the Creative Learning EXCHANGE

Volume 17, Number 3 • Fall 2008

Attracting Institutional Support through Better Assessment of Systems Thinking

Richard Plate, Center for Marine Resource Studies, Gainesville FL 32605

1. Introduction

In Part 1 of the Essex report on the future of system dynamics in K-12 education, Debra Lyneis explains, "No longer can we fill students up with all that they need to know and send them off to predictable jobs. Now students need a much broader set of skills to thrive in today's volatile economy. More important, they also need deeper understanding, courage and compassion to effectively deal with the increasingly complex social, political, economic and environmental problems facing all of us."

The criticism implicit in this quotation and held by many readers of this newsletter—that conventional curricula fail to prepare students to understand the complex systems in which they live and on which they depend—has a long history in curriculum development. For example, in their highly influential 1957 text *Fundamentals of Curriculum Development* Smith, Stanley and Shores argue, "It is the obligation of those who are responsible for curriculum building to provide opportunities for children, young people, and adults to engage in the common task of rebuilding ideas and attitudes so as to make them valid for the purpose of social judgment and action in a period dominated by the complex web of impersonal relations."

Similarly, the 1958 Rockefeller Report, *Education and the Future of America*, points to *"the constant pressure of an ever more complex society against the total creative capacity of its people"* (Italics in original). The report continues, "Among the tasks that have increased most frighteningly in complexity is the task of the ordinary citizen who wishes to discharge his civic responsibilities intelligently."

For Smith et al. the necessary response to these challenges is the development of an educational system that fosters "new patterns of thinking, wherein social variables in politics, economics, and the like are kept in the picture in the process of reaching conclusions about social policies and actions, instead of the prevailing and now obsolete habit of thinking in a linear and compartmentalized fashion."

Let's take a moment to reflect on this. Linear and compartmentalized thinking—the type of thought that still forms the foundation for many of our political, economic, social, and environmental policies and the type of thought to which systems thinking has been offered as an alternative—was considered obsolete by authors of a mainstream educational text over half a century ago.

Systems-oriented curricula seems to be a promising tool for effecting the types of changes that Smith et al. called for so long ago. Lyneis summarizes well the changes that teachers implementing a systems approach report from their students, suggesting that their students are better equipped "with the skills, perspective, courage, and responsibility to deal effectively with the dynamically complex social, economic, and environmental problems facing them."

Assessment continued on page 3

THIS ISSUE AT A GLANCE

EDITORIAL

For me, as well as for many of you, the real beginning of the year is the first day of school. As this school year starts, we are looking ahead to new and renewed projects and connections.

Richard Plate's article is clearly written and I think it functions very nicely as a rallying cry. The bibliography references some classic CLE articles as well as others which we think may be helpful to people.

A retrospective on the Systems Thinking and Dynamic Modeling Conference held at the end of June renews my sense of respect and admiration for this community of ours. Looking back over being with many dear friends, and making many new ones as well, makes me appreciative for having such a great bunch of people to interact with! The atmosphere of learning and trust at the conference was a tribute to all of you. Thank you.

May we use the energy created during the conference to dedicate this year to the next generation, and to move our contributions to their learning, thinking, and growing to the next level. Have a great and dynamic year!

Take care,
Lees Stuntz
(stuntzln@clexchange.org)

Review

Planting Seeds for Change in Education : An Interview with Tim Lucas

by Vicky Schubert

Learning to See Differently

These systems thinking lessons build the teachers' leadership capacity and sometimes have immediate applicability in the classroom. Tim shares the poignant story of one teacher who had an opportunity to use these ideas in his work with a middle school student. The student was a young man whose disruptive behavior had reached the point where he was being banned from fieldtrips, and the teacher was trying unsuccessfully to use performance contracts with him.

As a last resort, the teacher sat down with him and said, "Let me show you this in a different way. I don't want to talk about your behavior; you're responsible for that, and we want to help you. But do you know what's happening here? You're breaking down our trust." The teacher drew a picture of a bathtub—a basic stock and flow—and wrote "Trust" in it. He drew one arrow coming into the tub and one arrow going out, and he showed it to the student. He said, "Here's trust. When you deliver on your promise to be constructive for two days your bathtub fills up, and we see more trust. What do you think drains the trust and causes problems?" The student rattled off all of his missteps from the last week in school. The teacher said, "We want to be able to offer you the chance to go on fieldtrips, but can you see why we're having problems?" The child started crying. His question through the tears was, "How can I get my bathtub to fill up?" He could suddenly see what was happening to him in terms of trust. Lucas observes, "When teachers can get that kind of reinforcement in using these tools with students, then it gets easier to see how they might apply them in collaborative work with other adults—a critical aspect of learning how to lead."

Tim believes that the visual nature of these tools is one reason for their effectiveness in helping teachers see whole systems, so he emphasizes mapping skills in the curriculum. Maps, graphs, and models also contribute to the quality of the dialogue within each cohort as they move through the program together. "I can ask people to write a 5- or 8-page paper about their project," he explains, "but then I'm reading it, and even if they make copies for everyone in the class, the dialogue just drops. But when people are holding up 2 x 3 foot posters that they've created, and their classmates can see the questions emerging and actively stick their Post-It notes on them, the level of conversation becomes much more generative and much more enjoyable."

TIM LUCAS is a co-author of the *Fifth Discipline* fieldbook, *Schools That Learn*, and a longtime advocate of transforming education by applying the tools and principles of systems thinking and organizational learning. Now a professor of practice at Lehigh University in Pennsylvania, he recently spoke with *Leverage Points* about his efforts to nurture the next

***Review** continued on page 12*

Attracting Institutional Support through Better Assessment of Systems Thinking

continued from page 1

Among the benefits that Lyneis cites are an expanded sense of self, empowerment, and an extended time horizon. Having a general public that portrays these three characteristics will be crucial as we continue to struggle with contemporary social and environmental challenges.

Yet, many of our leading institutions developed to help diffuse systems thinking into curricula across the country report difficulty in attaining widespread support of systems-oriented instruction on an institutional level. In Debra Lyneis's and Lees Stuntz's article in the Spring 2008 issue of this journal, Diana Fisher emphasizes the importance of convincing educational administrators of the value of systems-oriented instruction, explaining that "the 'No Child Left Behind' and 'Adequate Yearly Progress' pressures on public schools have kept teachers from adopting new techniques that are not part of the district-approved materials for specific basic skills assessment."

In the same article, Debra Lyneis, reporting on progress at Carlisle Public Schools, explains, "Although we had tried to institutionalize our progress…we have been dismayed at how quickly our systems work could be extinguished throughout the school with a change in administrative priorities and the departure of just a few key people."

Lees Stuntz describes similar difficulties again in the same article: "The use of ST/SD in the classroom has not been ingrained to such a degree that it has become person-independent. At the moment it is not clear how to do that."

Chances are, readers of this article have experienced firsthand the benefits of systems-oriented curriculum or know someone who has. The problem is that efforts to evaluate and document those benefits have not progressed in a systematic way. Efforts to encourage more widespread adoption of systems-oriented curriculum will continue to stall at the institutional level without a more formalized and standardized methodology for assessment.

I understand the baggage that comes with the term *standardized*. For most educators it likely makes the hair on one's neck stand, conjuring thoughts of innovative teaching tools and approaches that have been ignored because they did not fit neatly into the scope of a standardized test.

As a former high school teacher, I sympathize with that frustration, but in an age where standardized tests hold the attention of administrators across the country, it would be wise to speak that language as much as possible without compromising educational quality. Furthermore, skeptics of systems-oriented instruction are quite right to want to see widespread and verifiable results before channeling limited resources toward what to them may seem like yet another educational fad.

Toward this end, I have developed a classroom activity designed to assess how students organize new information about complex systems. I have conducted my research in the context of environmental literacy, with the hypothesis that students who are taught to be better systems thinkers will be better prepared to understand the most pressing environmental challenges that we face today. (For example, we have seen from John Sterman and Linda Booth Sweeney how a lack of understanding of stocks and flows encourages complacency with regard to greenhouse gases and global climate change.)

In the following section of this article, I describe the assessment methodology that I have designed. The technique guides participants through a series of cognitive mapping exercises, so I refer to the tool simply as CMAST or a Cognitive Mapping Assessment of Systems Thinking. In the third section, I will briefly describe the results from one study in which I used these methods and discuss their significance.

2. Classroom Activity

The assessment begins with participants reading a short article about a complex system. The students then work through the cognitive mapping exercises, in which each student constructs two cognitive maps of the situation described in the article. Since this tool is designed to assess a thinking skill rather than knowledge, the specific system used can vary, but it must have certain characteristics in order to produce useful results.

First, it needs to be a topic about which the participants do not have prior knowledge. If students have prior knowledge of the topic, then the maps will be a measure of this knowledge rather than a measure of their ability to comprehend new information about a complex system.

With my research, I began pilot tests with global warming as the context, but it quickly became apparent that I was measuring knowledge of the issue rather than thinking processes. Therefore, I shifted to a less known environmental controversy: menhaden.

***Assessment** continued on page 4*

Attracting Institutional Support through Better Assessment of Systems Thinking

continued from page 3

Menhaden are a small, sardine-like fish that serve an important ecological role, eating algae and, in turn, being eaten by a wide array of fish and marine birds. In the past, the economic importance of menhaden has been indirect, as they represent a significant proportion of the diet for commercially important fish and arguably help to control algal blooms in coastal waters.

More recently, menhaden have become economically important themselves as a source of protein in livestock feed, aquaculture feed, and even human food supplements. (If you took a fish-based Omega-3 supplement today, then you are most likely digesting menhaden as you read this.)

The topic was obscure enough for me to feel confident that an effect of prior knowledge on study results would be unlikely. (As an extra precaution, I changed the name of menhaden to a fictitious species I called *samaki*, the Swahili word for fish.)

After reading the article, participants are asked to go through a stack of cards—with each card expressing one concept, such as *Industry profits* or *Coastal water quality*, pertaining to the article—and to pick out all the cards they feel they would need to explain the controversy completely.

The use of pre-written concept cards follows the structured format of a mapping technique called Conceptual Content Cognitive Mapping (3CM), which is used to identify associations that participants draw between relevant concepts. In the alternative open format of the technique, participants fill in their own cards. The structured format is most appropriate here to facilitate quantitative analysis of the results. However, the cards themselves are developed during pilot tests of the article using the open format.

Both 3CM techniques allow participants to work only with those concepts they feel are important. After the participants identify these concepts and lay the rest aside, they are given the opportunity to write in any relevant concept not listed in the cards.

Once the participants have included all the concepts deemed important, they sort them into groups based on whatever criteria they choose. There are no restrictions either on the number of cards chosen or on the number of cards in a group. Participants then label the groups with short descriptive titles that indicate why those cards were together.

After labeling their groups and reviewing their groupings, participants move on to the causal mapping portion of the exercise in which they identify causal relationships between their chosen cards. Participants characterize the relationship between any two cards as fitting into one of the following categories:

- An increase in Card 1 leads to an increase in Card 2.
- An increase in Card 1 leads to a decrease in Card 2.
- An increase in Card 1 does not affect Card 2.

Note that the relationships are directional. Participants are encouraged to assess the same pair of cards, transposing Card 1 and Card 2. Cards are then connected with positive arrows (category 1) or negative arrows (category 2).

A simple, four-card example is used to model the use of positive arrows, negative arrows, bi-directional causality, and feedback loops. Participants then follow the same conventions to complete their own maps. After participants have completed their map, they are asked to review it once more, checking to see that the map accurately represents their understanding of the situation. This completes the mapping exercise.

3. Application of CMAST

The exercise is suitable for a broad range of age groups, and has been used in studies with participants ranging from adults down to seventh grade. The study described below involved 23 undergraduate students from a political science class on environmental ethics and politics. Most of the students were political science majors. Other majors represented included English, journalism, marketing, and one environmental studies major. None of the students had received any systems training before taking this class.

While the class was not specifically devoted to systems concepts, the material was presented from a systems perspective. That is, each new topic included explicit lessons on systems concepts—such as stocks and flows, nonlinear causality, and scale—and was explained in the context of those concepts. The course focused on understanding the nonlinear causal relationships within several natural resource issues, including family planning policies, water management, and global warming.

The study has a pre-test/post-test design with participants working through the mapping exercise once during the second week of the course and again at the end of the course, fourteen weeks later. The course did not cover any issue involving the management of a fishery. Therefore, whatever skills the students applied to the study problem during the post-test had to be transferred from lessons given in other natural resource contexts.

3.1 Analysis of 3CM Maps

The first step in the analysis is looking at the number of concepts chosen by the participants. This number is generally considered an indication of the participant's confidence in his or her knowledge about the issue. The participants chose an average of 16.0 concepts during the pre-test and 20.1 concepts during the post-test, suggesting a greater confidence with the material in the post-test.

Still, it is difficult to say here whether the increase in cards signifies an increased confidence with complex systems or simply greater comfort with natural resource issues, participants having just completed a course on them.

The next step is to look at differences in which cards were chosen. Two differences are worth noting: *Reproduction rate of samaki* and *Amount of samaki caught*. *Reproduction rate of samaki* was chosen by 17% (4 students) during the pre-test and 43% (10 students) during the post, and *Amount of samaki caught* was chosen by 65% (15 students) in the pre-test and 96% (22 students) in the post.

These concepts are particularly important in terms of systems thinking because they represent an in-flow and out-flow for the samaki population, which suggests a dynamic view of that population.

Once we have looked at the cards chosen, we can look at the associations that the students draw between those cards during the 3CM portion of the exercise. A hierarchical cluster analysis is a statistical technique that indicates which concepts the students tended to group together. This technique produced four distinct categories in the pre-test and five distinct categories in the post-test (Table 1). For each test, one of the clusters constituted a sort of miscellaneous category. Concepts from this category are not listed, and only those concepts chosen by at least one-third of the students are included.

The first three clusters, regarding demand, economic aspects, and ecological aspects, remain relatively constant from pre-test to post-test. The fourth cluster, not included in the pre-test results, shows *Samaki population* and *Amount of samaki caught* as a separate category. This extra category, may again suggest a more nuanced view of the resource as its own entity, affecting and being affected by the other clusters.

Table 1: Stable Categories Chosen by Participants

	Cluster 1	Cluster 2	Cluster 3	Cluster 4
Pre-Test	• Demand for farm-raised fish • Demand for livestock feed • Demand for Omega-3 • Public information about fish oil intake	• Donestre & Sons' profits • Price of competing products • Production from international competitors • Soybean sales • Sales price per unit catch	• Algae blooms/ Dead zones • Coastal water quality • Sport fish populations • Sport fish health • Predatory bird populations • Samaki population	
Post-Test	• Demand for farm-raised fish • Demand for livestock feed • Demand for Omega-3 • Public information about fish oil intake	• Donestre & Sons' profits • Price of competing products • Production from international competitors • Sales price per unit catch (samaki) • Soybean sales • Cost per unit catch (samaki) • Bad weather • El Nino	• Algae blooms/ Dead zones • Coastal water quality • Sport fish populations • Sport fish health • Predatory bird populations • Amount of sport fish caught • Nutrients in the water	• Amount of samaki caught • Samaki population

Assessment *continued on page 6*

Attracting Institutional Support through Better Assessment of Systems Thinking

continued from page 5

3.2 Analysis of Causal Maps

After assessing the 3CM results, I was ready to look at the students' causal maps. First, I wanted to compare the general structure of the maps. More specifically, I wanted to assess the students' use of web-like causality, a term I use to indicate causal structures that deviate from purely linear causal maps.

Most people think linearly—that is, in terms of chains of events, in which A causes B causes C and so on. Systems thinking requires a shift from causal chains to causal webs as the structural metaphor. Therefore, one indication that students are exhibiting systems thinking is to see how much their causal maps look like webs rather than chains.

I do this in two different ways in order to capture the different types of web-like causality that students may use in their maps. Both measures indicate that the students used more web-like causality in the post-test than in the pre-test.

Causal loops are a particularly important form of web-like causality, so I look at them separately. Their importance stems from the fact that much of the counter-intuitive behavior exhibited by complex systems is a result of reinforcing and balancing feedback loops in the system.

In this study, 26 percent (six students) included at least one causal loop in their maps during the pre-test. Five of those six students included at least one loop in their post-tests as well. In addition, seven students who did not include a causal loop in their pre-tests included at least one in their post-tests, making a total of 52 percent (twelve students) who included causal feedback in their post-test maps.

It is worth noting here that most of the students (four out of six), who included loops in the pre-test, included only two-node loops. That is, their sense of feedback seems restricted to a two-node relationship in which Node 1 affects Node 2 and Node 2 in turn affects Node 1. While this type of two-way causality is important, it is arguably the easiest type of loop to identify. In the post-test, conversely, nine students included loops involving three or more nodes.

This provides some evidence that these nine students have a deeper sense of feedback loops than they did in the pre-test. Nonetheless, the failure of almost half of the students to

Table 2: Percentage of Participants Identifying Causal Links in 5th-Order Matrices among Undergraduates

	Cause	Effect	Pre-Test %	Post-Test %
1	Algae blooms/ Dead zones	Sport fish populations	4	30
2	Bad weather	Donestre & Sons' Profits	17	52
3	Cost/unit catch (samaki)	Donestre & Sons' Profits	0	17
4	Cost/unit catch (samaki)	Amount of samaki caught	0	20
5	Amount of samaki caught	Reproduction rate of samaki	0	20
6	Amount of samaki caught	Samaki population	35	78
7	Management of samaki catch	Amount of samaki caught	0	30
8	Management at ecosystem level	Sport fish populations	0	17
9	Coastal water quality	Management of samaki catch	0	20
10	Predatory bird populations	Management of samaki catch	0	20
11	Samaki population	Amount of sport fish caught	4	35

include any loops at all in the post-test suggests that more needs to be done to stress the importance of feedback.

After looking at the general structure of the causal maps, I focused on the differences in specific connections identified during the pre-test and post-test. However, some differences in connections may represent semantic differences rather than interpretive ones. For example, a student may suggest in the pre-test that increased *Demand for Omega-3 food supplement* will decrease the *Samaki population*. In the post-test the student may suggest that increased *Demand for Omega-3* will increase *Effort put into catching samaki*, which in turn will decrease the *Samaki population*.

Note that in this case, the original connection remains in the post-test, but with an intermediate concept. In order to account for these kinds of differences, I included direct and indirect connections when comparing student maps. Therefore, in the example above, the connection between *Demand for Omega-3* and *Samaki population* is counted as a similarity between the two maps.

Fifty causal links were identified as significantly more common in the post-test than the pre-test. Table 2 shows a subset of these links, illustrating the greater connection between catch levels and fish populations and the greater role that *Management of samaki catch* plays in the post-test results. Again, since the course itself focused on natural resource issues, the greater role of resource management cannot be attributed solely to systems-oriented instruction. However, the greater focus on population flows is an important part of systems thinking.

For the final part of the analysis, I focused on the accuracy of the students' understanding. It is one thing to conclude that students receiving systems-oriented instruction tend to identify more connections and exhibit more web-like causality, but it is quite another to say that their understanding of the system has improved as a result.

The difficulty here is that there is no one correct answer when it comes to designing a causal map. Nonetheless, some causal maps are going to provide more accurate representations than others. To measure this, I asked experts in systems ecology, fisheries, and ecological modeling to work through the same exercise that the students worked through, and I compared the students' maps to the experts' maps.

Using two different techniques for comparison, the post-test maps proved to be far more like the expert maps than the pre-test maps.

In summary, the findings suggest a more dynamic view of the samaki population, a clearer sense of its role in the larger system, and an improved ability at the end of the class to understand the complex environmental system described in the article.

But there are a number of factors—besides systems-oriented instruction—that could have affected the results. First, any change from pre-test to post-test might be the result of a semester of being forced to learn and think about environmental issues. Second, because of the course's explicit focus on systems concepts, the students would likely have been conscious of the types of causal structures to look for during the post-test. Addressing these shortcomings requires, first, performing this assessment in a course focused on something other than natural resources and, second, separating the assessment from the course itself so that the exercise does not overtly cue students to use systems concepts.

I address these issues in a later study, but I am keen to do more of this type of research (and to have others do the same) with the hope of developing a database of results that provide a quantitative, verifiable record of the effect systems-oriented instruction has on students' ability to understand the complex social, economic, and environmental challenges that are in the news everyday.

But the tool presented here is just one idea. I believe that it is a good start in that it satisfies many of the requirements for a systems thinking assessment tool, including providing quantitative data and requiring relatively little class time for implementation.

Still, my main goal with this article is to foster discussion regarding what would make a good assessment tool that could be broadly implemented in order to obtain more data regarding the benefits and shortcomings of systems-oriented instruction.

Such a tool would be useful in garnering more institutional attention for a tool that shows much promise in addressing the educational needs of the 21st Century.

Works Cited

Lyneis D, Stuntz L, Richardson G. 2003. *The Future of System Dynamics and Learner-centered Learning in K-12 Education, Part I*. Creative Learning Exchange Newsletter 12(1).

Lyneis D, Stuntz L, Richardson G. 2003. *The Future of System Dynamics and Learner-centered Learning in K-12 Education, Part II*. Creative Learning Exchange Newsletter 12(2).

Assessment *continued on page 8*

Guest Lecturer Launches Trio School "Systems Learning" Initiative

David Wheat, senior lecturer in system dynamics at the University of Bergen in Norway, will conduct guest lectures and teacher workshops at the Trio World School on June 4-5, 2008. The appearance marks the beginning of a collaborative venture in «systems teaching and learning» involving the Trio School and the University of Bergen. A major goal of the initiative is to foster a systemic perspective across the curriculum and at all grade levels. Also, middle- and upper-level students will develop computer modeling skills that enable simulation of simple systems in both the physical and social sciences.

In addition to teaching system dynamics modeling in Bergen's international master's degree program, Wheat is adjunct associate professor of economics at Virginia Western Community College in the United States. He also has K-12 teaching experience at elementary, middle, and high school levels, and he received a national teacher-of-the-year award in 1996. He is the current president of the economics chapter of the International System Dynamics Society, and associate editor of the System Dynamics Review and the International Journal for Pluralism and Economics Education. His most recent journal publication is "The Feedback Method of Teaching Macroeconomics: Is It Effective." Wheat also has extensive private consulting experience, and he has served in government. He received his PhD in system dynamics at the University of Bergen, his master's degree in public policy from the Kennedy School of Government at Harvard University, and his bachelor's degree in political science at Texas Tech University.

David Wheat is joined by some of his international students at a popular Bergen coffee shop. Maria Saldarriaga, center, is working on her doctorate in system dynamics and will be a Trio Teaching Fellow during the 2008-09 school year.

Attracting Institutional Support through Better Assessment of Systems Thinking

continued from page 7

Lyneis D and Stuntz L. 2008. *System Dynamics in K-12 Education: Lessons Learned*. Creative Learning Exchange Newsletter 17(2).

Rockefeller Brothers Fund. 1958. *The Pursuit of Excellence: Education and the Future of America.* Doubleday & Company: Garden City, NY.

Smith BO, Stanley WO, Shores JH. 1957. *Fundamentals of Curriculum, Revised Edition.* World Book Company: Yonkers-on-Hudson, NY.

Richard Plate, Center for Marine Resource Studies, 1701 NW 38th Drive, Gainesville FL 32605
rplate@FIELDSTUDIES.ORG
352-271-5281

This article is available on the CLE website, clexchange.org.

The 18th Annual Pegasus Conference

Synergy at Work: Gathering Momentum for Meaningful Performance

November 17-19, 2008

Boston, Massachusetts

Pegasus invites Creative Learning Exchange members to **help us increase the generational diversity of this year's conference by bringing students to join us as active participants. We are working to attract more young attendees to ensure that we have the whole system in the room.** Special rates as low as $500 per student are available. Please let us know if you are in a position to bring students or know someone who is. You can contact Vicky Schubert at 781-398-9700 or by email at vickys@pegasuscom.com.

Over the past few years, the number of educators at the conference has grown steadily, and now represents about one-third of the learning community. These are administrators, classroom teachers, and sometimes school board members who are passionate about preparing students to thrive in the 21st century by modeling the systems thinking necessary to transform educational organizations capable of creating new realities.

Keynotes include Peter Senge, Betty Sue Flowers, Adam Kahane, Atul Gawande, and—of particular interest to educators—Sara Lawrence-Lightfoot, a pioneering sociologist from the Harvard Graduate School of Education who examines the culture of schools, the patterns and structures of classroom life, socialization within families and communities, and the relationships between culture and learning styles.

If you are in a position to bring young people to this conference, please contact Vicky Schubert to discuss the possibilities for supporting their participation. Call 781-398-9700 or email vickys@pegasuscom.com.

Download the conference flyer at http://www.pegasuscom.com/pc08/synergyatworkflyer.pdf.

Six Great Reasons for Attending the 2008 Pegasus Conference AND Bringing Your Students with You!

1. Keynotes include Peter Senge, Betty Sue Flowers, Adam Kahane, Atul Gawande, and—of particular interest to educators—Sara Lawrence-Lightfoot.
2. Educators represent about one-third of the conference learning community: administrators and teachers with a systems perspective who are passionate about transforming their students' learning experience and outcomes.
3. This conference provides an unparalleled opportunity for cross-professional learning with champions of large-scale systems change from all sectors of society.
4. The Pegasus Conference offers an incomparable opportunity for students to strengthen their thinking skills outside the classroom.
5. The mutual benefit to students and the conference community amply offsets any logistical challenges created by the loss of class time for students who attend.
6. The Pegasus Conference is an ideal place for intergenerational learning.

2008 ST/DM Conference for K-12 Education Update

The Systems Thinking and Dynamic Modelling conference was a remarkable gathering, attended by many of the experienced teachers and system dynamicists who have been working for almost 20 years to make system dynamics accessible to the education community, both students and teachers. The Babson Conference Center did a magnificent job of feeding and housing us, freeing all, including those responsible for the conference, to concentrate on the people and the content.

Our three keynote speakers, Peter Senge, Elaine Johnson and George Richardson, broadened our outlooks in diverse yet synergistic ways. Peter put our mission to encourage system citizenship in the context of the global society, its interconnected needs and issues. He encouraged us to continue in the pursuit of teaching and learning systems thinking and system dynamics in order to help our youth—the future of our world—understand interdependencies.

Elaine Johnson gave us the benefit of her many years of learning about the human brain, its physiology, and its power. She delineated how the brain learns, and defined many points that we know are pertinent to the understanding of systems thinking and system dynamics. She pointed out that, relevancy and emotion, connectedness to real world situations, and working with problems using multiple modalities are all ways to help the brain retain what it has learned. She gave all of us who know that systems thinking and system dynamics are important learning tools a bit more grist for persuasion of others and another bulwark for our convictions.

George Richardson came from yet another angle, but his presentation dovetailed beautifully into the previous two keynotes by exploring a central premise of system dynamics—

Are You Interested?

I am seeking expressions of interest from educators in Australia, New Zealand and Singapore who would be interested in attending a Waters Foundation run Systems Thinking in Schools (Level 1) workshop.

The 4 day workshop would most likely occur in the second week of January 2009 (around 4th—7th) in Brisbane, Australia.

Registration costs will depend on the number of participants. At current estimates (based on a minimum of 15 participants) this fee would be around the AUD$1000—$1500 mark. Participants would be responsible for organising their own travel and accommodation requirements.

Efforts will be made to attain 3rd party sponsorship of this event in a bid to reduce costs. If you are able to assist with this then please let me know.

If this is an event that you might be interested in attending, please email Ian Marsden at imars7@eq.edu.au.

No firm plans have been made to date. This expression of interest is to find out whether this would be a viable event to occur outside of the U.S.

Please pass this on to other networks that you think may be interested.

endogenous* thinking. He talked about an endogenous point of view being central to thinking in a complex world, and contrasted it with an exogenous viewpoint. The contrast in the two viewpoints crosses the boundaries of emotional maturity and intellectual acuity.

In the midst of these three keynotes, the parallel sessions gave participants a wide variety of workshops and session from which to choose. Authors such as Dennis Meadows, Linda Booth Sweeney, Mary Scheetz, and Tim Lucas all gave informative and interesting sessions which broadened knowledge and understanding. Teachers who have been immeshed in ST/DM for well over a decade, Tracy Benson, Joan Yates, Diana Fisher, Alan Ticotsky, and Rob Quaden, dispensed their wisdom. Experienced system dynamicists such as Jay Forrester, Jim Hines, George Richardson, Gary Hirsch, and David Wheat were available not only for sessions, but to chat with in between.

Mostly, however, the center of the conference was the conversation: conversation sparked by interesting content and even more by wise and interesting people. Sitting in the dining room over the delicious desserts at every meal, the networking abounded.

A final note to the conference was singing Happy Birthday to Jay Forrester, the founder of system dynamics, who celebrated his ninetieth birthday in July. Both he and his wife Susan are a constant source of inspiration!

More information on specific sessions from the conference can be found at http://www.clexchange.org/conference/

*The word endogenous means "arising from within."

Samar Singh and David Wheat bring Jay Forrester up to date on their project in India.

Review

continued from page 2

generation of educational change agents through a unique teacher leader development program. Tim joined us at the Systems Thinking and Dynamics Modeling Conference this summer. The powerpoint from his talk, *Developing Teacher Leaders: Using Systems Tools in School-Based Action Research Projects*, is available on the CLE website. The above is quoted from the *Leverage Points* article. The complete article is available from Leverage Points (http://www.pegasuscom.com/), a free on-line newspaper available from Pegasus Communications.

http://wwwpegasuscom.com/levpoints/timlucasint.html

Newsletter Subscription Information

The Creative Learning Exchange newsletter is available in three different formats:

- On the web site at www.clexchange.org
- As an attachment to an E-mail
- In paper format via US mail ($15.00 outside the USA)

Since we vastly prefer electronic distribution to paper because it is so much less expensive, please e-mail us at any time when you would like to have an electronic subscription.

milleras@clexchange.org

Interested In Investing?

If you would like to invest in our effort here at *The Creative Learning Exchange*, your contribution would be appreciated. You may donate any amount you wish; perhaps $50.00 is a reasonable amount for a year. All contributions are tax-deductible.

Enclosed is __________________ to ***The Creative Learning Exchange*** to help invest in the future of K-12 systems education.

Name____

Address____

____

E-mail____

THANK YOU!
The Creative Learning Exchange, 27 Central Street, Acton, MA 01720

The Creative Learning Exchange
27 Central Street
Acton, MA 01720
Phone 978-635-9797
Fax 978-635-3737
www.clexchange.org

The Creative Learning Exchange is a trust devoted to encouraging exchanges to help people to learn through discovery. It is a non-profit educational institution and all contributions to it are tax deductible.