

1 How We Got Started

Opening the Door to Systems Thinking at James M Bennett High School

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- Linda Davis
- Teacher: Computer Science, Math Modeling, Networking
- Systems Thinking Mentor

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- Maryland Virtual High School 1994-1997
- Trinity College ST/SD Curriculum Symposium 1995
- ST/SD Conference in New Hampshire 1998

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- Administrative Applications
- Classroom Instruction
- Interdisciplinary Collaboration
- Implementation of Modeling Course

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- How it began at JMB
 - Study, reading, more study, mentor training (MVHS, Waters Mentor Sessions, Trinity College)
 - Networking, questioning
 - Offering group training sessions with staff at JMB
 - One-on-one training/curriculum development

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- Who is using Systems Thinking in the classroom?
 - Science: physics, biology
 - Math: algebra 2
 - Social Studies: psychology
 - English
 - Tech Ed: introduction to business, introduction to tech education

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- Introduction to Math Modeling
 - Getting permission to field test the course from our Board of Education
 - Hands-on science labs to gather experimental data
 - Laying the groundwork: graphing calculator, Excel spreadsheets, introductory statistics

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- **Introduction to Math Modeling**

- How we used A First Course in Systems Dynamics by Diana Fisher
- How we evaluated our students' work
 - Easter Island projects

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- **Assessing our Progress**

- Usage in the classroom
- Course evaluations by our students
- Research plans to assess student achievement

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- **Maryland Virtual High School**

- Mary Ellen Verona and Susan Ragan @ Montgomery Blair High School
 - <http://mvhs.mbhs.edu>
- Charlotte Trout @ Williamsport High School
 - <http://isaac.williamsport.wa.k12.md.us/~ctrout>

- **Waters Center for System Dynamics**

- wat-cent@trinityvt.edu

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- **CC-SUSTAIN/CC-STADDUS**

- <http://www.teleport.com/~sguthrie/cc-stadus.html>
- Lessons for A First Course in System Dynamics Modeling by Diana Fisher

- **Understandable Statistics** by Brase and Brase

- **Introduction to Computer Simulation** by Nancy Roberts

An account
of a system dynamics course
for high school students and teachers,
and community sustainability activists

Presented at the
Systems Thinking & Dynamic Modeling
in K-12 Education Conference
June 25-27, 2000
by Paul Newton and Larry Smith

Agenda

- Background & long-term objective
 - Overview
 - K-12 learning perspective
 - K-12 & community roles in the process
- Curriculum and process
- Initiatives undertaken by the students
- Reflections on our experience

ABSTRACT

Over the 1999-2000 academic year, an introductory course in system dynamics was held at the high school in Sturgeon Bay, Wisconsin, USA. The students consisted of high school students, K-12 teachers, and community members. Two social studies, one economics, and one biology teacher participated in the course. Five high school sophomores participated in the fall course, one sophomore continued with the spring course. The community members consisted of a retiree, a university professor of social change and development, the director of a local non-profit property owners association, and a business process-modeling consultant.

The course was primarily driven by the need to develop system dynamics modeling capacity to support economic, environmental, and social sustainability in Sturgeon Bay and Door County. Our view is that, with proper education, some high school students and retirees can serve their communities through providing system dynamics consulting to their communities. To achieve this vision, teachers need to learn to use system dynamics in their teaching. And community organizations, including businesses, non-profits, and government, need to be aware of the potential of system dynamics to address organization and community problems. This course is a first effort at bringing these groups together to develop community system dynamics modeling capacity, and to raise awareness of the potential of system dynamics to address community problems.

This paper gives an account of various aspects of this course, including

- a more detailed discussion of the purposes of the course,
- the history of how the course came about,
- descriptions of the students and their interests,
- curriculum used in the course (we actually split the course into two sections, and used a different curriculum for each section), and why specific curriculum was selected,
- results from the course, and what we will do differently next time,
- how we plan to maintain the momentum we have developed, and
- the inter-relationships of the course with other community sustainability activities

This document contains the overheads used in the conference presentation. For more information, see the full paper in the conference proceedings.

Roles and resources to fill them

Roles	
Systems thinkers and for community sust	A w

This course was a first step
toward achieving the vision in the
previous slides

Students

- High school sophomores: 5-1st semester, 1-2nd semester
- 4 high school teachers: 1-social studies; 1-economics, 1-biology, 1-history.
- Community members: 1 non-profit organization director; 1 retiree, 1 business modeling consultant; 1 university professor
- Total: 13-1st semester; 9-2nd semester

Instructors

- System dynamics graduate student from University of Bergen, Norway
- High school social studies teacher - 1st semester only.

Primary Fall Curricula

- HS students' & business consultant's class
 - Diana Fisher's curriculum
 - Forrester's *Principles of Systems*
 - Joint homework readings and class discussions with the other class
- Teachers' & community members' class
 - Waters' Center Course 1
 - Selected chapters from Sterman's *Business Dynamics*
 - Joint homework readings and class discussions with the other class

Readings & classroom discussions addressing the following topics

- Why systems thinking?
- What is system dynamics?
- What does system dynamics have to do with learning?
- How do I use system dynamics
- How do I get started?
- Why are model purpose & boundaries so important?
- Looking for leverage in a system.
- System dynamics' value to people and society
- System dynamics' value to education

Intended readings/discussions topics not held due to time constraints

- System dynamics' value to business
- System dynamics' value to government
- System dynamics' value to sustainability
- History of system dynamics
- Modeling soft variables
- What is dialogue?
- System dynamics & dialogue working together

Fall Process

- 5 hours meeting time per week - 3 hours Saturday morning & 2 hours Monday evenings
- Classes often split (e.g. 9-12 & 10-1 on Saturday), but with shared reading discussion hour (e.g. 10-11 or 11-12)
- Homework consisted of reading only. Class time was spent doing exercises and in group discussions
- High school students given elective credit

Primary Spring Curricula

- HS student's & community members' class
 - Alfeld's & Graham's *Introduction to Urban Dynamics*
 - Homework was readings from Alfeld. Class time spent doing Alfeld exercises & in group discussion on readings
- Teachers' class
 - Waters' Center Course 2
 - self-study, but the teachers met every week and after school to work together
 - administration shifted to Waters' Center

Distance learning tools used in Spring

- Instructor in Ithaca, NY & class in Sturgeon Bay, WI
- www.webex.com & phone call
 - for communication between class and instructor during class time
- www.blackboard.com
 - for posting assignments, assignment solutions, reading reviews, etc.

Initiatives by students

- Developing & teaching a HS SD course next year
- Continuing their own education
- Using SD in teaching
 - fiscal policy
 - financial planning
 - savings and credit
 - exponential growth
 - immigration studies
 - fish population studies
- Using SD in teaching
 - prison overcrowding
 - biology applications
 - civil rights studies
 - Easter Island
- Developing curriculum
 - wars unit
 - current issues
 - undergraduate global studies course
- Held a spring in-service to expose SD to teachers

Initiatives by students (2 of 3)

- Promoting the idea of hosting Waters Center Course 1 this summer in northeast Wisconsin
- Attending the *Systems Thinking & Dynamic Modeling in K12 Education* conference this summer (4 students plan to attend)
- Beginning to use SD on land-use planning and sprawl problems (Nasewaupee Township)
- Developing collaborations with other local organizations
 - University of Wisconsin
 - CESA 7
 - Other schools & districts
 - Rotary Club

Initiatives by students (3 of 3)

- Presenting 3 different topics at the GWETC (Governor's Wisconsin Education Technology Conference) this fall in Madison, WI.
 - *Systems thinking and computer modeling as tools in 7-12 classrooms*, Don Ziegelbauer
 - *Computer simulations: From student education to learning communities*, Roy Aiken
 - *Sustainable development and global studies using system dynamics*, Larry Smith

Reflections on our experience

How well does our experience support the following assertions?

- Community sustainability is a viable mechanism for introducing systems thinking and dynamic modeling to communities and their K-12 schools [supported]
- Both a ‘citizen-advocate’ and a ‘teacher-advocate’ are very beneficial, if not necessary, to successfully launch a community system dynamics initiative [supported]

Reflections on our experience (2 of 2)

How well does our experience support the following assertions?

- We devised a curriculum that works for a mix of community members interested in sustainability, & K12 teachers interested in using systems for learning. [partially supported]

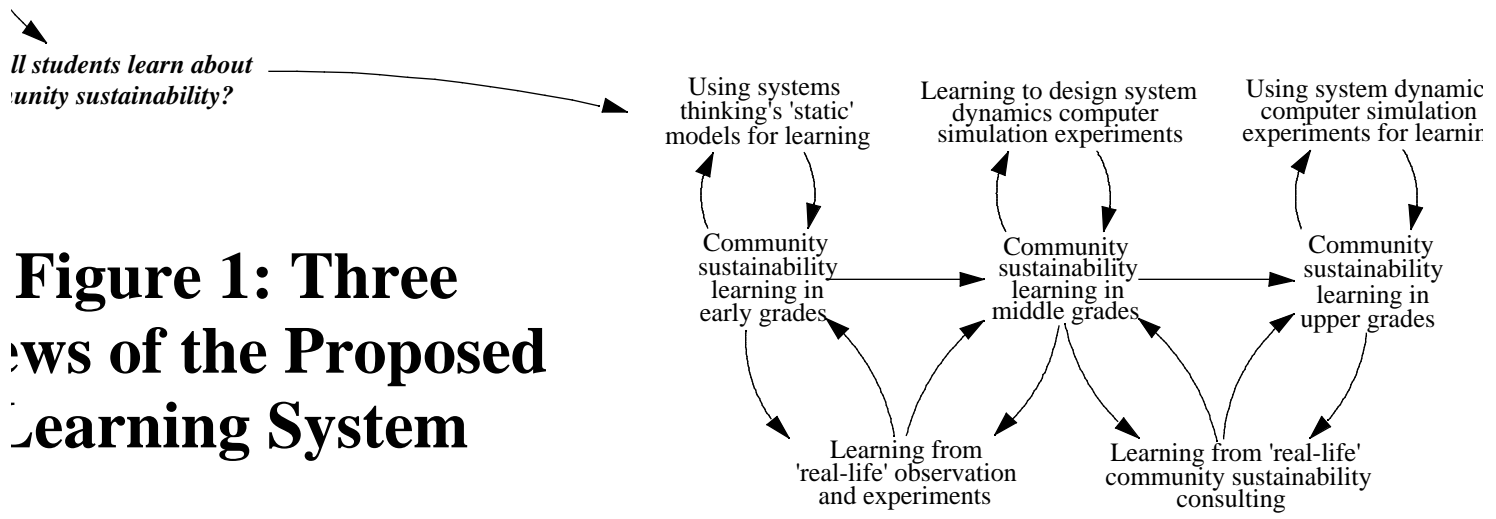
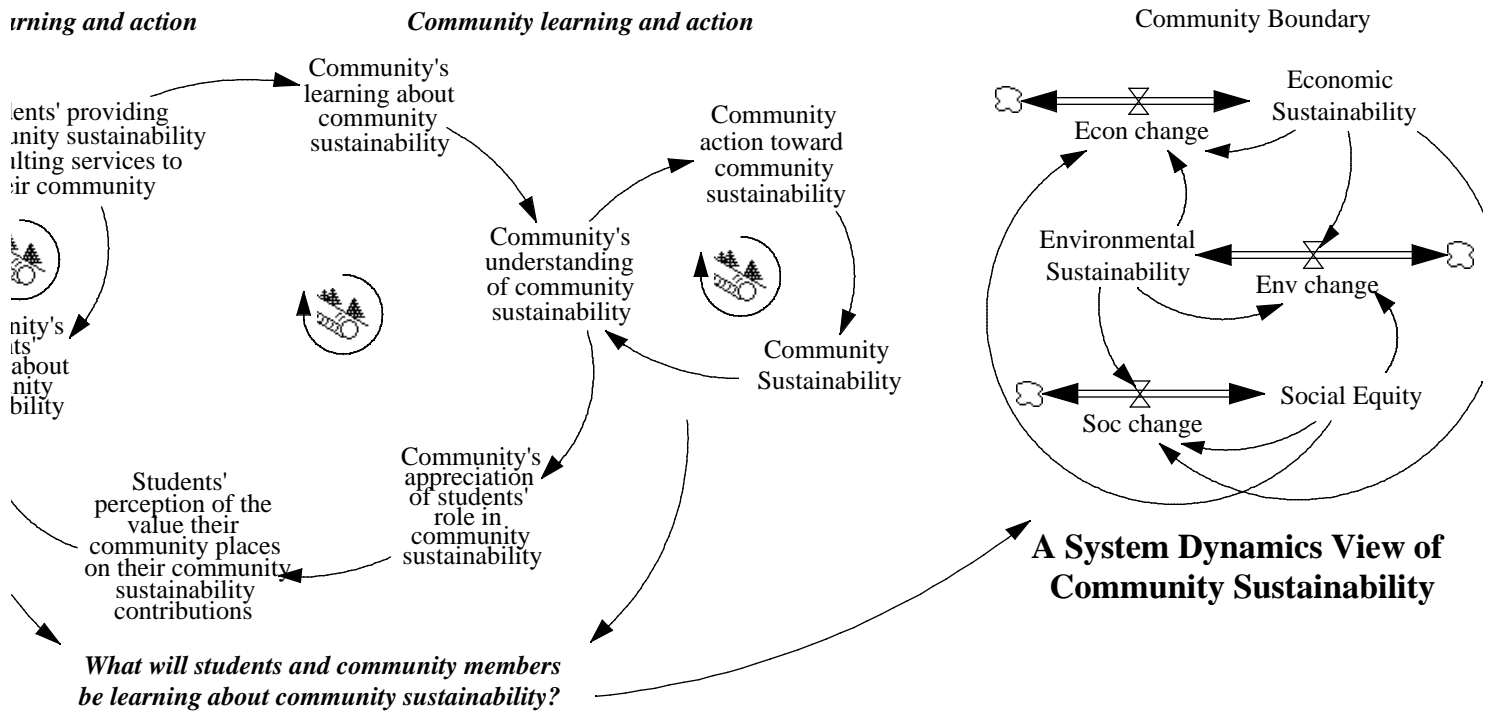


Figure 1: Three Views of the Proposed Learning System

Student Learning Progression Throughout School