

CALIFORNIA Algebra Forum II

A Continuing Focus on Algebra Research



$$\frac{dx}{\sqrt{1-x^2}} = \frac{dx}{2\sqrt{x^3+1} + \sqrt{x^2}} = \left[\frac{\sqrt{x^3+1} - E}{dx \cdot 6b^5 dt} \right] = \frac{6t^5}{t^3+k^2}$$
$$\frac{6t^5}{E} = \int \left(\frac{t^3+1}{b-1} - \frac{1}{t+1} \right) dt = 6 \left(t^2 \cdot t \cdot \frac{1}{t} - \frac{1}{t} \right) dt$$
$$6 \left[\frac{t^3+1}{2} + E - Cn |E+A| \right] + C =$$
$$6 \left[\frac{t^3+1}{2} + \sqrt{x} \cdot \ln |\sqrt{x} - 1| \right] + C$$



WESTIN SAN FRANCISCO AIRPORT OCTOBER 13-15, 2008 MILLBRAE, CALIFORNIA

A Collaborative Project of the California Department of Education, the Curriculum and Instruction Steering Committee of the California County Superintendents Educational Services Association, and the California Comprehensive Center at WestEd

California Algebra Forum II

A Continuing Focus on Algebra Research

WELCOME

The 2008 California Algebra Forum II is an opportunity to learn from leading state and national mathematicians and mathematics educators, share knowledge of current research that supports success in algebra, discuss the recent state board of education algebra mandate, and communicate and reflect upon the findings of the National Mathematics Advisory Panel Report. During this forum, regional teams will showcase their efforts, share exemplary practices, and network within and across regional teams.

The purpose of the California Algebra Forum is to build a clear, cohesive and consistent vision for mathematics in California by expanding the expertise and capacity of the state's technical assistance providers to deliver statewide and regional support in their efforts to improve student achievement in mathematics, develop mathematical proficiency for all students and ensure success in algebra for all students.

Forum participants, as members of regional teams, represent a range of perspectives that includes pre-K through higher education educators. Over the last eighteen months, regional teams have regularly convened and collaborated to use the knowledge and research gained from Algebra Forum I to inform, plan and implement projects focused on specific needs within their regions. Team members have served as leaders and organized technical assistance. Thank you to each of you for your hard work and continuous efforts!

The goals of the Algebra Forum II are to:

- Share knowledge of current research that supports success in algebra
- Provide continuing support and resources for the statewide network of technical assistance providers
- Support the development of Mathematical Proficiency for all students
- Share final findings of the National Math Panel and set the stage for the 2010 Algebra Forum.

We want to thank you for the commitment you have made to this forum and the continuing work: attending pre-conference meetings, reading research, planning regional projects, preparing for post-conference events, and agreeing to share your learning with organizations, networks, schools and districts.

SPONSORS

California Department of Education

Curriculum and Instruction Steering Committee of the California County Superintendents
Educational Services Association

California Comprehensive Center at WestEd

ALGEBRA FORUM II

SCHEDULE

Monday, October 13

- 1:00-2:00pm **Registration**
- 2:00-2:10pm **Welcome**
Henry Mothner, Director, Curriculum and Instruction Steering Committee (CISC)
Phil Lafontaine, Director, California Department of Education
Fred Tempes, Director, California Comprehensive Center at WestEd
- 2:10-2:20pm **Program Overview, Goals of Forum, Define Call to Action with Puzzle Activity**
- Regional Share Out**
Linda Menvielle and Cathy Carroll,
Algebra Forum Leadership Committee
- 2:20-2:40pm **State Vision**
Phil Lafontaine, California Department of Education
- 2:40-3:00pm **Table and Regional Responses**
- 3:15-4:15pm **Keynote: Mathematics as sense-making, with a focus on Algebra**
Alan H. Schoenfeld, University of California, Berkeley
- 4:30-6:30pm **Regional Showcase, Networking and Overview for Day 2**

Tuesday, October 14

- 7:00-8:30am **Continental Breakfast and Registration**
- 8:30-8:45am **Welcome**
- 8:45-10:00am Findings and Recommendations of the National Mathematics Advisory Panel
Larry R. Faulkner, Chair, National Mathematics Advisory Panel,
President of Houston Endowment
- 10:00-10:15am **Question and Answer Session**
- 10:15-10:30am **Break**
- 10:30-11:30am **Learning Arithmetic as a Foundation for Learning Algebra**
Thomas Carpenter, University of Wisconsin-Madison
- 11:30-11:45am **Question and Answer Session**
- 11:45-12:00pm **State Address**
Jack O'Connell, State Superintendent of Public Instruction

ALGEBRA FORUM II

SCHEDULE

Tuesday, October 14 *(continued)*

12:00-12:45pm	Lunch
12:45-1:45pm	Secrets of the Algebra Game: Generalizability and Equivalence <i>Carolyn Kieran, Université du Québec à Montréal</i>
1:45-2:00pm	Question and Answer Session
2:00-2:15pm	Break
2:15-3:15pm	Applying Research-Based Principles for Effective Teaching to Algebra Classrooms <i>James Hiebert, University of Delaware</i>
3:15-3:30pm	Question and Answer Session
3:30-4:15pm	Call to Action and Mixed Regional Time
4:15-5:15pm	Reflections and Moderated Panel
5:15-5:30pm	Closing and Overview for Day 3

Wednesday, October 15

7:00-8:30am	Continental Breakfast
8:30-8:45am	Welcome
8:45-10:00am	Beyond Words: Language(s) and Learning Mathematics <i>Judit Moschkovich, University of California, Santa Cruz, with Q&A Session</i>
10:00-10:15am	Break
10:15-11:45am	The Algebra Crisis <i>Philip Daro, America's Choice and David Foster, Robert N. Noyce Foundation, with Q&A Session</i>
11:45-1:15pm	Lunch
1:15-1:45pm	Regional Teams Puzzle Activity
1:45-2:30pm	Panel focusing on Call to Action
2:30-2:45pm	Puzzle Activity and Sharing Findings
2:45-3:00pm	Next Steps and Closing

Monday, Oct 13**Alan H. Schoenfeld*****Mathematics as sense-making, with a focus on Algebra***

Part of the reason that mathematics seems so hard to so many people is that mathematical rules and procedures seem to come “out of the blue.” I’ll address the fundamental importance of viewing all of mathematics (including algebra) as a sense-making activity. I’ll discuss the need to teach for understanding, with a focus on “big ideas” and a balance of concepts, problem solving, and procedures, and evidence that doing so results in improved student performance. Then, I’ll explain why some of the things that seem so straightforward to us, such as word problems, are actually much more difficult than they seem.

Tuesday, Oct 14**Larry R. Faulkner*****Findings and Recommendations of the National Mathematics Advisory Panel***

The National Mathematics Advisory Panel was established by presidential executive order in April 2006 to make recommendations, on “the best available scientific evidence,” toward improved achievement among American students, especially with respect to preparation for algebra. The Panel embodied full spectra of both philosophy and expertise and had access to unprecedented resources. In March 2008, the Panel’s unanimously adopted report was released to the public. It contains 45 major findings and recommendations. This presentation will cover the most significant messages from the Panel and will allow time for questions from the audience.

Thomas Carpenter***Learning Arithmetic as a Foundation for Learning Algebra***

The artificial separation of arithmetic and algebra deprives students of powerful ways of thinking about mathematics in the early grades and makes it more difficult for them to learn algebra in the later grades. Rather than teaching algebra procedures to elementary school children, our goal is to support them to develop ways of thinking about arithmetic that are more consistent with the ways that students have to think to learn algebra successfully.

Carolyn Kieran***Secrets of the Algebra Game: Generalizability and Equivalence***

Many students arrive at the end of their first algebra course never having quite figured out what the course was all about! They may have solved many real-world problems by a variety of methods and representations – tables of values, graphs, maybe even equations; but they sensed that the problem question was often not the real question, nor the problem answer the real answer. This presentation looks at some of the elusive aspects of school algebra that rarely become articulated in the algebra class. Some of these “secrets” involve seeing sequences of problem-solving operations in a general way, abstracting and representing general relationships based on multiple examples that embody a given phenomenon, and being aware of the role played by equivalence/non-equivalence in making sense of and coordinating these various algebraic objects and their transformations.

Tuesday, Oct 14**James Hiebert*****Applying Research-Based Principles for Effective Teaching to Algebra Classrooms***

Teaching is the pathway through which all our efforts to improve algebra learning reach the students. How can we improve our teaching to enrich the opportunities for students' learning? Research points to several features of teaching that support conceptual understanding and procedural fluency, documents the need for incorporating these features into U.S. classroom instruction, and reveals the school environments in which these kinds of instructional improvements can develop.

Wednesday, Oct 15**Judit Moschkovich*****Beyond Words: Language(s) and Learning Mathematics***

This presentation summarizes my research on language(s) and learning mathematics. Drawing on reviews of the research literature and examples from classroom video data, I address claims and questions about language(s) and learning mathematics that are relevant to both research and practice, in particular for students who are bilingual or English Learners. I consider the following questions:

- What are common language practices in mathematics classrooms among students who are bilingual or learning English?
- What are mathematical discourse practices? How is mathematical discourse more than words?
- What resources do bilingual learners use to communicate mathematically? How can instruction build on these resources?

Philip Daro and David Foster***The Algebra Crisis***

The California State Board of Education, following the Governor's lead, has raised the mathematical bar for students in the state. The new policy comes at a time when schools are already struggling, with mixed success, to meet the needs of an ever-increasing student population in algebra. There aren't any silver bullets or easy remedies for this challenge, but we do know from research and experience what it does take to significantly increase the achievement of students in mathematics. This presentation will share lessons learned and successes from a decade long math initiative of school districts in the Bay Area. We will share information about high leveraged assessments, intensive professional development and support strategies for struggling students.

Jack O'Connell

Jack O'Connell, as chief of California's public school system and leader of the California Department of Education, has focused on closing the achievement gap and preparing students for a rapidly changing global economy by holding high standards for all students.

He is a strong supporter and facilitator of partnerships between schools, businesses, communities, and philanthropies in order to engage students with challenging, real-world education experiences. Throughout his career, Superintendent O'Connell has worked to improve public education in California. As the author of numerous landmark education bills in both the California Assembly and the State Senate, he made quality education his number one priority. This commitment to the children of California earned Superintendent O'Connell the praise and the respect of colleagues and educators statewide.



vost. From 1998 into 2006, he served the University of Texas as its 27th president. He is a member of the American Academy of Arts and Sciences and recently chaired the National Mathematics Advisory Panel. He now serves on the boards of Exxon Mobil, Guaranty Financial Group, and Temple-Inland, and was previously on the boards of Sandia National Laboratories and Internet2.

Thomas Carpenter

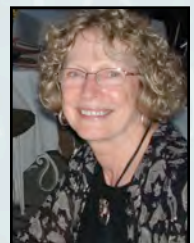
Thomas Carpenter is Emeritus Professor of Curriculum and Instruction (Mathematics Education) at the University of Wisconsin-Madison and Director of Diversity in Mathematics Education Center for Learning and Teaching. He served as Director of the National Center for Improving Student Learning and Achievement in Mathematics and Science and as editor of the *Journal for Research in Mathematics Education*. His research integrates the study of the development of children's mathematical thinking, instruction that supports that development, and professional development that fosters instruction that leads to learning with understanding. His recent research focuses on the development of algebraic thinking in the elementary school, in particular the development of relational thinking, generalization, mathematical representations, and proof.

**Alan H. Schoenfeld**

Alan Schoenfeld is the Elizabeth and Edward Conner Professor of Education and Affiliated Professor of Mathematics at the University of California at Berkeley. He is a Fellow of the American Association for the Advancement of Science and the American Educational Research Association (AERA), and a Laureate of Kappa Delta Pi. He has served as AERA President and as National Academy of Education vice president. He was recently given the Senior Scholar Award by AERA's Special Interest Group for Research in Mathematics Education. Schoenfeld was one of the authors of the 1992 California mathematics Framework and of NCTM's Principles and Standards for School Mathematics.

**Carolyn Kieran**

Carolyn Kieran is Professor of Mathematics Education at the Université du Québec à Montréal, where she has been a faculty member of the Department of Mathematics since 1983. She is also the Director of the Algebra in Partnership with Technology (APT) research group. She served as President of the International Group for the Psychology of Mathematics Education (PME) from 1992 to 1995 and as a Director of the National Council of Teachers of Mathematics, 2001-2004. Among her more than 250 publications related to research on the learning and teaching of algebra are chapters in the recently published *Second Handbook of Research on Mathematics Teaching and Learning* and the *Handbook of Research on the Psychology of Mathematics Education*.

**Larry R. Faulkner**

Larry R. Faulkner is President of Houston Endowment, a private philanthropy established by Jesse H. and Mary Gibbs Jones. He is also President Emeritus of The University of Texas at Austin. Dr. Faulkner served on the chemistry faculties of Harvard University, the University of Illinois, and the University of Texas. At Illinois, he was also department head, dean, and pro-



James Hiebert

James Hiebert is the Robert J. Barkley Professor of Mathematics Education at the University of Delaware. He has co-authored *Making Sense* and *The Teaching Gap*, and recently served as Director of the mathematics portion of the TIMSS-R Video Study. He is a former high school algebra teacher.

**Judit Moschkovich**

Judit Moschkovich is Associate Professor, Mathematics Education, University of California Santa Cruz. Her research focuses on socio-cultural approaches to mathematical thinking and learning. She has developed a research agenda in three main areas: a) the transition from arithmetic to algebraic thinking, especially how students understand functions, b) discourse in mathematics classrooms, and c) bilingual mathematics learners. Her research has examined student understanding of algebraic and graphical representations of functions, discourse practices in mathematics classrooms and everyday settings, and the relationship between learning mathematics and language(s). Her current research examines how middle-school Latino students participate in mathematical discussions about representations of everyday motion. She was the Principal Investigator of a National Science Foundation project (1998-2003) titled "Mathematical discourse in bilingual settings: Learning mathematics in two languages" and is currently a PI for a CLT (Center for Learning and Teaching) funded by NSF (2004-2009), the Center for the Mathematics Education of Latinos (CEMELA).

**Philip Daro**

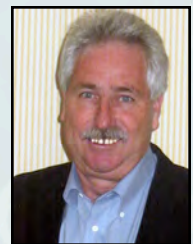
Currently, Philip Daro is a Senior Fellow for Mathematics for America's Choice where he focuses on programs for students who are behind and algebra for all; he also directs the partnership of University of California, Stanford and others with San Francisco Unified School District for the Strategic Education Research Partnership (SERP), with a focus on mathematics and science learning among stu-



dents learning English or developing academic English, develops research agenda and projects that address priorities identified in the school district. He has directed, advised and consulted to a range of mathematics education projects. The most extensive and intensive engagements include NAEP Validity studies, ACHIEVE, FAM (Foundations of Mathematics) program development for America's Choice, Balanced Assessment Project (co – Director), Mathematics Assessment Resources (MARS), the El Paso Collaborative (consultant), Pittsburgh School District, Los Angeles USD, New York City Board of Education, the state of Georgia, and the New Standards Project. From the mid-'80s until the '90s, Phil was the state Director of the California Mathematics Project for the University of California. He has also worked with reading and literacy experts and panels on problems related to academic language development, especially in mathematics classroom discourse.

David Foster

David Foster is the mathematics director of the Robert N. Noyce Foundation. He oversees and directs the Silicon Valley Mathematics Initiative comprised of 43 member districts in the Bay Area. He is the primary author of *Interactive Mathematics: Activities and Investigations*, Glencoe/McGraw-Hill, 1994. This publication is an innovative mathematics program for middle school students, grades 6 through 8. His other works included *Exploring Circles*, Glencoe, 1996 and *Computer Science One*, Coherent Curriculum, 1988. His most current work is *Middle School Mathematics*, an online curriculum by Agile Mind, 2006. Two recent articles, *Making Meaning in Algebra: Examining Students' Understandings and Misconceptions* and *When Assessment Guides Instruction: Silicon Valley's Mathematics Assessment Collaborative* appear in MSRI's "Assessing Students' Mathematics Learning: Issues, Costs And Benefits" 2007. David taught mathematics and computer science at middle school, high school and community college for 18 years. He also works part-time for San Jose State University. He is Co-Director of the Santa Clara Valley Math Project. He is also Co-Chair of the advisory committee of the Mathematics Assessment Resource Service/Balanced Assessment. He is a consultant to the Urban Math Leadership Network that work with the 30 largest school districts in America.



Algebra Forum II Leadership Team 2007-2009

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California Algebra Forum
Online Community
www.cacompcenter.org/algebraforum

NOTES

Alan H. Schoenfeld
Monday, October 13

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Regional Showcase and Poster Session
Monday, October 13

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Larry R. Faulkner
Tuesday, October 14

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Thomas Carpenter
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Carolyn Kieran
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James Hiebert

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Reflections and Moderated Panel

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Judit Moschkovich
Wednesday, October 15

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Philip Daro and David Foster

Wednesday, October 15

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Panel Focusing on Call to Action

Wednesday, October 15

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General Session: Westin Ballroom
 Lunch: Bayshore, Laurel and Oak rooms

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