

Carlisle System Dynamics Materials On-Line

*Rob Quaden and Debra Lyneis, Carlisle, Massachusetts
CLE Conference, June 2000*

The Carlisle Public Schools have developed these system dynamics curriculum materials with the support of the Waters Foundation and published them with the support of the Gordon Stanley Brown Fund. They are available to download for free from the Creative Learning Exchange through the MIT System Dynamics in Education website at <http://sysdyn.mit.edu/cle> or at <http://www.clexchange.org>. Under the annotated List of Materials, look for the lessons in the following curriculum categories:

Systems Education Materials

SE1994-11 ConsiderGypsyMoth. Consider the Gypsy Moth: An Example of System Dynamics for Carlisle, D. Lyneis. This brief paper explains how system dynamics can work in a curriculum.

SE1995-08 STIn25 Systems Thinking in "25 Words or Less," D. Lyneis. This brief paper attempts to answer the frequently asked questions, "Just what is system thinking anyway and what does it have to do with education?"

SE1999-09 In&OutGame. The In and Out Game: A Preliminary System Dynamics Modeling Lesson, A. Ticotsky, R. Quaden, D. Lyneis. Primary students play a classroom game to learn about stocks and flows and simple graphing. The game is adapted for students up to grade 8. Older students build models of the concrete game.

Cross Curricular Materials

CC1997-01 LetItRollRampModel. Let It Roll! An Interdisciplinary Middle School Math/Science Unit Using a STELLA Model of the Physics of Motion, R. Quaden, J. Trierweiler, D. Lyneis. Eighth graders roll cars down ramps and build a model to understand the behavior.

CC1999-04 MammothExtinction. The Mammoth Extinction Game, G. Stammel, A. Ticotsky, D. Lyneis. Third graders studying the Ice Ages play a classroom dice game and graph the extinction of their herds. They then play the game on a STELLA model to understand the process of extinction.

Math Materials

MA1999-09 LinearModelsIntro. Introduction to Linear Models: Using STELLA to Solve Word Problems, R. Quaden, A. Ticotsky, D. Lyneis. Eighth grade algebra students use this alternative way to understand and solve typical problems about behavior over time. They are introduced to the mechanics of STELLA in preparation for later system dynamics modeling.

Science Materials

SC1999-01 GrowGrowYeastModel. Grow, Grow, Grow? A Middle School Microbiology Unit Using a STELLA Model of Yeast Population Dynamics, C. Lombardo, D. Lyneis. Seventh graders grow yeast cells in a laboratory and extend the

experiment by using a STELLA model of the yeast population to examine growth under varying temperatures.

SC1999-09 ItsCool. It's Cool! An Experiment and a Modeling Lesson. Fifth graders measure and graph the temperature of a cooling cup of boiled water. They then build models of the behavior.

More Coming Soon

Graphing the Friendship Game, A. Ticotsky, D. Lyneis. K-2 students play a classroom game showing how friendship spreads. They graph the behavior.

Drawing and Reading Behavior Over Time Graphs, Four Math Lessons to Build Graphing Skills. R. Quaden, D. Lyneis. Eighth graders use pencil and paper activities to communicate using graphs. This is a preliminary modeling lesson.

The Insect Game, R. Quaden, W. Stack, D. Lyneis. Sixth graders play a classroom game with beads representing insect crop infestations. They draw causal loop diagrams to show that pesticides have the unintended consequence of producing resistant insects.

Several other Carlisle lessons are in the works and will be posted on the website as they are completed.

Software

These lessons use the STELLA system dynamics simulation software. It is available from High Performance Systems, 45 Lyme Road, Suite 300, Hanover, NH 03755. There is also a STELLA Run-Time Demo 5.1.1 version which you can download for free from High Performance Systems at <http://www.hps-inc.com>.

Authors

Rob Quaden and Alan Ticotsky are systems mentors in the Carlisle Public Schools supported by the Waters Foundation. They help their fellow teachers learn about system thinking/system dynamics and teach using the tools of this approach. Their goal is to help them teach what they are already teaching, only better. The enthusiastic response of students to this approach speaks to their success and motivates further use of the tools throughout the Carlisle curriculum.

Gene Stammel, Jim Trierweiler, Wendy Stack, and Clair Lombardo are classroom teachers.

Debra Lyneis is a member of the Carlisle Waters team who helps develop the lessons and writes them up under the Gordon Stanley Brown Fund for publication through the Creative Learning Exchange.

Your Feedback

We would love to hear how it goes if you try these lessons with your students. We would especially like your suggestions for improvements. Reach us at the Carlisle Public Schools or e-mail us at LyneisD@clexchange.org. Thanks.

Tips on Developing and Implementing a System Dynamics Lesson

*Rob Quaden, Alan Ticotsky, and Debra Lyneis
Carlisle Public Schools, Carlisle, MA
CLE Conference, June 2000*

- Systems lessons should enhance the current curriculum. Look for places in the curriculum where the systems tools can improve what is already being taught.
- Classroom teachers must be involved in developing and implementing systems lessons. Teachers ask, “Why should I do it? Will my kids get something out of it?” Help them to perceive a benefit to their students. Once they see the benefits, their involvement reinforces itself as they use the tools to improve their lessons.
- Lessons should include a hands-on component, so that students can learn the concepts in a concrete way before moving to the more abstract systems activities.
- Don’t save systems activities for “dessert” at the end of the year after everything else is done because you risk running out of time for them. Instead, start early in the year so that the activities can build on one another to enhance the curriculum all year long.
- There are two different approaches to integrating systems lessons into the curriculum:
 - Large units devote a concentrated chunk of time using all of the systems tools on one curriculum project. For example, Carlisle eighth graders spend a week studying over-fishing; they play Fishbanks, draw behavior over time graphs and stock/flow diagrams of the problem, build the Fishbanks model as a class, and use it to test various policies.
 - Smaller lessons focus on just one tool which the teacher applies to many other lessons throughout the year. A lesson using behavior over time graphs might help a teacher make that tool part of his/her repertoire. For example, Carlisle eighth graders are required to include behavior over time graphs in every science lab report.
 - These two approaches reinforce one another.
- Remember to keep your focus on the big picture—using systems tools to deepen the understanding of concepts in science, social studies, literature, etc. Teachers and students need to spend some time developing a mastery of the systems tools in order to gain their benefits in the curriculum. However, avoid getting caught up in focusing on the tools as an end in themselves. They are just tools; the purpose for learning them is to apply them to big picture understanding.
- Share your ideas and feedback with other teachers. Be willing to try new things and learn from experience. Enjoy the eager and insightful responses of students. Have fun!