The CREATIVE LEARNING Exchange
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A Structure for Assessing Systems Thinking

Richard Plate and Martha Monroe

Introduction

Many educators agree on the importance of systems thinking. Indeed, it has reached buzzword status, with many state and national educational guidelines acknowledging the importance of systems thinking skills. Recent evidence of the support for systems thinking can be seen in *Next Generation Science Standards* (NGSS), which now contain “cross-cutting concepts” that sound very much like systems thinking, including one explicitly on “systems and systems models” (NGSS, 2013).

However, even though the foundational concepts and methods of systems thinking have been around for decades (e.g., Forester 1961), progress toward a standard way of assessing systems thinking skills in a way that translates to broader educational goals has been slow. As a result, systems thinking has remained a somewhat nebulous goal for educators, who may be interested in systems thinking in the abstract, but unsure of how to implement it productively into their classrooms. Anecdotally, educators who are interested in incorporating systems thinking into their curricula express an interest in more specific, longitudinally connected objectives so that progress can be measured. Without a clearer system of progress and evaluation, the rate of adoption of systems-oriented curriculum by educators will continue to be disappointing to systems proponents.

In this paper we suggest a structure for evaluating the level of systems thinking in students. Designing such a structure requires clarity with regard to educational goals and objectives. In short, we must ask, what is the long-term goal of systems-oriented curriculum, and what are reasonable shorter-term, achievable objectives? To answer these questions, we sought guidance from educational efforts in traditional disciplines. In the front matter of *Next Generation Science Standards*, the authors observe:

> Never before has our world been so complex and science knowledge so critical to making sense of it all. When comprehending current events, choosing and using technology, or making informed decisions about one’s healthcare, science understanding is key. Science is also at the heart of the United States’ ability to continue to innovate, lead, and create the jobs of the future (NGSS 2012).

Note that the authors include two overlapping goals: 1) the importance of scientific understanding simply to be an informed and participating member of society, and 2) the importance of enabling a large pool of students to become the scientific leaders and professionals of tomorrow. In other words, all students should understand the basics of biology, ecology, chemistry, and physics enough to understand the scientific aspects of contemporary issues regarding, for example, human and environmental health. In addition, a significant proportion of students must be motivated and competent to go beyond this basic understanding to become the scientific innovators of the future.

Proponents of systems thinking have a parallel set of challenges. While some may dream of a society proficient in computer modeling of complex systems, educators would be wise to identify more modest goals as well. For some students, these modest goals may be the extent of their systems thinking, while for future innovators and leaders they will be stepping stones to more sophisticated study of complexity. In either case, systems-oriented curriculum will stagnate until these intermediate goals are identified and explained. In this article we suggest a structure for assessing and documenting students’ progress through these intermediate goals.

Evaluating Systems Thinking

One can view systems thinking skills as a subset of critical thinking skills that help individuals make “reliable inferences about behavior by developing an increasingly deep understanding of underlying structure” (Richmond, 1994, p. 6). Numerous

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THIS ISSUE AT A GLANCE

EDITORIAL

In the years when we have a conference scheduled, the post-holiday season has a rhythm palpably different from other years. We now are busy with the ST/DM conference program. We await proposals for sessions as the program takes shape around the keynote speakers. We are lucky to have George Richardson and Peter Senge returning, as well as Linda Booth Sweeney, who has contributed to every conference. Peter Hovmand brings expertise not only in system dynamics, but also in working with small groups of K-12 students with group modeling.

I think that when things are bubbling, they attract other bubbles! We have some new ventures this summer, and are hoping thereby to extend our outreach in the New England area. We are working with the WPI system dynamics experts to create opportunities for students in the Worcester, MA area to experience systems thinking and system dynamics. The first is a week-long modeling and simulation course entitled *Modeling the Environment: Games, Computer Modeling and Simulations* for grades 8-10, held at WPI on July 7-11. The CLE and staff at Innovation Academy are collaborating with WPI to host the session. See the box on this page.

Also new this year is an introductory workshop we are hosting in conjunction with the ST/DM conference. It offers the best of both worlds—separate time to learn the day before the conference, followed by the stimulation of others who have years of experience, as well as renowned experts and intellectually challenging keynotes. Attendeees will have the support of experienced teachers to discuss and guide learning as the conference progresses. It promises to be a win/win situation for those who are just starting out.

We look forward to hearing from you over the next few weeks. Tell us if you want to propose a session at the conference, are thinking of coming and have questions to ask, or wish to apply for a scholarship. Stay warm and safe as the winter progresses!

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

Updates

Over the past year, the SoL Ed partnership and the Creative Learning Exchange have enjoyed getting together with Boston area educators to discuss what is happening in the Boston area and work together on a systems model of our mental models. Peter Senge and Rebecca Niles have joined us in this venture, and schools systems such as Carlisle, Brockton, Lincoln, and the Boston Public Schools have been active participants. If anyone wishes to be informed of the meetings, please email Lees Stuntz (stuntzln@clechange.org) to be added to the list.

Camp Snowball

If you can't come to the ST/DM conference in MA in June, there is another systems training conference, in Portland, OR, for you to consider.

Camp Snowball (July 14-18) is in its fourth year of providing a fun, upbeat and stimulating conference. The SoL Education Partnership hosts the event in conjunction with the CLE, the Waters Foundation and the Cloud Institute for Sustainability.

For more information: campsnowball.org/

Modeling the Environment: Games, Computer Modeling and Simulations

Worcester Polytechnic Institute
Worcester, MA

Date: July 7-11, 2014 **Age Range: Grades 8-10**

Learn about the concept of sustainability in complex systems through use of computer models, online simulations, and hands-on games. You will gain a new perspective on some of the toughest environmental problems we face today and learn what we can do to bring our use of natural resources into balance.

FMI: info@clexchange.org

A Structure for Assessing Systems Thinking

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educators and scholars have offered sets of specific skills that collectively comprise systems thinking (e.g., Maani and Maharaj 2004; Assaraf and Orion 2005; Riess and Mischo 2010). Most characterizations borrow heavily from Richmond's (1993;1994; 2000) seven essential systems thinking skills, which outline the developing maturity of a systems thinker. With this in mind, Stave and Hopper (2008) suggest a similar system to be used as a taxonomy of systems thinking skills which parallels Bloom's taxonomy of learning. Figure 1 shows Stave's and Hopper's proposed taxonomy along with the suggested level of systems thinking assigned to each.

Stave and Hopper (2008) report that when they presented this taxonomy to systems experts, many of the criticisms stemmed from disagreement over the proper order of the skills with some questioning whether systems thinking can be represented as a single continuum at all and suggesting that multidimensional space may be necessary. These criticisms are interesting in light of the wide acceptance of Richmond's essential systems thinking skills. While it is clear that some skills are more fundamental and may need to be acquired before other skills, the interesting questions are what determines mastery of these basic skills? And, are these skills sequential, or, as some have argued with Bloom's Taxonomy (Paul 1995), do learners practice many of these skills concurrently as they improve their abilities to think in systems?

While a continuum of systems thinking skills may be useful as a loose guide to the development of systems thinking, we suggest that as an evaluative tool, it presents an overly simplified image of students' progress as they learn about systems. Therefore, providing a scale of measurement for each systems thinking skill may be a more fruitful step toward developing a system for evaluating systems thinking interventions.

Our goal is to develop a system of evaluation that can measure a student's proficiency in a complicated set of interrelated skills and communicate the results in a simple and easily understood way. This challenge is similar to that of measuring literacy. Reading requires a multitude of interrelated skills and knowledge that the National Center for Education Statistics (NCES) aggregates into four levels of competence. We have adopted a similar approach to assessing literacy in systems thinking. The sections that follow focus on a set of systems thinking skills similar to those proposed by Stave and Hopper (2008)[1]. For each skill, we describe four levels of literacy with the same labels as the NCES system.

1 The "Creating Simulation Models" skill included by Stave and Hopper (2008) is not included here, since creating quantitative computer models is incorporated in this set of system thinking skills.

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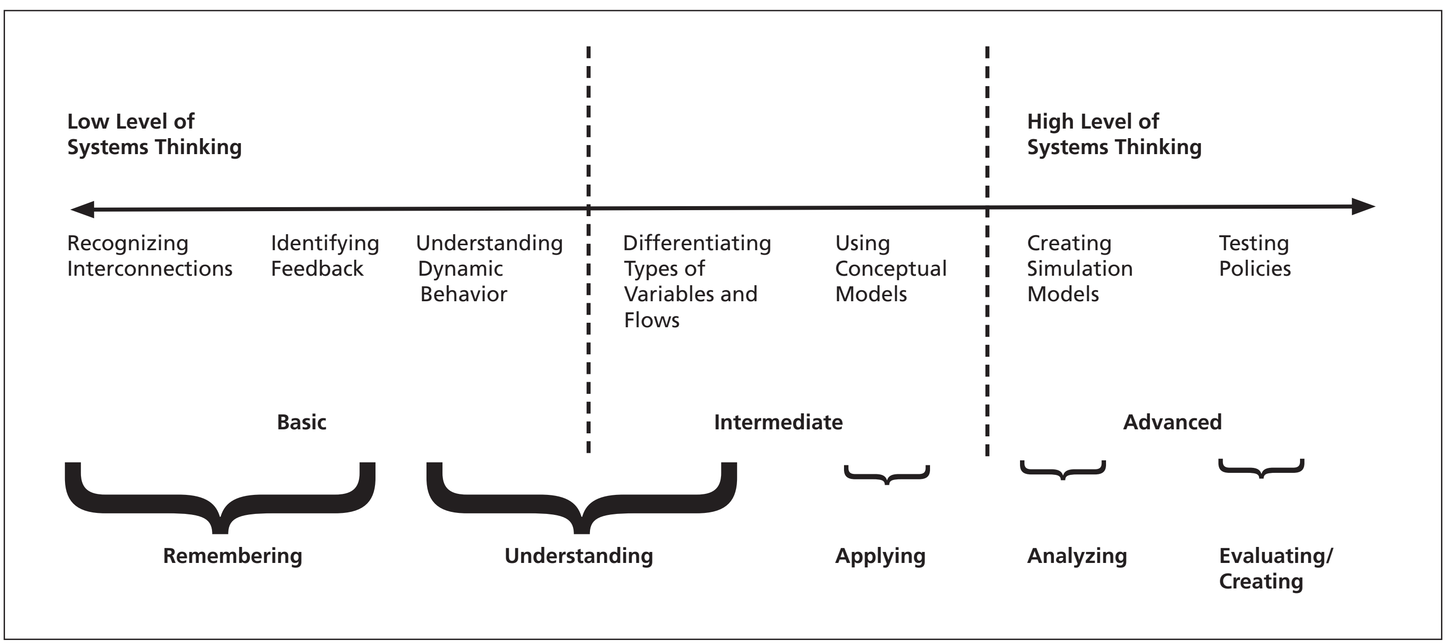

Figure 1: Proposed taxonomy of systems thinking skills from Stave and Hopper (2008)

A Structure for Assessing Systems Thinking

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Skill 1: Recognizing Interconnections

This skill refers to individuals' ability to identify key connections between parts of a system. Lacking training in systems thinking, even highly educated adults tend to have tunnel vision, focusing on narrow chains of causality and failing to apprehend the impacts of our actions beyond our narrow focus (Plate 2010).

Below Basic Systems Literacy	Recognizes only linear connections; does not look for connections not included in prior beliefs
Basic Systems Literacy	Includes some non-linear connections in understanding of causal structure of a system; can understand an explanation of a system's behavior in terms of non-linear causal structures
Intermediate Systems Literacy	Includes many non-linear connections in one's understanding of the causal structure of a system; actively looks for connections beyond prior beliefs; can explain a systems behavior in terms of non-linear causal structures
Advanced Systems Literacy	Can develop a quantitative model of complex systems that provides insights into how impacts will ripple across a system

Skill 2: Identifying Feedback

Some of those interconnections that lie beyond our tunnel vision combine to form feedback loops, which can play a significant role in the behavior of a system. Systems thinking requires identifying those feedback loops and understanding how they can impact the behavior of a complex system.

Below Basic Systems Literacy	Little or no understanding of the role that feedback plays in a system
Basic Systems Literacy	Understands the basic role of feedback in a system; can understand an explanation of a system's behavior in terms of feedback
Intermediate Systems Literacy	Can identify feedback loops in complex systems and explain a system's behavior in the context of those feedback loops
Advanced Systems Literacy	Can incorporate multiple feedback loops in quantitative models to predict the varying influence of such feedback at different points in time

Skill 3: Understanding Systems at Different Scales

This skill represents the first deviation from Stave's and Hopper's (2008) taxonomy. Often descriptions of systems thinking involve the ability to observe a system at multiple scales. Garret Hardin's famous tragedy of the commons results from the inability of people to understand the system beyond the individual scale. This skill is not entirely different from Richmond's forest thinking—the ability to zoom out and understand the system's behavior in a broad scale and then to zoom back in to understand the details.

Below Basic Systems Literacy	Tends to interpret system behavior on a single scale (typically individual and short-term)
Basic Systems Literacy	Understands that the behavior observed at any specific scale of a system is affected by broader and narrower levels of scale
Intermediate Systems Literacy	Can explain the behavior of a system in terms of interconnections between variables at multiple scales
Advanced Systems Literacy	Can incorporate behavioral interactions at multiple scales into a quantitative model

Skill 4: Differentiating Types of Stocks and Flows

The term stocks refers to any storage or pool within a system. This can be something physical, such as nitrogen in a lake to more abstract concepts, such as a stock of money in an account or even a stock of public trust in government. Flows represent changes in levels of a stock. Those untrained in systems are often surprised by delayed responses of complex systems. These delays can often be easily understood when one views a system as a set of stocks and flows.

Below Basic Systems Literacy	Little or no understanding of the relationship between stocks and flows
Basic Systems Literacy	Has a conceptual understanding of the distinction between stocks and flows and can follow an explanation of a systems behavior in the context of the interactions between multiple stocks
Intermediate Systems Literacy	Has a conceptual and practical understanding of stocks and flows and can interpret the behavior of a system based on this understanding
Advanced Systems Literacy	Can develop a model with multiple stocks and flows and use that model to make valid inferences about the behavior of the system

Skill 5: Understanding Dynamic Behavior

Complex systems tend to go through long periods of stability with little change and relatively short periods of rapid change (Gunderson and Holling, 2001). These rhythms are the result of changes in stocks which allow different feedback loops to become stronger or weaker drivers of a system. Without any systems training, our mental models tend to be static, so we fail to include these rhythms in our decisions (Moxnes, 1998).

Below Basic Systems Literacy	Has a static mental model of a system; does not incorporate the idea of change over time
Basic Systems Literacy	Has a basic conceptual understanding that systems change over time; can understand explanations of a system's behavior in terms of non-linear causal structures, feedback, and stocks and flows
Intermediate Systems Literacy	Has a thorough understanding of how systems change over time, which includes fast- and slowly-changing variables and delayed feedback; can develop reasonable hypotheses about a system's behavior in the context of non-linear causal structures, feedback, and stocks and flows
Advanced Systems Literacy	Can develop quantitative models to test hypotheses and explore scenarios regarding how a system may change over time.

Skill 6: Creating Simulation Models

Hirsch (2006) argues convincingly that experience with pre-packaged simulations may be a more effective way of introducing systems thinking skills than model-building. Still, few would deny the importance of being able to create computer simulations for more advanced systems thinking (Sterman, 2002). For this reason, we have incorporated simulation modeling at the "Proficient" level of other skills. However, working with pre-packaged simulations and creating more basic simulation models may be a significant part of a student's training in systems thinking, and there is certainly a learning curve involved with these skills. Therefore, we follow Stave and Hopper's (2008) lead, including model-building as a separate skill as well.

Below Basic Systems Literacy	Cannot interpret behavior in a simulated computer model; cannot represent complex systems in a diagram
Basic Systems Literacy	Can interpret the behavior of a basic pre-packaged simulation and describe how the structure of the system contributes to that behavior; can create simple simulation models involving a handful of stocks and flows and use the model to explain the system's behavior
Intermediate Systems Literacy	Can interpret the behavior of more sophisticated pre-packaged simulations in the context of system structure; can create simulation models of systems that are sufficiently complex to make computer simulations required for making reasonable projections regarding how the system will behave over time; can use the computer model to test hypotheses and glean insights about the behavior of the system
Advanced Systems Literacy	Can observe a system and collect the data needed to create a simulation model of highly complex systems with numerous stocks and flows; can use the model to test hypotheses and glean insights about the behavior of the system

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A Structure for Assessing Systems Thinking

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Skill 7: Incorporating Systems Thinking into Policies

Both skills 5 and 6 require some level of proficiency of the other skills. Skill 7 implies incorporating inferences from systems thinking into one's decision-making process. As one improves at skills 1 through 5, she should be able to apply those thinking skills to make more informed decisions about her behavior in the complex systems in which she lives.

Below Basic Systems Literacy	Does not apply understanding of the complexity of a system when making decisions
Basic Systems Literacy	Applies systems thinking to personal decisions and can discern the likely effects of policies at multiple scales
Intermediate Systems Literacy	Applies systems thinking to personal decisions and uses systems concepts to assess broader policies; Can understand explanations of policies in terms of results from quantitative models
Advanced Systems Literacy	Can develop quantitative models of complex systems and use them as tools to make valid inferences about various competing policies

The Advantages of Using a Standardized Structure for Evaluation

We see this system has having value in numerous ways. First, it can provide a sense of structure and foster longitudinal connections by which students build their systems thinking skills over multiple educational experiences and even multiple years. Most implementation of systems-oriented instruction taking place today is in the form of episodic activities that do not connect directly to specific long-term educational goals in the context of systems thinking. Longitudinal connections regarding systems thinking can help teachers place current systems-oriented activities within the context of long-term goals.

Second, it can serve as a tool for improving systems-oriented instruction. A systems-thinking lesson need not address all of the skills at once. Current assessment of systems interventions are problematic because they do not seem to connect directly to each other or to broader educational goals or even to a shared and explicit set of systems thinking goals. Providing a common structure to the evaluation of these interventions can help educators identify effective methods and activities for achieving their goals within the context of specific systems thinking skills.

Third, it can provide a greater degree of legitimacy to systems thinking skills. If a teacher claims that a student is proficient at geometry at the tenth-grade level, educators from across the country know, within reason, what that means. Proficiency at systems thinking needs to have the same level of consistency.

Fourth, it helps to bridge systems thinking with the broadly accepted Next Generation Science Standards, as well as other standardized educational benchmarks which mention systems thinking concepts, but do not address them with the level of detail and longitudinal structure needed to make them useful to a broader pool of educators. Developing such connections can foster broader adoption of systems-oriented curriculum. Few educators speak negatively of systems thinking; they simply do not know how to contribute to the goal of improving systems thinking in a meaningful way. With this standardized structure for assessing systems thinking, more educators will be able to identify how they contribute to the larger goal of bringing students to basic, intermediate, or proficient levels of systems literacy.

Conclusion

Following the assessment models provided by more established fields of learning, such as science and literacy, provides practical advantages both in the further development of system-related curriculum and in the adoption of systems thinking across a broader range of educators. Certainly, there would be some disagreement as to the specific details indicated at each level of systems thinking proficiency. Indeed, our goal here is to encourage further discussion in that direction. Research findings could be useful in the development of measurable indicators for each skill and each level of proficiency. Additional work on effective strategies that teachers can use to engage learners in these skills will also be needed. However, such discussion should not divert attention from the need to have a broadly applicable, easily understood system of assessing systems thinking.

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Thinking Systemically about Common Core Mathematical Practice Standards: "Mathematically Proficient Students can…"

Jeff Potash

As system thinkers and dynamic modelers, we strive to apply our unique tools and perspective to foster in ourselves and in our students a deeper understanding of how to perceive and manage change. Behavior-over-time graphs, stock/flow diagrams, causal/feedback loops, and computer models combine to nurture a powerful set of critical thinking skills.[1] Effectively used, systems tools and concepts build skills and habits of mind over time that deepen learning, challenge preconceptions, build new conceptual frames, and enhance student confidence to translate learning into action in becoming system citizens.

While we all share that vision, for any systems educator unfamiliar with the machinations of mathematics education in K-12, the Common Core standards for K-12 Mathematics present a daunting challenge: seventy pages of text list hundreds of detailed standards across what is described as a "sequence of topics and performances." Jay Forrester reminds us that "laundry list" thinking, contrasted with systems thinking, can inhibit understanding. Consider the mundane illustration of a grocery trip: Will I remember a list of ten items I need (flour, eggs, vanilla, butter, cocoa….), without an overarching conceptual frame (a recipe) and an understanding how the parts create the whole (chocolate cake)? It's a system, not just a haphazard list.

[1] See the Creative Learning Exchange, *Critical Thinking: Using Systems Thinking & Dynamic Modeling* (2012), for more on Barry Richmond's pioneering efforts to describe eight types of systems thinking skills.

In trying to connect the *Dollars and Sense* personal finance curriculum with grade-relevant Common Core Mathematics Standards, I discovered that the "sequence" of Common Core Standards in the text did not match up with the progression of mathematical skills developed in our lessons. References to money are, for the most part, focused on the lower elementary level, where they are applied to learning about numbers and arithmetic. Some references appear at the middle school level, typically dealing with linear algebra and exponential growth. The mathematics of balancing multiple financial instruments over time is far outside what the standards specify. In sum, our approach seems altogether out of sync.

Hence the question: *Can the mathematics standards be organized to support systems thinking and learning?*

Here I would call attention to a three-page section of the standards at the beginning of the document (pp. 6-8), labeled *Standards for Mathematical Practice*. This section focuses upon "what is known about how students learn," followed by an important question, "What does mathematical understanding look like?"

What follows is an overarching or systemic set of learning skills that operates across specific content areas. The *Standards for Mathematical Practice* identify familiar National Council of Teachers of Mathematics[2] "processes" (problem solving, reasoning and proof, communication, representation, and connections) along with "proficiencies" described in the National Research Council's report, *Adding it Up*[3] (adaptive reasoning, strategic competence, conceptual understanding, procedural fluency, and productive disposition), that support long-term learning. Interestingly, the eight Common Core Practice Standards are presented in the same manner as the content standards, in list form:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

But there is something in these practices that speaks to systems educators. Over time, the document explains, these practices strive to develop in students an increasing ability "to engage with subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle, and high school years." That describes a learning curve, or, in behavior-over-time terms, an

[2] www.nctm.org

[3] http://www.nap.edu/catalog.php?record_id=9822

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Thinking Systemically about Common Core Math Practice Standards

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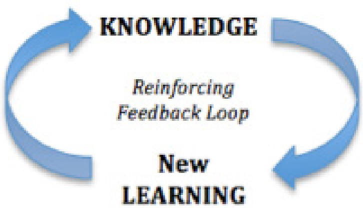
ever growing rate in student capacity, interest, and ability to apply mathematical skills in meaningful ways. As systems thinkers, we recognize that the structure underlying this behavior is a reinforcing feedback loop.

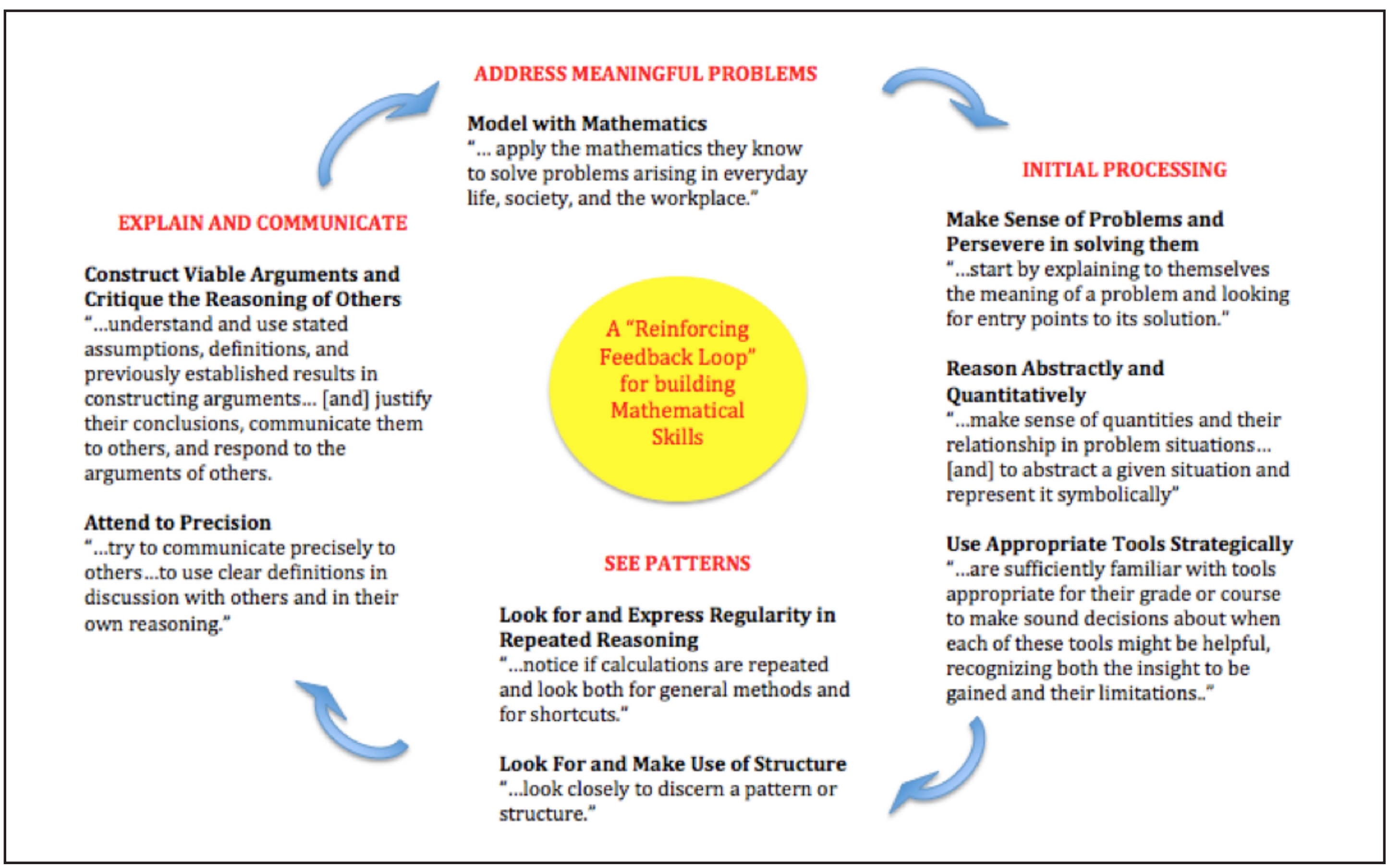


Over time, as student knowledge, capacity, and confidence grow, so, too, do rates of future learning. Represented in the language of cognitive science, systemic learning opens new doors to discover what one doesn't yet know, provides a conceptual basis upon which to grow that knowledge and, most critically, apply that knowledge to issues of personal import. When students "own" and apply what they've learned, the discoveries foster curiosity and new questions upon which future learning can then occur.

The key here rests with conceptually converting the list of eight key practices into a systemic process. As such, what I have proposed—largely for conversational purposes as a first step in fostering systems "ownership" of the standards—is a consciously "virtuous" learning loop (recognizing, of course, that it can quickly reverse itself and become a vicious cycle).

The diagram I've constructed serves two purposes. The first is to rearrange the "list" so that it more accurately and effectively illustrates a network or causal relationships. Imagine the overarching goal is to "Model with Mathematics," specifically to "apply the mathematics they know to solve problems arising in everyday life, society, and the workplace." For that to occur, there needs to be a set of initial processing skills (moving clockwise in the diagram). These involve taking a mathematical problem, deciphering how to approach it and which tools to use.

The second purpose is to inform patterns and structure, both of which are at the center of systems thinking. These then allow for progression into the next level of thinking, which involves comparing and communicating one's own understanding with others. That is



where one learns most deeply, both in describing what one knows and in learning from others. All of that leads to the ultimate goal, which is to empower individuals to solve meaningful problems. And, again, from a systems perspective, learning is demonstrated by asking "better questions," relating what one knows to what one would like to know. Questions may seek to extrapolate or apply knowledge in other areas, or deepen understanding in the same area. All of this cycles back to "modeling with mathematics," which reinitiates the cycle. It is, over time, in the repeated iterations of this learning cycle that deeper learning occurs.

I've experimented with this cycle using the *Dollars and Sense* curriculum. In contrast with the scattered and disparate content standards, the D&S curriculum operates in a purposeful way to foster a powerful understanding for where and how mathematical concepts and tools inform meaningful real-world problems. There is a logical progression in mathematical concepts, illuminated through the use of equations, tables, and graphs offering multiple perspectives for how to represent patterns of change over time (eg., adding $, subtracting $, adding and subtracting simultaneously, adding compound interest, subtracting compound interest, then adding income, subtracting expenses, while adding and/or subtracting compounding interest). Equally as important, the simulations emphasize the value of undertaking multiple runs: in addition to challenging preconceptions about what factors matter most over time, comparative runs inform recurring patterns. These, in turn, help inform the next set of questions.

Again, I offer this not as an "answer," but as a starting point for asking better questions relating to where and how we systems educators can own these standards, recognizing that true learning involves putting pieces together to solve meaningful problems. The Common Core Practice Content Standards in Mathematics provide a powerful framework to foster learning in mathematics. And *Dollars and Sense* provides a set of tools with which to foster the Practice Content Standards.

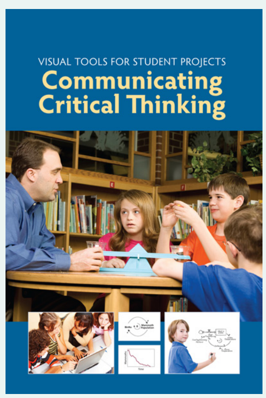
What do you think?

New CLE Booklet!

Visual Tools for Student Projects

Communicating Critical Thinking

available to download from the CLE website: www.clexchange.org



A collaborative project of the *Creative Learning Exchange* and the Gelfand Family Charitable Trust, compiled with the help of Alan Ticotsky, this booklet is designed to help teachers and students create and complete all kinds of projects (in science and other curricula) which clearly show and explain the critical thinking incorporated within the project.

Much of the material in the booklet is taken from the following publications of the *Creative Learning Exchange*:

- *Critical Thinking Using Systems Thinking and Dynamic Modeling*, based on the work of Barry Richmond, Jeff Potash and John Heinbokel
- *Rubrics for Understanding*, developed for DynamiQueST.

These and other materials about critical thinking using systems thinking and system dynamics are available from the Creative Learning Exchange website: www.clexchange.org.

GFCT
Gelfand Family Charitable Trust

CREATIVE LEARNING Exchange
System Dynamics & Systems Thinking in K-12 Education

Systems Thinking & Dynamic Modeling Conference for K-12 Education

INTEGRATING LEARNING ENVIRONMENTS

• June 28 – June 30, 2014 • Babson Executive Conference Center • Wellesley, Massachusetts

The Systems Thinking and Dynamic Modeling Conference for K-12 education will provide resources and opportunity for educators and interested citizens to explore what is current and possible in K-12 systems education.

With Common Core being implemented and education evolving, we all look for effective methods to improve learning. The variety of tools available today can lead to disjointed instruction. However, with an effective approach to integrating all aspects of the learning environment, students learn and teachers succeed. System dynamics and systems thinking provide such strategies. System dynamics is a methodology to explore complexity, interconnectedness and change over time.

KEYNOTE SPEAKERS

Peter Hovmand
George Richardson
Peter Senge
Linda Booth Sweeney

- **WORKSHOPS WITH HANDS-ON LEARNING**
- **INFORMATIVE PLENARY PRESENTATIONS**
- **DISCUSSION ROUNDTABLES**
- **AMPLE OPPORTUNITIES FOR LESS FORMAL NETWORKING**

The conference will run from registration, which starts at 10:00 AM Saturday morning, June 28, to noon on Monday, June 30th. The conference will be held at Babson Executive Conference Center, located on Babson College's campus in Wellesley, Massachusetts, 20 minutes from Boston and Logan International Airport. With rolling hills and landscaped grounds, the seclusion and serenity of the setting will ensure that the focus of the conference is on learning, engaging, and sharing.

NEW!! INTRODUCTORY TRAINING IN SYSTEMS THINKING

A new, introductory workshop will be held at Babson Executive Conference Center on **June 27th**, the day before the conference. This training workshop will include 8 hours on Friday (9 AM — 5 PM), breaks and lunch on Friday, a 3-hour workshop session on Saturday afternoon, and mentorship time scheduled during the conference, tailor-made to increase your knowledge and help you integrate the offerings of the conference. Work with systems mentors with decades of experience in 11 hours of introductory content and utilize their guidance in integrating the stimulating material and discussion presented throughout. The workshop is offered for an additional fee of $110.00. This does not include lodging on Friday night. Anne LaVigne and Alan Ticotsky will facilitate the workshop sessions.

REGISTRATION

Please register online at CreativeLearningExchange.org or by mailing the registration form.

LODGING

The conference registration does not include a room reservation. Babson Conference Center hotel rooms with one or two queen beds cost $144/single or double occupancy, per night, during the conference dates of June 28-29. Rooms at the Conference Center before or after those dates cost $168/single occupancy or $194 double occupancy, per night, including breakfast. All room rates are subject to a 9.7% Massachusetts room tax. Reserve early to be assured of room availability. To reserve a room at the Babson Conference Center, please call or email Mr. Silvano Senn, 781-239-5816 or silvano.senn@babson.edu. Mention the CLE conference for group rates.

MORE INFORMATION

Bunny Lawton, Creative Learning Exchange, lawtons@clexchange.org, 978-635-9797

Call for Conference Presenters

Proposals for Presentations due February 5, 2014

The deadline for proposals for presentations at the Conference has been extended to February 5, 2014. Please send your proposals and abstracts to Lees Stuntz via e-mail (stuntzln@clexchange.org). Various types of sessions will be offered:

- Workshops (Beginner to Advanced) for learning in depth about systems thinking and system dynamics and their use in K-12 education; skills and conceptual building sessions encouraged (3 hours)
- Sessions to share stories, curricula, teaching techniques, and lessons learned, with a special emphasis on the use of ST/SD tools to integrate classrooms and schools (90 minutes)
- Simulations of all types, games, on-line simulations to stimulate learning and critical thinking (90 minutes).

Potential Topics

- Systems Thinking and System Dynamics as a vehicle for collaboration, questioning, and the integration of educational initiatives, including Common Core and STEM
- Training sessions for all levels from neophyte to experienced practitioners, as well as how to train
- Educational technologies and simulations that contribute to learner-centered learning of systems thinking and system dynamics
- Tools for the integration of understanding and communicating in the classroom and in school administration
- Successive improvement—how have we done it? What are the markers of our failures and triumphs?
- Case studies—where has ST/SD made a difference, both in education and in the world?
- People enter systems education through various doors. How do we create paths from those doors? What paths have worked or have not worked?
- Learner-centered learning in K-12 and ST/SD
- Other relevant possibilities

How to Submit a Proposal

The proposal should include all presenters' names, emails and addresses. A paragraph about the session should include:

- a description of the session
- the context and history behind the session
- the experience level of the participants for whom it is geared.

A more complete outline or paper is expected by June 2, 2014.

Submission Deadlines

February 5, 2014 (extended)

Submit an abstract to Lees Stuntz via e-mail (stuntzln@clexchange.org) that includes the context and history of the session topic and the experience level of expected participants.

February 25, 2014

All authors will be notified of the status of their submission via e-mail.

June 2, 2014

A final outline, presentation, or paper due via e-mail for incorporation into the conference CD.

Systems Thinking & Dynamic Modeling Conference Scholarships

The Creative Learning Exchange is proud to offer scholarships for the upcoming conference. These are scholarships designed to encourage the use of systems thinking and dynamic modeling in K-12 education.

Some or all of the following criteria will apply. You do *not* need to meet all the criteria:

- The recipient has done his/her own learning in the area of SD in K-12. The recipient has explored the basics and knows why ST/SD is relevant, and why there is more to learn.
- The recipient is willing to write a report on how he/she has used ST/SD in the classroom or organization in the 2014-15 school year.
- The recipient is involved with others who are also interested and committed, either in their school or nearby.
- The recipient has submitted a proposal that has been accepted for presentation at the ST/DM conference.

The application is the same for all of the scholarships. Any questions concerning scholarships should be directed to Lees Stuntz *(stuntzln@clexchange.org)*. Please apply online or download an application.

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