap their own experiences around the knowledge,” says Karen Sonner, a Fulcrum Institute student and teacher at the Merriam School in Acton. “As teachers get excited over the experiments, they explore other areas, ask questions, and take the questioning to different levels. That’s what being a scientist means and that’s what we want students to feel, know, and do!”

“...normally science is not something that teachers are trained in and explicitly prepared to teach unless they are teaching at the secondary level. What we are trying to do is a departure from normal practice.”

PROFESSOR JUDAH SCHWARTZ

As the program continues into the summer and fall, institute members will be taking an even closer look at water.

Professor Schwartz, who also taught at the Massachusetts Institute of Technology (MIT) during his teaching career, believes the institute can have an impact on many different levels. “A lot of the visible outcomes of the institute have to do with, at least as far as the university is concerned, changing the way Tufts thinks of preparing elementary and middle school teachers in the area of science, and to present something of a model of how other schools or departments of education might do the same sort of thing. Part of the reason this is important is that normally science is not something that teachers are trained in and explicitly prepared to teach unless they are teaching at the secondary level. What we are trying to do is a departure from normal practice.”

While the first Fulcrum students are enrolled and flourishing, Professor Schwartz and his colleagues are looking at ways to enhance the program by drawing upon the resources of the Department of Education. One possible addition to the institute may involve the participation of graduate students. “The overwhelming likelihood is that graduate students with a strong science background, such as those in the Mathematics, Science, Technology, and Engineering (MSTE) education program, will serve as mentors in the online capacity and possibly as facilitators of discussions,” says Schwartz, who is also the author or co-author of several software environments including “The Semantic Calculator,” “The Newtonian Sandbox,” “Calculus Unlimited,” and the “Geometric Supposer.” “The graduate students will also help in the research, going into the classrooms of the teachers and videotaping teacher/student interactions. In all likelihood, graduate students will also get involved in the interpretation of video data. So, there are a variety of ways that graduate students will be involved.”

For information on the Fulcrum Institute and how to apply, go to <http://fulcrum.tufts.edu/> or call 617-627-3039.

Message from the Chair

A Commitment to Improving Teaching and Learning in the Public Schools

This has been an exciting year for the Department of Education. The master’s and Ph.D. students in our new Mathematics, Science, Technology and Engineering (MSTE) education program are completing their first full year of work. These students have brought their energy and commitment to the department as they participate in ongoing projects and begin to formulate their own research agendas.

The active engagement of the faculty is expressed in a number of new and continuing research projects, a few

of which are covered in this newsletter. We are particularly excited by the establishment of the Fulcrum Institute under the direction of Professor Judah Schwartz (see pages 3 and 4). The institute, dedicated to the development of innovative approaches



Kathleen Weiler

to science teaching, is being supported by a multi-year National Science Foundation (NSF) grant of just under 5 million dollars. As is true of the MSTE and other departmental programs, the work of the institute brings together professors and graduate students from across the university to work toward the advancement of science teaching.

While initiatives like the Fulcrum Institute, Project LOCAL, and the NSF-funded Early Algebra Project differ in terms of subject areas covered, their practical commitment to improving teaching and learning in the public schools is a common goal. We hope this newsletter communicates some of the excitement and energy of these programs. To learn more about the department’s offerings and activities, visit our website at: <http://ase.tufts.edu/education/>.

Exploring the Potential of Children

A FEW YEARS AGO, THE DESKS AND CHALKBOARD located in Mary McClellan's 7th grade classroom at the East Somerville Community School disappeared. The students remained, though, stranded on a deserted island that had formerly been their classroom. As the story goes, the children had been traveling to visit the New Zealand shooting location of *The Lord of the Rings* when their plane crashed into the ocean. The twenty students swam for a time and eventually reached the shore of a nearby island. Although they had little in the way of material possessions and no idea where they were, the marooned students did have a couple of invaluable tools at their disposal—namely, math and engineering.

The scenario above was presented to a group of students in Mary McClellan's class as part of the Tufts Building Math project. The project is a three-year, \$360,000 GE Foundation funded initiative aimed at, as the project's website states, developing "innovative practices for integrating engineering with math into classrooms." Bárbara Brizuela, co-principal investigator of the project and assistant professor in the Department of Education, helped develop the curriculum and visits the four participating Massachusetts schools in Lynn, Malden, and Somerville (East and West) regularly to engage students in these areas. "We're trying to create meaningful contexts in which kids can get a hold of algebra and engineering," says Brizuela, who is joined in this effort by Program Coordinator Lori Weiss and Co-Principal Investigator Peter Wong of the Tufts Department of Mechanical Engineering. "The students who were part of this assignment had to figure out where they were located, what was the probability they were on one island versus another, what were the climatic conditions, and what kinds of constructions they had to make to help them survive. They had to take hold of all the resources they had. They had to write, count, calculate, and build things. The way I see it, a project like this is emulating what real life is."

While the lives of the students who are part of the Building Math initiative is one of disaster averted, albeit under imaginary situations (another assignment involved an expedition into the Amazon), the life of Professor Brizuela is about movement. Each week, as a member of three different research groups and a full-time professor, Brizuela shuttles herself back and forth from Tufts to elementary and middle schools in the area. The goals of these trips are to both introduce the novel classroom sit-

uations mentioned previously and to demonstrate the capacity that students, especially children, have to understand and master complex mathematical concepts. This mastery is covered extensively in Brizuela's recent book, *Mathematical Development in Young Children: Exploring Notations*. In it, Brizuela uncovered how a group of young children understood and constructed new meanings out of mathematical concepts like written numbers, tables, graphs, and number lines. For example, the reader witnesses the strides of a kindergarten student named Paula who

invents "capital numbers" to better understand two digit numbers (Chapter 3) and the process elementary students go through when asked to create tables of numeric data (Chapter 6).

The examples provided in the book serve as proof that children can do more than many people think. "One of my goals is for parents, teachers, and researchers not to underestimate the capacity that children have to learn," says Brizuela, whose research activities also include the Tufts Early Algebra Project and a mapping project carried out at the AMIGOS

school in Cambridge, MA. "There's a constant watering down of what we expose kids to in math, but kids have very sophisticated ideas about written numbers and mathematical representations. These representations give us access to many of their understandings."

Brizuela's book is also unique for what it doesn't include, specifically volumes of statistical data and charts. Instead, Brizuela focuses very closely on a few children as she strives to understand the many different ways they learn and understand. "I think there is a drive, in general, in education research that there needs to be more kids and bigger samples," she says. "Can these [findings] be generalized? I find that kind of research much less helpful than going in depth with fewer kids and being able to tell a story. I listen very closely to learners. I interview them. I work with them and try to figure out what they are thinking and understanding."

It's safe to say that the impact of Bárbara Brizuela's work will spread even further in the coming years. In addition to her teaching and research, she is in the process of co-writing two books, co-editing another, and developing a new multimedia project to further represent her research findings.

To learn more about Professor Bárbara Brizuela's work, go to <http://ase.tufts.edu/education/faculty/brizuela.asp>.



Bárbara Brizuela



A student at Samuel Mason explains his graph.

CONTINUED FROM PAGE ONE

thing from lesson plans to papers to videos chronicling class assignments with titles such as: “The Candy Boxes” and “Piggy Bank.” “We are trying to get the word out about early algebra with the disks,” says Schliemann. “The idea is to have them available for teachers if they want to see what we do and how to implement the lessons in their classrooms.”

The Early Algebra Project is also confronting the stereotype that kids, especially those in urban schools, cannot handle the rigors of algebra. During an interview in her office, Schliemann shared what often happens

when she and her colleagues present their research results, from both the East Somerville Community School and Samuel Mason, at conferences and other professional gatherings. “We were getting ready to give a presentation at the annual meeting of the National Council of Teachers of Mathematics when someone asked: ‘So, you are doing this in a school for gifted children?’ and we said, ‘No, we are doing this in a school where some people think the kids have no gifts.’ We really want to show that algebra is something that can and should become part of the elementary school curriculum, even when the conditions seem to be so much more difficult,” says Schliemann. “Many of the kids we have been working with don’t have someone at home to follow up with their homework and we know that some of them are recent immigrants and have trouble with English. These kids are coming into a new world at these schools, and that is where we want to make a difference.”

Other members of the Early Algebra Project include: TERC’s Darrell Earnest, Anne Goodrow of Rhode Island College, and Mara Martinez, Gabrielle Cayton, and Camille Burnett, graduate students in the Mathematics, Science, Technology, and Engineering (MSTE) education program at Tufts. To learn more about the Early Algebra Project, go to www.earlyalgebra.terc.edu/ or call 617-547-0430.

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EDITOR Robert Bochnak

PHOTOS Robert Bochnak

Daniel Cogan-Drew

Kathleen Dooher

DESIGN RelishDesignBoston

For more information, call 617-627-3244
or fax 617-627-3901

We’d like to hear from you. If there are issues you would like to see covered, a faculty member you’d like to see profiled, or have news to share with fellow education alumni, contact Patricia Romeo at: Department of Education, Tufts University, Paige Hall, Medford, MA 02155 or e-mail patricia.romeo@tufts.edu.

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