



**Systems Thinking and Dynamic
Modeling Conference
JUNE 30 - JULY 2, 2004**

**Wednesday
8:30 CONFERENCE CENTER FOYER
Registration. Coffee and pastries.**

**10:00—10:15 CASCADE LOCKS BALLROOM
Welcome and Introductions**

10:15—11:45

**Thinking about Systems Thinking: How We Improve
KEYNOTE BY GEORGE RICHARDSON**



GEORGE RICHARDSON

George P. Richardson is chair of the Department of Public Administration and Policy in the Rockefeller College of Public Affairs and Policy at the University at Albany, and professor of public administration, public policy, and information science. He has held various administration positions in the department of public administration, including directing each of the MPA, MPP, and PhD degree programs. With degrees from Harvard, the University of Chicago, and MIT, his teaching, research, and consulting center on computer-based tools and analyses for public administration and policy. His recent work has focused on public policy problems in social welfare, public health, and interagency collaboration, and the use of formal computer-based tools and models to help groups move toward policy consensus in complex dynamic systems. He founded and served for seven years as the executive editor of the "System Dynamics Review."

Richardson's publications include *Introduction to System Dynamics Modeling with DYNAMO* (1981), *Feedback Thought in Social Science and Systems Theory* (1991, 1999), both of which were honored with the System Dynamics Society's Forrester Award, and the edited two-volume collection *Modeling for Management: Simulation in Support of Systems Thinking* (1996). In 2003 he was honored with the University at Albany's Award for Excellence in Teaching, and the corresponding award given by the Chancellor of the State University of New York.

11:45—1:00 Luncheon served in the Dining Room

1:00—3:00

Five Parallel Sessions

People who are new to systems work should attend one of the first two sessions. These sessions will give you a grasp of systems concepts and vocabulary that will make the rest of the conference more meaningful. Sessions 3-5 are more suitable for experienced attendees.

1. Systems Thinking: Visual Tools for Increasing Student Learning — Mary Scheetz, The Waters Foundation, Portland, OR

CASCADE LOCKS A/C

Learners of every age can benefit from using visual tools to map their thinking. This session will introduce the concepts and mechanics of an array of systems thinking tools and will demonstrate how K-12 educators and students have used the tools to increase student learning. Participants will have opportunities to use some of the tools in an experimental practice field.

2. Introduction to Computer Modeling with STELLA
— Ron Zaraza, Portland Public Schools, Portland, OR

BAKER

Dynamic models deal with the way in which important variables (quantities) change in a system. Understanding how to build some basic models helps us understand the basic patterns of change we see in systems. In this workshop, participants will familiarize themselves with the basic tools of STELLA and System Dynamics (stocks, flows, converters, connectors), then build models that exhibit linear and exponential growth. These will be expanded into simple population models and population models that show s-shaped (goal-seeking) growth. These basic model structures are the core models from which thousands of useful models are derived. **Bring a computer, if you have one, to work in teams.**

3. Intermediate/Advanced Model Building Workshop

— Jim Lyneis, Worcester Polytechnic Institute, and Deb Lyneis, Creative Learning Exchange, Weston, VT

RANIER

Participants will conceptualize, build and analyze a small model step by step. Participants should be experienced with basic modeling and familiar with the workings of Vensim or STELLA. *Bring a computer, if you have one, to work in teams.*

4. Connecting Systems Thinking to the Larger Dynamics in the Fields of Teaching and Learning —

Will Costello, Chittendon South S.D., Champlain Valley UHS, Hinesburg, VT

CASCADE LOCKS B/D

Where does our work fit in relation to other, major thrusts in educational reform? Are we a tiny outlier or do we share some fundamental aspects with current research on thinking, memory, learning, and teaching? Education has long been anomalous for consisting of two (inappropriately) distinct fields: research and application. This distinction is finally beginning to evaporate as schools look more to educational research and statistical data in guiding their decisions. What is the role of systems in reshaping and becoming an integral component in the school of the future? How do we insure that “systems” has a voice in teaching and thinking across a wide spectrum of educational delivery? This session will be one of discussion and information. Bring what you have and a willingness to share.

5. Learning from the Past — Jeff Potash and John Heinbokel, CIESD, LLP, Vermont Commons School, South Burlington, VT

ST. HELEN'S

Jay Forrester's frequent admonition to “share your mistakes” recognizes the extraordinary power with which experienced modelers can accelerate the learning curve of “newbies” through sharing a variety of modeling errors they have observed and committed in the course of their own maturation. We may prefer to talk about our glorious victories, but thoughtful reflection on and analysis of our errors can result in growth and improvement. In this interactive session, we draw upon our own impressive repertoire of mistakes, as well as those of others (who shall remain nameless!), to advise aspiring modelers on pitfalls best avoided.

Break

3:30-5:00 Eight Parallel Sessions

6. It's Elementary! How Elementary School Teachers and Administrators Use Systems Thinking in Classrooms —

Jennifer Arzberger, Patrice Becicka, Gaylen Brannon, Liane Cooper, Kendra Hanzlik, Becky Hill, Donna Hollm, Cheryl Kiburz, Kathy Kittredge, Tracy Laue, Veda Lawrence, Julie McCann, and Joan Scurren, Waters Foundation Action Research Group

JEFFERSON

Elementary teachers who have used systems thinking concepts and tools in their classrooms will share their experiences. Teachers' areas of interest include reading comprehension and related literacy topics, the study of ecosystems, and student self-management skills. The session will begin with teacher presenters sharing classroom applications of systems thinking and insights gained, followed by presenter and participant dialogue sessions for more in-depth sharing and conversation. All presenters have participated in Waters Foundation collaborative action research, which challenged them to investigate the effects of systems thinking on student and/or adult learning.

7. How Does a Model Facilitate Learning? Some Preliminary Experimental Findings — Larry Weathers and Robin Goldstein, Harvard Public Schools, Harvard, MA, and David Wheat, PhD student, University of Bergen

ST. HELEN'S

Research suggests that a traditional undergraduate economics education does not provide an adequate understanding of essential macroeconomics. The hypothesis is that the weakness in economics education stems from instructional methods that fail to provide a learning framework that supports a useful mental model of a national economy. One of the authors is developing a system dynamics model and interactive learning environment (“MacroLab”) that he uses in a macroeconomics distance-learning course for Virginia community college students. He is also developing a set of experiments to test the effectiveness of MacroLab as an instructional tool. The purpose of one of the experiments is to compare the learning that takes place with three different methods of delivering essentially the same information about Gross Domestic Product to three student groups. The three delivery methods are (1) simple narrative only, (2) the same narrative, accompanied by a diagram revealed in stages (using STELLA's “story” feature), and (3) the same narrative and diagram, accompanied by a simulation activity. The second author recently administered this experiment to secondary students in the Harvard Public Schools system in Massachusetts. Additional experiments are underway this spring at both secondary and higher education institutions. This paper presents the preliminary findings and, hopefully, sheds some light on how a model facilitates learning.

8. Using Infection and Population Models in Interdisciplinary Lessons — Ron Zaraza, Portland Public Schools, Portland, OR, and Scott Guthrie, Portland Public Schools - Wilson H.S., Portland, OR

SUMMIT 7

Basic population models can be adapted to many different situations that show exponential or goal-seeking behavior. In addition, the basic infection model and its extensions illustrate a wide range of human problems and interactions, from disease spread to advertising and marketing. Perhaps more importantly, the very basic population and infection models themselves can be used to explore many questions in geography, economics, human biology, population studies, ecology, history, and related fields. This session will explore ways of using the simplest population and infection models and a few simple extensions of them to enhance student learning in a wide range of topics. Applications cover the full range of subjects taught in middle and high school. Examples will be shared from more than ten years of classroom use of the models. Focus will be on concepts and content specific activities, not active modeling. The models will be used, not created.

9. Creating Content Specific Lessons Incorporating System Dynamics Models — Diana Fisher, Portland Public Schools - Wilson H.S., Portland, OR

CASCADE LOCKS A/C

Examples of system dynamics lessons will be explored. These lessons fall into one of four categories: Introductory SD lessons that reinforce simple core content; Second level lessons to study more sophisticated behavioral interactions over time; and two additional levels that require students to create original models. *I would like to ask the participants to bring ideas for lessons they want to create, so that we may have time in the second half of the workshop to start looking at how they could get off the ground with their ideas.*

10. Savagery, Fear, and Leadership: Feedback in *Lord of the Flies* — Amy Lovin and Steve Kipp, Glynn County Schools, Brunswick, GA

CASCADE LOCKS B/D

In addition to the usual examination of plot, character, setting, and theme, students in a 10th Grade Literature and Composition class used behavior-over-time graphs, causal loop diagrams, and a STELLA model to examine the human dynamics in William Golding's *Lord of the Flies*. Please join us as we reproduce this lesson experience, exploring questions such as "Why do we need rules?" "Is fear a choice we make?" and "How could Ralph have been successful in leading the boys?"

11. Learning Environments in Biology. STELLA-based Food Chain and Fly a Cell — Sarah Strack and Kristen Mahony, Champlain Valley Union High School, Hinesburg, VT

SUMMIT 6

Participants will learn how to use two STELLA-based learning environments, Food Chain and Fly a Cell, to teach biology and environmental science concepts. Both learning environments meet national science education standards, and are inquiry-based science experiments that take students from beyond memorizing names and functions to building their understanding of how things work as dynamic systems. Experienced high school biology teachers, who have practical classroom experience with these products, will be leading the session with sample lesson plans to use in your classroom.

12. Manage Middle Eastern Oil with STELLA: the OPEC Simulation — Chris Lambert and Dave Mason, Catalina Foothills High School Social Studies Teachers and Mike Sloomaker, Catalina Foothills High School Systems Mentor, Tucson, AZ

RANIER

Participants will engage in the multi-player OPEC simulation as high school students do when studying the social and economic interdependencies intrinsic in the production, sale and consumption of petroleum in the Middle East. See how analyzing connections, leverage, scarcity, and current events interplay in the global petroleum arena.

13. How Did I Get that Grade? Helping Students See the Effects of Their Academic Decisions over Time — Anne LaVigne, Catalina Foothills School District, Tucson, AZ

BAKER

Do your students sometimes not understand how their decisions about school affect them over time? Do they question how they received a particular grade? In this session, participants will see a simple computer simulation that can help middle/high school students understand how their choices regarding completing, doing quality work on, and turning in homework affect the report card grades they receive. Participants will also see how use of the iceberg visual and a kinesthetic activity can help students understand/evaluate their current academic reality and make a plan to achieve a self-selected academic goal.

STEVENSON A/B

6:00-6:30 **Cash bar**

6:30-7:30 **Dinner**

7:30-8:45 **Roundtable discussion moderated by George Richardson**
Panel includes Jay Forrester, Andy Ford, Jim Lyneis, George Richardson and John Sterman

JAY W. FORRESTER

Jay W. Forrester became professor of management at the MIT Sloan School of Management in 1956. He applied his background in computer sciences and engineering to the development of computer modeling and analysis of social systems leading to the field now known as "system dynamics." Professor Forrester directed the System Dynamics Program at MIT Sloan School of Management until 1989. He is currently applying system dynamics to understanding the economic forces underlying inflation, unemployment, business cycles, and causes of the great depressions. He is also introducing system dynamics and learner-centered learning as a basis for a more effective kindergarten through 12th grade education. Professor Forrester was director of the MIT Digital Computer Laboratory from 1946 to 1951 and was responsible for the design and construction of Whirlwind I, one of the first high-speed computers. While working on computer technology, he invented, and holds the basic patent for, random-access, coincident-current magnetic memory, which was for many years the standard memory device for digital computers. He was head of the Digital Computer Division of MIT's Lincoln Laboratory from 1952 to 1956 where he guided the planning, technical design, and implementation of the Air Force SAGE (Semi-Automatic Ground Environment) system for continental air defense, the most extensive early application of digital computer technology. A native of a cattle ranch near Arnold, Nebraska, Professor Forrester received a B.S. degree in electrical engineering from the University of Nebraska in 1939 and in 1945 the S.M. degree in electrical engineering from MIT. Author of five books on systems and world dynamics, he has been awarded several honorary doctorate degrees in multiple fields: engineering, science, political science, Humane Letters, and philosophy. Professor Forrester's work and books have brought him numerous national and international awards and honors, among them the Inventor of the Year Award from George Washington University (1968); the Valdemar Poulsen Gold Medal from the Danish Academy of Technical Sciences (1969); the Medal of Honor (1972) and the Systems, Man, and Cybernetics Society Award for Outstanding Accomplishment (1972), both from the Institute of Electrical and Electronics Engineers; the New England Award (1972) of the Engineering Societies of New England; the Howard N. Potts Award (1974) from The Franklin Institute; and the Information Technology Leadership Award for Lifetime Achievement, Computerworld Smithsonian Awards (1998). Professor Forrester was honored by Thomas J. Watson, Jr., who endowed the Jay W. Forrester Chair of Computer Studies at MIT (1986); and he also received the James R. Killian Faculty Achievement Award, MIT (1987). In 1989, he received the National Medal of Technology from President Bush.

ANDREW FORD

Andrew Ford is Professor of Environmental Science and Regional Planning at Washington State University. He teaches system dynamics modeling with an emphasis on environmental and energy problems in the western USA. His recent research uses system dynamics to simulate the problems that have emerged in the restructured electricity system in California and in the western USA. His students have developed models to aid our understanding of a variety of environmental problems. Recent examples include Stella models of the grizzly bear population of Yellowstone, the deer population of the Kaibab Plateau, and the frequency of wildfire in Ponderosa Pine forests.

JAMES LYNEIS

James Lyneis is a Professor of Practice in the Social Science and Policy Studies Department at Worcester Polytechnic Institute, where he teaches system dynamics and economics. He is also a Senior Lecturer at MIT, where he teaches System and Project Management. Prior to joining the WPI faculty, Dr. Lyneis worked for 25 years in the Business Dynamics Practice of PA Consulting Group (formerly known as Pugh-Roberts Associates). He was General Manager for Pugh-Robert's European office from 1988 - 1990. At Pugh-Roberts, he specialized in the application of system dynamics techniques to business strategy, market analysis, project management, and management training, and worked in the telecommunications, electric utility, aerospace, and financial services industries. Prior to consulting, he was an Assistant Professor at MIT's Sloan School of Management. He is author of the book *Corporate Planning and Policy Design: A System Dynamics Approach*, as well as numerous journal articles. Dr. Lyneis has a Ph.D. in Business Administration from the University of Michigan and undergraduate degrees in Electrical Engineering and Industrial Management from MIT.

(See biographical sketches of George Richardson and John Sterman with their keynote speeches in the program.)

Thursday

7:00-8:30 Breakfast served in the Dining Room

8:30-10:00 Seven Parallel Sessions

14. What's Happening in High School? How High School Teachers and Administrators Use Systems Thinking Concepts and Tools in Their Classrooms
— Anne Boswell, Maureen Byrne, Lou Garard, Dave Hamilton, Steve Kipp, Chris Lambert, Amy Lovin, Dave Mason, Ron Peterman, Mary Scheetz, Mike Sloomaker, Sarah Strack, Tim Taber, and Larry Weathers, Waters Foundation Action Research Group

JEFFERSON

Science, Algebra, Language Arts, Social Studies and more... High School teachers share the many ways students use systems thinking strategies to increase learning. Session participants will have a chance to dialogue in small groups with teacher practitioners to ask questions, share insights, and generate new ideas as to how systems thinking can positively impact high school students' learning. All presenters have participated in Waters Foundation collaborative action research, which challenged them to investigate the effects of systems thinking on student and/or adult learning.

15. Dynamics of Open Content Development for Introducing Systems Thinking/System Dynamics in K-12 Education — Vedat G. Diker, Assistant Professor, College of Information Studies, University of Maryland

BAKER

Development and diffusion of highly accessible, high quality instructional materials are important leverage points for propagating the systems thinking/system dynamics approach in K-12 education. This presentation introduces a dynamic feedback framework for analyzing policy problems in open online content development projects, and testing possible solutions. The framework was developed by integrating the insights derived from a system dynamics model representing a hypothetical open online content development community, and the findings of interviews with the members of the system dynamics K-12 community.

16. Working with the Five Disciplines: the Dutch Way
— Guus Geisen and Jan Jutten, Schools That Learn Group, The Netherlands

RANIER

In the Netherlands, education has lost a lot of its status. We cannot get enough teachers: they compare this work with being a policeman. ("How do I control this classroom?") More and more teachers leave the school for a "better" job. For about seven or eight years we have worked with Peter Senge's ideas in schools. We are working with the five disciplines, in the school and in the classroom as well, using systems thinking as a leverage to use the disciplines and connect them with multiple intelligence, habits of minds and cooperative learning. We work with teachers and principals, but the real leverage came when we started working with children. They are the key to the future. In this workshop we want to share our experiences with you: how we got so inspired, what exactly we are doing in the Netherlands, what our plans are for the future. We will also tell shortly about the historical background of this "Dutch movement" and we will give some examples from our fieldwork.

17. Using Systems to Develop Literacy Among Elementary Students — Liane Cooper and Donna Hollm, Catalina Foothills School District Elementary Teachers, Julie Guerrero, CFSD Elementary Systems Mentor, Tucson, AZ

CASCADE LOCKS A/C

Participants will experience lessons that integrate systems concepts and tools with proven literacy strategies in order to meet district reading standards derived from National Standards. There will be active participation in intermediate as well as primary activities that teachers can adapt for use in their classrooms. Experience Level: Appropriate for beginners and anyone interested in systems work in elementary schools (primary and intermediate grades)

18. The Virtual School District: A Reflective Place for School and District Leaders — Dennis Arthur Conners, Program Director & Faculty Tutor, Leadership Formation Program, School of Education, Gonzaga University, Spokane, WA

ST. HELEN'S

Preparing leaders for tomorrow's schools requires a fundamentally different approach. Dramatically expanding the ideas of a learning lab by creating a virtual school district, this session will detail how Gonzaga University's Leadership Formation Program "forms" principals, program administrators, and superintendents to deal with the dynamic complexity inherent in leading educational organizations in this era of *No Child Left Behind*. The session will describe how systems thinking, as a perspective and as a set of tools, is used within the virtual school district of this graduate program as a means to support strategic thinking, group discussion, and team learning as the candidates attempt to understand and address the multiple problems of enhancing student, professional and systems learning.

19. What CAN Our Students Learn: The Kids Tell the Story — Paul Griffith, Portland Schools, Portland, OR

SUMMIT 6

Sixth grade students from Winterhaven School, a math, science and technology special focus option in the Portland Public

Schools, will be available to talk with and answer questions during a poster session. Students have begun to learn about basic Systems Thinking/Dynamic Modeling concepts in the past year as the staff works toward implementing a K-8 Systems Thinking/Dynamic Modeling curriculum component for their school.

20. What Works in Staff Meetings: A Middle School Principal's Experience Using System Dynamics —

Mary Quinnan, Tucson Unified School District, Tucson, AZ

CASCADE LOCKS B/D

Does the utilization of systems tools in professional development, the evaluation process, and organizational management create a "ripple" effect that influences school culture and academic achievement? How does the use of system dynamics during staff meetings impact staff awareness and transfer to classroom practice? Share in taking a look at the practical application of systems tools in a middle school setting with issues such as staff communication, the impact of instructional strategies on student engagement and the problem of student failure, retention and social promotion.

Break

10:30- 12:00 CASCADE LOCKS BALLROOM

Why I Want My Children to Learn System Dynamics

KEYNOTE BY JOHN STERMAN

Thoughtful leaders increasingly recognize that we are not only failing to solve the persistent problems we face, but are in fact causing them. System dynamics is designed to help avoid such policy resistance and identify high leverage policies for sustained improvement. What does it take to be an effective systems thinker and to teach system dynamics fruitfully? Understanding complex systems requires mastery of concepts such as feedback, stocks and flows, time delays, and non-linearity. Research shows these concepts are highly counterintuitive and poorly understood. It also shows how they can be taught and learned. Doing so requires the use of formal models and simulations to test our mental models and develop our intuition about complex systems. Yet, though essential, these concepts and tools are not sufficient. Becoming an effective systems thinker also requires the rigorous and disciplined use of scientific inquiry skills so that we can uncover our hidden assumptions and biases. It requires respect and empathy for others and other viewpoints. Most important, and most difficult to learn, systems thinking requires understanding that all models are wrong and humility about the limitations of our knowledge. Such humility is essential in creating an environment in which we can learn about the complex systems in which we are embedded and work effectively to create the world we truly desire.



JOHN STERMAN

John D. Sterman is the Jay W. Forrester Professor of Management at the MIT Sloan School of Management and Director of MIT's System Dynamics Group. His research includes systems thinking and organizational learning, computer simulation of corporate strategy, and the theory of nonlinear dynamics. Author of many scholarly and popular articles on the challenges and opportunities facing organizations today, including the book *Modeling for Organizational Learning*, and the award-winning textbook *Business Dynamics*, he has presented his work before corporate, financial, and government audiences world wide. Prof. Sterman's research centers on improving managerial decision making in complex systems. He has pioneered the development of "management flight simulators" of corporate and economic systems. These flight simulators are now used by corporations and universities around the world. His recent research ranges from the dynamics of organizational change and the implementation of sustainable improvement programs to experimental studies assessing public understanding of global climate change. Prof. Sterman has twice been awarded the Jay W. Forrester Prize for the best published work in system dynamics, won the 2001 Accenture Award for the best paper of the year published in the "California Management Review" (with Nelson Reppenning), has five times won awards for teaching excellence from the students of the Sloan School, and was named one of the Sloan School's "Outstanding Faculty" by the 2001 "Business Week Guide to the Best Business Schools." He has been featured on public television's "News Hour," National Public Radio's "Marketplace," CBC television, "Fortune," "The Financial Times," "Business Week," and many other newspapers and journals for his research work and innovative use of interactive simulations in management education and corporate problem solving.

12:00-1:15 Luncheon served in the Dining Room

During lunch time, students from Portland schools will be in the lobby with poster presentations of their work.

How Does the Percent of Females Receiving Pap Tests Affect the Number of Women Diagnosed With Cervical Cancer? — Jonathan Kadish and Kimberlee Pelster, Wilson High School

What are the Factors That Affect the Number of Heroin Addicts in the United States? — Dillon Nakata and Dori Zabari, Wilson High School

Will the Population, Industry, and Agriculture of Togo, Africa Prosper with the Freshwater They Have? — Maria Grompe and Annalise Johnson, Wilson High School

Can a Species Specific Virus Contain an Exploding Rabbit Population in Australia? — Stephanie Hemmingson, Wilson High School

Will Social Security Bankrupt Us All? — Andrey Sharikov, Wilson High School

SARS: What Effect Does Delaying Acknowledgement of the Outbreak Have on the Spread of the Disease? — Sandeep Parmar, Wilson High School

1:15-3:45

Five Parallel Workshop Sessions

21. Using Storytelling Features of STELLA to Communicate — Scott Guthrie, Portland Public Schools - Wilson H.S., Portland, OR

RANIER

Sometimes you have a group you want to explain a model to that doesn't really understand STELLA. Sometimes you have a complicated model you wish to explain to a group, but you don't want to overwhelm them with it all at once. STELLA has features built into it that allow you to slowly build the story of your model to an audience. This session will show you how to use all those hidden and little used features of STELLA.

22. Using Non Computer Activities in Grades 3-8 — Rob Quaden, Alan Ticotsky, and Debra Lyneis, Carlisle, MA Public Schools, Waters Foundation Project

CASCADE LOCKS A/C

Participants in this hands-on session will engage in and learn how to lead simulations designed for students in grades 3-8. These classroom-tested activities are selected from a set of systems lessons developed or adapted by the presenters. See how important concepts and principles can be brought alive for students using ordinary classroom materials.

23. Systemic Planning and Decision Making — Ralph Brauer, Transforming Schools Consortium, Ramsey, MN, Jeff Potash and John Heinbokel, CIESD, LLP, Vermont Commons School, South Burlington, VT

CASCADE LOCKS B/D

We call this experience an open house rather than a seminar or workshop because it is designed to open the doors and windows of your minds to the insights System Dynamics can bring to P-12 education. The "house" we are opening is the systemic planning process highlighted in the winter edition of *The Exchange*. We want to give you a chance to live in that house, to actually explore and run a large-scale System Dynamics model of a real school district. We will use the model to frame specific issues of your choice such as staffing, budgeting, and maximizing student performance. Our style will be participative and collaborative, featuring hands-on experiences and frank discussions. Our intent is to stimulate thought, not provide a "magic bullet." We guarantee after this experience you will never view schools the same way again. Specific outcomes include:

- Recognize fundamental mental models and their impact on policy.
- Recognize important behavior over time patterns.
- Understand how a new perspective on resources revolutionizes key debates.
- Become more skilled at decision-making involving multiple variables.
- Learn application of fundamental systems concepts to school problems.
- Identify some basic feedbacks that can influence outcomes.

Limited to 25 with preference given to school administrators and teachers.

24. Simulating Habitat Restoration: Surprising Results from a Student Project on the Tucannon Salmon Model — Andy Ford, Washington State University, Pullman, WA

BAKER

This session works through a case study of habitat restoration on the Tucannon River in eastern Washington. The model was implemented in STELLA with photographs to connect the model variables to images of river water in various stages of recovery. The images and the simulations will be presented at Skamania, along with the surprising results that emerged when the student experimented with the new model. The session concludes with lessons from one doctoral student's experiences that show promise for transferring to the K-12 setting.

25. So What Would A Systems Thinker Do? — Mary Scheetz, The Waters Foundation, Portland, OR

JEFFERSON

This workshop will involve participants in activities and discussions related to the habits of a systems thinker in the context of a variety of scenarios, including K-12 curriculum examples, family and work situations, and school change challenges. The habits of a systems thinker used in this workshop have been adapted from the work of Linda Booth Sweeney and Dennis Meadows and are described in the *Systems Thinking Playbook*. Strategies for developing the habits of a systems thinker will be identified and practiced.

Break

DINNER ON OWN THURSDAY EVENING

7:30 CASCADE LOCKS BALLROOM
Video of Barry Richmond's keynote from the 2002 conference, entitled *Working toward a Unifying Vision*, with informal discussion afterward.

Friday

7:00-8:30 Breakfast served in the Dining Room

8:30-10:00 Eight Parallel Sessions

26. Making Meaning at the Middle Level: How Middle School Teachers and Administrators Use Systems Thinking — Anne Boswell, Gaylen Brannon, Cheryl Dow, Robin Goldstein, Karen Greene, Anne LaVigne, David Lyons, Willie Poinsette, Rob Quaden, Mary Quinnan, Paul Seidler, and Katie Starbuck, Waters Foundation Action Research Group

JEFFERSON

Over one dozen middle school educators will share insights gained through classroom application of systems thinking. As teachers share their systems learning journeys, they will highlight a variety of systems tools, subject areas, and instructional strategies. Following these brief presentations, participants will have a chance to dialogue in small groups with the teacher practitioners to ask questions, share insights, and generate new ideas as to how systems thinking can positively impact middle level learning. All presenters have participated in Waters Foundation collaborative action research, which challenged them to investigate the effects of systems thinking on student and/or adult learning.

27. Panarchy: A Metaphor for Conveying Systems Concepts and Improving Systems Thinking Skills — Richard Plate, School of Natural Resources and Environment, University of Florida, Gainesville, FL

ST. HELEN'S

The term "Panarchy" is a blend of "hierarchy" and Pan, the Greek nature god who revels in disorder. Ecologists Lance Gunderson and C.S. Holling use the term to describe their view of systems and the adaptive cycles systems go through at all levels of scale. While their ideas are used broadly in the field of natural resource management, they may prove equally useful as a means of visualizing system dynamics without the luxury of a computer model. In this session, I will provide an introduction to Panarchy as a pedagogical tool in the context of Richmond's seven essential thinking skills. Then, I will solicit the insights of session participants in a discussion about potential applications for—and barriers to—using Panarchy in the classroom.

28. *Nota Bene* – How You Will Create a Useful Notebook and Learn Interesting Things about System Dynamics — Tim Joy, De La Salle North Catholic High School, Portland, OR

CASCADE LOCKS A/C

Help students organize the array of new tools, new skills, and new concepts in an easy-to-learn, easy-to-maintain notebook system. This workshop will help you combine the structure and rigor of a *scientific* notebook with the openness and flexibility of a *writer's* notebook. Some features of this workshop include "Just Right" Stories—a collection of one- and two-sentence

system stories, a handful of class warm ups, effective but brief notebook evaluation methods, and a handful of other lesson tips on helping students reach through simple models and capture some meaning. Participants will set up and use a notebook, participate in a few exercises, briefly evaluate their work, and walk away with their own notebook and the experience of how to make it a tool in their own classrooms. Participants will receive a copy of *Writing and Modeling: using a notebook to learn about System Dynamics*.

29. Teaching Systems Thinking with Spreadsheets — Mohammad Mojtahedzadeh, Managing Director, Attune Group, Inc., and Deborah Upton, Assistant Professor, Stonehill College, MA

BAKER

This presentation will be about bringing systems thinking tools and techniques to the spreadsheet programs for high school students. We have developed a software package add-in called Exposé to Microsoft Excel that facilitates utilizing systems thinking tools in spreadsheets. Exposé provides a graphical environment that interacts with MS Excel in real-time and allows students to work with models in a graphical environment as well as in spreadsheets. Exposé maps out interrelations among cells and variables that remain hidden in the spreadsheet models in the form of tree diagrams and feedback loop process. The software automatically highlights dynamic and stock variables to help users to focus on one of the most important sources of dynamic complexity. Exposé provides many features that help students to better understand the subtlety of dynamic systems in mathematics, economics, physics and biology. In this presentation, we demonstrate how the new technology can help in utilizing systems thinking tools for teaching students who already know spreadsheet programs.

30. A Systems Approach to Teaching Immunology for High School — Sarah Strack, Champlain Valley Union High School, Hinesburg, VT

SUMMIT 6

As a 10th-grade teacher of a required course in Human Biology, I was searching for some more powerful instructional approaches to improve student performance on the Immunology Unit of the course. At a Waters Foundation R&D site I had the opportunity to work with a Waters consultant and develop a unit that included the NERDS simulation, student-extended STELLA models for immunization, and stock/flow maps for antigen/antibody dynamics. Student performance was compared to past classes and student feedback was gathered as to the effectiveness of the approach.

31. Recruiting and Retaining a High Quality Mathematics and Science Teaching Workforce Using a System Dynamics Simulation — Daniel

Burke, Ph.D. Deputy Director for Education, The CNA Corporation, Alexandria, VA; Linda Cavalluzzo, Ph.D., Senior Education Analyst, The CNA Corporation, Alexandria, VA; Joseph Harris, Ed.D., Senior Associate, The McKenzie Group, Washington, DC; Gary Hirsch, Consultant, Creator of Learning Environments

SUMMIT 7

School districts, particularly urban and high poverty districts, have critical shortages of science and mathematics teachers. We are developing a system dynamics-based management simulator linking hiring, retention, teacher quality, and student achievement to district resources. This will enable districts to run "what if" experiments to determine the best mix of resource allocation among recruiting, induction, mentoring, professional development, retention increases, and delaying retirement to optimize the quality of the instructional workforce.

**32. Using Dynamic Models to Teach Ecology/
Environmental Science** — Ron Zaraza, Portland Public
Schools, Portland, OR

RANIER

Many of the topics covered in ecology and environmental science classes focus on patterns of growth and feedback relationships, key ideas in System Dynamics. Many of these same ideas are explored in traditional biology classes and even in some social studies classes (particularly classes looking at global cultures and civilizations). This workshop will present a number of simple models that have been tested in ecology classes (some for 5 years) as well as examples and suggestions for their use in a variety of classroom activities. Included will be a discussion of how these models allow students to enrich their understanding of basic topics by assisting them in making the transition from abstract concepts to real applications and explorations of these topics.

**33. Looking at Everyday Artifacts and Finding the
Systems Message** — Linda Booth Sweeney, Harvard
School of Education, Cambridge, MA

CASCADE LOCKS B/D

This will be a working session that looks at every day artifacts — including children's books, text books, school posters, newspapers, computer software, even museum displays — from a systems perspective. We'll explore questions such as: How are interconnections and dynamics represented? How are feedback loops represented (or not) when feedback is present? Please bring your own examples.

Break

10:30- 11:45 CASCADE LOCKS BALLROOM
**Using a “Ladder of Engagement” as a Template for Guiding Student
Activities with Systems Thinking and Dynamic Modeling**

KEYNOTE BY JOHN HEINBOKEL AND JEFF POTASH

In the concluding Keynote presentation at the 2002 Systems Thinking & Dynamic Modeling Conference, Barry Richmond advocated using system dynamics to inspire what he called “systems citizenship.” Properly supported over the course of their educational careers, students could be propelled with the tools of systems beyond the boundaries of individual learning and into the realm of educating others and actively and collaboratively changing the systems around them. The “Ladder of Engagement” that we have crafted is an explicit progression through sequences of objectives, of tools and activities, and of identifiable outcomes for effectively organizing and developing student abilities to utilize the tools of system dynamics. In our session we plan to present this three-rung ladder in detail and place it in the context of our work at the Vermont Commons School (VCS). Finally, we look forward to facilitating a conversation on the ideas we have presented and how they might prove useful to others striving for the ideal of “systems citizenship” that Barry Richmond placed before us.



JOHN HEINBOKEL and JEFF POTASH

The Center for Interdisciplinary Excellence in System Dynamics, LLP (CIESD) is a recently formed partnership that provides organizational consulting, model-based problem solving, curriculum development, and system dynamics training for K-12 students, their teachers and administrators, and other government and non-profit organizations. Current and recent projects involve(d) collaborations with colleagues and clients in Oregon, Minnesota, Indiana, Illinois, Massachusetts, New York, the U.S. Federal Government, and Vermont. CIESD's partners have collaborated for over a dozen years, beginning as colleagues on the faculty of Trinity College. An academic “odd-couple,” they have worked to blend the strengths and perspectives of their individual disciplinary training with the power of system dynamics to provide and to model an interdisciplinary problem solving approach to complex real-world issues and educational opportunities.

P. Jeffrey Potash is an historian and educator with a particular focus on American religious movements and the use of system dynamics to support student learning. His baccalaureate degree in History is from the University of Vermont; he earned a Ph.D. in History from the University of Chicago. He taught at Trinity College for over 20 years with adjunct appointments at St. Michael's College, the University of Vermont, and Norwich University. He currently is on the faculty of the Vermont Commons School, where he co-directs their Center for System Dynamics.

John F. Heinbokel is an aquatic ecologist and educator with a particular focus on the role of zooplankton within aquatic food webs and the use of system dynamics to support student learning. His baccalaureate degree in Biology is from Dartmouth College; he earned a Ph.D. in Oceanography from the University of California, San Diego. He served as a research scientist for nine years at the Chesapeake Bay Institute at the Johns Hopkins University and taught for two years at Washington College before moving to Vermont, where he taught at Trinity College for 12 years. He currently is on the faculty of the Vermont Commons School, where he co-directs their Center for System Dynamics.

11:45-12:00 Closing Remarks