

# CSMATE Highlights

THE CENTER FOR SCIENCE, MATHEMATICS & TECHNOLOGY EDUCATION

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## CSMATE Professor Distinguished Teaching Scholar

It is our great pleasure to announce that Dr. Stephen Thompson, Professor of Chemistry and CSMATE Associate Director has been chosen as one of the four Colorado State University Distinguished Teaching Scholars.

For almost 30 years, Dr. Thompson has served Colorado State University (CSU) as: (1) an exceptional teacher, dedicated to the enhancement of undergraduate student learning, (2) a pioneer in the development and dissemination of Small-Scale Science instruction, materials, and practices, and (3) as an innovator in the teaching of chemistry for both Chemistry majors and non-majors. Dr. Thompson currently holds a joint appointment with CSMATE and the Department of Chemistry.

### Teaching and Awards

In 1971 Dr. Thompson arrived at the CSU Chemistry department and began the development of a new undergraduate laboratory program. During the development of this program, Dr. Thompson began experimenting with innovative ways to teach chemistry, which in turn led to the development of Small-Scale Science concepts and practices. Since 1971, Dr. Thompson has taught numerous undergraduate chemistry courses for majors and non-majors, but has specialized in teaching freshman chemistry and quantitative analysis. From 1971 to 1995, Dr. Thompson



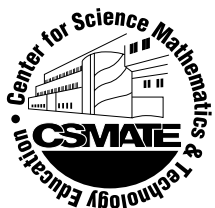
also directed the undergraduate laboratory program in chemistry and worked with hundreds of teaching assistants to improve their instructional knowledge and teaching practices.

More recently, Dr. Thompson has been working with the Key Academic Community (KAC) to help foster chemical understanding and promote the retention of underrepresented first year students in science. In 1977, in recognition of his outstanding teaching, Dr. Thompson received the L.W. Durrell Distinguished Award for Innovative and Creative teaching methods. In 1984, Dr. Thompson was named as a University Honors Professor and was

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## Mission

To serve as the focal point for program development and research aimed at fostering improvements, innovations, and reforms in science, mathematics, and technology instruction and curriculum at all levels, K-16.



# CATALiST

Recent assessments of secondary school students' mathematics understanding, such as the Third International Mathematics and Science Study (TIMSS) and the Colorado Student Achievement Tests (CSAP), show a large percentage falling below grade level by the time they reach the eighth grade. The international study, TIMSS, has also shown that United States teachers have substantially less time for instructional planning, collegial networking, and learning about effective instructional methods than their counterparts overseas. A new project led by Dr. Kelly Chappell, Change Agents: Teachers Analyzing Lessons in Study Teams (CATALiST) will address this issue. The missing and essential pieces to the puzzle of mathematics reform are classroom-based professional development programs that position teachers to be the responsible agents for the implementation of effective strategies for teaching and learning into classroom practice. The Colorado Commission on Higher Education Eisenhower Professional Development Program has awarded the Center for Science, Mathematics and Technology Education in cooperation with the Department of Mathematics an 18-month professional development project of site-based educational enhancement that will institute a method for the systemic improvement of classroom instruction by infusing quality content into effective pedagogical strategies. The project will build into the educational structure time for teams of teachers to collaboratively design lessons; implement the lesson plans; and improve the plans and instruction based on student achievement on performance-based tasks, such as the constructed-response tasks from CSAP teacher guides. The project's strategic plan will include the development of site-based lesson study groups to serve as laboratories for the development, testing, refining and evaluation of lessons that focus on concepts central to the understanding of mathematics. The CATALiST project transforms the culture of secondary school mathematics departments by infusing them with school-based, on-going and intensive professional development activity.

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## CSMATE 2001: Welcome to the New Millennium

The beginning of the 21st century is both an exciting and challenging time for the Center for Science, Mathematics & Technology Education. On the "exciting" side of the ledger, opportunities to enhance and improve science, mathematics, and technology education abound, our faculty and staff are excellent and our past accomplishments are numerous. On the "challenging" side of the ledger, as current programs and activities reach completion, we face important decisions about: (1) our future programmatic emphasis, (2) the balance between K-12 and higher education activities, (3) the development of new strategic collaborations and funding sources, and (4) the allocation of our resources. As we explore these new opportunities and challenges, CSMATE's number one priority will continue to be: "To Improve the Learning of Science, Mathematics, and Technology for All Students, at All Levels."

### **The Past and The Present**

What I have learned during my first few months as the new Director of CSMATE is that there is a great deal to celebrate. For example, Dr. Thompson, one of our associate faculty, was recently selected as one of only four Distinguished University Teaching Scholars at Colorado State University (see cover article). Steve was selected not only for his passion and excellence as a teacher, but for his pioneering efforts in developing and promoting the use of Small-Scale Science techniques in college and secondary classrooms around the world. Small-Scale Science has been supported and enhanced by numerous CSMATE staff, but Barry Carroll and Lynne Judish, as well as Ed Waterman, one of Poudre School District's finest science teachers, deserves special mention for their Small-Scale Science efforts.

Other outstanding CSMATE projects include: (1) the Rocky Mountain Teacher Education Collaboration (RMTEC) which

has had a significant impact on mathematics and science teacher preparation in Colorado, (2) CONNECT, a statewide collaboration that assisted with local implementation of standards-based education in grades K-12, (3) the Colorado Integrated Mathematics Initiative which provided secondary teachers with the opportunity to learn an integrated, problem-solving based mathematics curriculum, (4) CO-STEP, a professional development which provided elementary and middle school teachers in Colorado with content and pedagogical training in science, and (5) the Annenberg/CPB distance learning workshops for in-service math and science teachers. Dr. Fred Stein, the former Director of CSMATE, Dr. Christine Jones, Dr. Barbara Nelson, Dr. Barbara Wallner, Dr. Jeff Gliner, Mr. Glenn Bruckhart, Ms. Barry Carroll and Ms. Courtney Butler all played key roles in the development, funding, implementation, and support of these projects.

I would also be remiss if I did not give special thanks for the dynamic efforts of Dr. Judith Hannah, and Dr. Christine Jones who co-directed CSMATE during the past year. CSMATE benefited greatly from their knowledge, concern, and thoughtful guidance during a year of transition.

CSMATE has also been fortunate over the years, in developing good relationships with numerous CSU faculty interested in science, mathematics and technology education. Among these faculty are: Dr. Kelly Chappell, PI of the Mid Math project, Mr. Brian Jones director of the Little Shop of Physics outreach program, Dr. Omnia El-Hakim, Director of the Colorado Alliance for Minority Participation, Dr. Bill Timpson, Director of the Center for Teaching and Learning, and Dr. Tom Gorell, Director of the Center for Life Sciences. Thanks also to Dean John Raich (College of Natural Sciences), Dean Nancy Hartley (College of Applied Human Sciences), and Associate Dean

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# Current Programs

## **Integrated Mathematics/Small-Scale Science Institute**

The IM/SSS teaching institute focuses on instruction that blends mathematics and science concepts into units and lessons that can be used in mathematics or science classrooms. This course will be offered again in Summer 2001.

## **Scientific Notebook**

The SN teaching institute is a workshop that guides participants through the computer software *Scientific Notebook* and how to use it in the classroom. This course will be offered again in Summer 2001.

## **Small-Scale Chemistry Institutes**

These one-week chemistry courses have been taught by Mr. Ed Waterman since 1993 to over 200 high school chemistry teachers from all over the United States. Course activities are based upon techniques and philosophies of Small-Scale Chemistry. The First Year Chemistry and Advanced Placement Chemistry courses will be taught again in Summer 2001.

## **SummerMath**

This 10-day mathematics workshop is taught by two master teachers from Fort Collins and Loveland and focuses on the use of manipulatives in the elementary school classroom. This course will be taught again in Summer 2001.

*For more information and registration material for any of the above courses, visit our web site at <http://www.csmate.colostate.edu>.*

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## **International Telementor Center**

Since 1995, the Hewlett-Packard E-mail Mentor Program has matched nearly 3,000 HP employees with students and teachers around the world. Mentor relationships are based on student projects, career options, and building information databases, with teachers playing a key role in guiding and monitoring the activities. The International Telementor Center has been housed at CSMATE since 1998, but with recent program growth, is now looking for a new home. For more information, check out the web site at <http://www.telementor.org>.

## **The Solutions Project: Reducing the Cost of Chemistry Laboratory Instruction**

Funded by a grant from the US Department of Education, FIPSE program, this project is attempting to reduce costs through the introduction, dissemination, and implementation of Small-Scale Chemistry to community colleges via an established network of regional centers. Video, print, and internet materials are being developed supporting the adoption of Small-Scale Chemistry at community colleges. To access these materials, please see the web site at <http://www.smallscalechemistry.colostate.edu>.

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## **Colorado Alliance for Minority Participation (CO-AMP)**

Now in its fourth year, CO-AMP is an alliance of 13 colleges and universities and four tribal partners. Its goal: To double the current number of underrepresented minority students receiving baccalaureate degrees in science, mathematics, engineering and technology.

## **Keys to Science**

CSMATE has hosted Keys to Science in collaboration with the Keystone Science School during the summer since 1996. The two week workshop introduces the concepts and advantages of biotechnology, molecular and cellular biology to 15 high school teachers from around the country.

## **The Little Shop of Physics**

Little Shop of Physics is an on-the-road outreach program of hands-on student and teacher workshops and exhibits developed by Mr. Brian Jones of the Colorado State University Physics Department. CSMATE is a supporter of this program.

## **MidMath**

MidMath is a collaboration between CSMATE and Poudre School District in conjunction with PSD's summer school. Since 1998, teachers from PSD have taught summer school mathematics to 6-10th grade students during the morning session and in afternoon, met as a group to develop activities that will better ready students for entering the Integrated Mathematics series.

## **Rocky Mountain Teacher Education Collaborative (RMTEC)**

RMTEC can claim a record of sustained change in the faculty and curricula of six institutions of higher education (CSU, UNC, MSCD, FRCC, CCD, Aims CC). Its goal: To redesign and implement a program to improve the mathematics and science preparation of preservice teachers.

# CSMATE History

CSMATE began in 1989 as a shared vision of administration and faculty at Colorado State University, and since 1991 has aggressively campaigned to raise programmatic funds from public and private sources to supplement the operational support provided from Colorado State University to fulfill our mission. To that end, from 1991-2000, 23 separate, one to five year long, systemic projects were supported by a variety of federal and corporate sources, such as the National Science Foundation with S<sup>3</sup>TAR: Small-Scale Science: Teachers-As-Researchers; MINDS: Minority Initiative in Denver Schools; and as a collaborative partner in RMTEC: Rocky Mountain Teacher Education Collaborative; the Colorado SSI-CONNECT; CO-AMP: Colorado Alliance for Minority Participation and CO-STEP: Colorado Science Teacher Enhancement Project. The Colorado Commission on Higher Education with Department of Education Eisenhower Program appropriations also funded S<sup>3</sup>TAR, and CIMI: Colorado Integrated Mathematics Initiative, CSTC: Colorado Science Teacher Consultants, EMTEP and REMTEP: Elementary and Regional Elementary Mathematics Teacher Enhancement Project; COBRAS: Classroom Based Research on the Achievement of Students; and MidMath. The Environmental Protection Agency funded the Pollution Prevention in General Chemistry Project and American Indians Bridging Culture with Small-Scale Science and Hewlett Packard funded the National Alliance for Secondary Science as well as S<sup>3</sup>TAR, and additional CONNECT programs.

Since 1991, these K-16 funded projects, as well as other K-12 teacher workshops have affected 115 university faculty in Colorado; 1550 K-12 teachers from Colorado; 160 community college faculty nationwide; 350 K-12 teachers from other states; 75 Colorado Districts; and 515 new science and mathematics teachers. In turn, these efforts have enhanced science and mathematics learning for tens of thousands of K-16 students.

In addition, since 1997, CSMATE has coordinated graduate credit for 850 teachers and principals, nationwide taking Annenberg CPB/Harvard Smithsonian produced distance learning courses.

Onward into CSMATE's second decade!

## CSMATE Staff

Dr. Ed Geary  
*Director*

Dr. Stephen Thompson  
*Associate Director*

Dr. Christine Jones  
*Assistant Director*

Ms. Courtney Butler  
*Assistant to the Director*

Ms. Barry Carroll  
*Program Coordinator*

Ms. Mary Clarkin  
*Administrative Assistant*

Ms. Lynne Judish  
*Laboratory Coordinator*

Mr. Dimitri Zarzhitsky  
*Computer Assistant*

Ms. Melynda Moczo  
*Office Assistant*

## CSMATE Faculty

Dr. Stephen Thompson  
*Professor of Chemistry*

Dr. Judith Hannah  
*Department of Earth Resources Chair*

Dr. Darel Hardy  
*Professor of Mathematics*

Dr. Sandy Kern  
*Professor of Physics*

Dr. Barbara Nelson  
*Professor of Education*

Dr. Kelly Chappell  
*Assistant Professor of Mathematics*

Mr. Brian Jones  
*Physics Program Coordinator*

Mr. Glenn Bruckhart  
*Mathematics Education Specialist*

Mr. Edward Waterman  
*Small-Scale Chemistry Specialist*

# CSMATE Professor

## Distinguished Teaching Scholar cont.

granted the U.S Department of Education's Mina Shaugnessy Scholar Award. In 1988, Dr. Thompson received the CSU Support Group for Adults with Learning Disabilities Award for outstanding dedication and effort. In 1992-1993 he received CSU's Preston Davis award for Instructional Innovation. Dr. Thompson's teaching has also been recognized nationally by being invited to instruct at the prestigious Woodrow Wilson Summer Chemistry Institutes at Princeton University from 1985 to 1990.

### Educational Innovation and Publications

In 1972, Dr. Thompson helped to pioneer a dramatic shift in chemistry instruction away from traditional forms of laboratory science instruction toward Small-Scale Science instruction and practices. The advantages of Small-Scale Science instruction include reduced costs, enhanced safety, less waste disposal, and more hands-on, inquiry-based learning. These changes have allowed thousands of undergraduate students to learn chemistry more effectively, by doing chemistry, rather than simply reading and hearing about it. To promote the use of small-scale science, Dr. Thompson has created over 200 new laboratory modules, many utilizing new designs for instruments and techniques. Working with secondary school science teachers, these small-scale science modules and techniques have subsequently been adapted for use at the secondary school level.

In the early 1990's Dr. Thompson was the principal architect in developing the "sciplex" laboratories at CSMATE. These 25 station "learning studios" are designed so that students can interact more easily with each other and with their instructors to do science. Using innovative design features, students can conduct desktop, small-scale science experiments and use computers simultaneously. In addition the configuration of the stations promotes collaborative discussions, facilitates one-on-one instruction, and provides better access to the laboratory sciences for mobility-impaired students.

Dr. Thompson has authored numerous science education publications and classroom texts including: (1) *ChemTrek*, first published in 1974 and now in its 4th edition with Prentice Hall, for general chemistry science major courses, (2) *Chemistry Laboratory: A New View*, published in 1976 for non-science major courses, (3) *Echem*, published by Kendall-Hunt in 1994 for non-science major courses, and (4) *Small-Scale Chemistry Laboratory Manual*, co-authored with Ed Waterman, first published in 1993 by Addison-Wesley and now in its 3rd edition for high school courses.

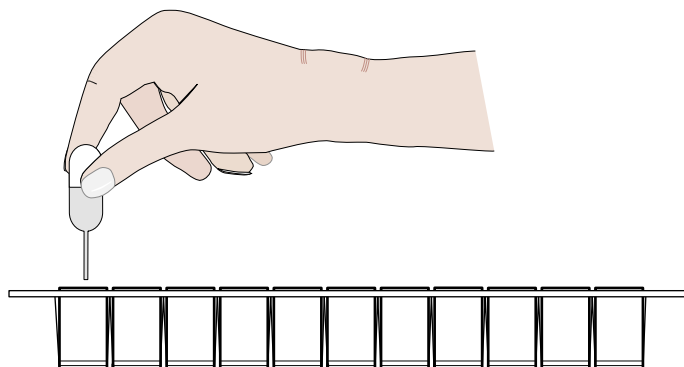
### Grants and Outreach

In support of his numerous efforts to transform Chemistry education at the undergraduate and secondary school levels, Dr. Thompson has received over \$1.5 million in funding for several science education projects. He has also been a co-Principal Investigator and collaborator on several other grants. Among the projects that Dr. Thompson has developed and led are:

- *Small-Scale Science: Teachers As Researchers*
- *The Solutions Project*
- *Pollution Prevention in Chemistry Instruction*
- *American Indians Bridging Culture with Small-Scale Science*

In addition to these projects, Dr. Thompson has served as the Secretary of Phi Kappa (1995-present), been a Distinguished Visiting Professor of Chemistry at the Air Force Academy (1985-1986), the John Wesley Powell Memorial Lecturer for the American Association for the Advancement of Science (AAAS, 1996), and conducted numerous classroom and public demonstrations of chemistry, fire-eating, and small-scale science in communities across the United States. Dr. Thompson is also the current President of the Western Region of the AAAS.

Dr. Thompson is becoming involved in the development of new small-scale laboratory instrumentation and investigation techniques that will allow students and researchers even greater access and capacity for doing experimental work using computer and flat display technologies. He also has recently been awarded a comprehensive program grant from FIPSE, US Department of Education to develop and test an interactive text in which foundational chemistry concepts are learned through molecular representation. The "Powerful Pictures" project will promote improved learning and greater accessibility to chemistry for all students.



# CSMATE 2001: Welcome to the New Millennium cont.

Tom Sneider (CNS) for their strong support of CSMATE programs and staff.

Finally, no summary of CSMATE's past accomplishments would be complete without a special "thank you" to Ms. Mary Clarkin (our friendly interface to the world) in the front office and to Mr. Dimitri Zarzhitsky, a remarkable CSU student who has provided invaluable technical support for CSMATE's classrooms, programs, and website.

## THE PRESENT AND THE FUTURE

As old projects finish, CSMATE faculty and staff are continuously planning and developing new projects. Some of our new projects build on past successes, while other projects try to anticipate what students will be learning in the classrooms of tomorrow. Our newest projects include:

**Powerful Pictures:** this project will develop and test an interactive text in which foundational concepts of first-year chemistry are learned through molecular representation. Funded by FIPSE, US Department of Education, Stephen Thompson and Barry Carroll will collaborate with the national small-scale chemistry network of community college faculty to develop curriculum.

**CATALiST:** is described elsewhere in this newsletter.

**Integrating Science and Technology in Middle Schools (ISTIMS):** a newly proposed professional development program designed to infuse new computer and information based technologies in middle school science classrooms across Colorado. Currently under review at the National Science Foundation, this project is being developed in collaboration with Dr. Bill Hoyt, University of Northern Colorado, Mr. Mike Nadiak, a middle school science teacher from Montrose, Colorado, and over a dozen Colorado School Districts.

**The Digital Library for Earth Systems Education (DLESE):** an exciting new venture into web-based learning and information sharing across the sciences, mathematics, economics, and policy. CSMATE has a one-year grant from the National Science Foundation to build digital library collaborations across the K-12 science, mathematics, and geography communities. DLESE is a federated partnership with the University Corporation for Atmospheric Research and numerous other academic, scientific, and government organizations.

**Studying the Use of Multimedia and Visualization Technologies** on student learning (**SUMuViT**): a new foray into research on teaching and student learning using multimedia and visualization technologies. This project is currently "under development". SUMuViT is a collaboration with Dr. Brian Cobb and Dr. Ann Foster co-directors of the Research and Development Center for the Advancement of Student Learning.

**The Northern Colorado Community College/University Articulation Partnership** in Teacher Preparation. Currently under review at the National Science Foundation, this project is being developed in collaboration with Dr. Rick Ginsberg, Director of the School of Education and four Community Colleges in Northern Colorado.

As you can tell from these brief descriptions, CSMATE is placing a great deal of emphasize on building Collaborations within CSU, with other Colleges and Universities, and with Colorado School Districts. Some of these collaborations are simply the strengthening of existing partnerships with Departments such as Physics, Biology, Mathematics and Education, while other collaborations are new. The rest of the CSMATE staff and I strongly believe that collaborations are one of the "keys to success" of CSMATE during the next five years.

CSMATE is also placing a strong emphasis on integration of new Technologies in Math and Science Classrooms (e.g. ranging from Small-Scale Science, to image processing, to GPS and GIS, to multimedia and web-based learning). We strongly believe that technology can help to improve teaching and learning, but only if faculty and students have ready access to these technologies, and an understanding of how and when to use them effectively in field, laboratory, and classroom environments.

In summary, as I begin my tenure at CSMATE there is much to be thankful for and much to look forward to. It is a time of change, a time of opportunity, and a time of adventure. I feel extremely fortunate to be at CSMATE during such an exciting period and to be working with such a great staff and faculty.

On behalf of all the CSMATE faculty and staff, I invite you to learn more about our new programs and activities and where you see an opportunity, please give us a call, send us an email, or stop by for a visit and perhaps our next adventure will be with you.

## About the Director:

Dr. Edward E. Geary comes to CSMATE after 8 years of Directing Education and Outreach Programs at the Geological Society of America. Prior to that, he was an associate professor of Geology at San Jose State University and co-director of the Bay Area Earth Science Institute, a professional development program for K-12 educators in the San Francisco Bay area. "Dr. Ed" (which is just one of his nicknames) has a deep and abiding interest in improving student learning in science and mathematics, a growing interest in the educational uses of new technologies, and a passion for understanding and exploring Planet Earth. He also holds a joint appointment as a Professor in the Department of Earth Resources at Colorado State University.

