WORKING WITH AN EXPERT

“What It’s Like to Be a Pioneer”

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By
Debra Lyneis

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Teaching children involves one whole set of skills and building complex system dynamics models involves another. How can teachers and system dynamicists best work together so that teachers can learn system dynamics and system dynamicists can contribute to the improvement of K-12 education?

Gary Hirsch and Dan Barcan set a good example. Gary Hirsch is a professional system dynamicist who builds models in his management consulting business in Wayland, Massachusetts. Dan teaches middle school social studies at the Murdoch Middle School, Public Charter School of Chelmsford, Massachusetts where system dynamics is written into the school’s charter. In the school’s first year, Gary volunteered to help teachers with system dynamics. At first, Gary gave a modeling workshop to the faculty and he taught the basics of system dynamics in a couple of Dan’s classes. These were a good try, but not really very satisfying for Gary, the teachers, or the students, because the system dynamics lessons were not directly related to anything in the curriculum and because Gary was having to learn on the spot how to teach a bunch of seventh graders.

Looking for a better way, Gary and Dan decided that the best use of Gary’s time and expertise would be to have Gary work directly with Dan and another teacher, Leah Zuckerman, to build a model that they could use with students in their curriculum. This proved to be a good arrangement. Working together over several sessions, Gary, Dan and Leah built a management flight simulator of the newspaper business to complement a current journalism unit. In the process, Dan and Leah learned a great deal about model-building by working closely with an expert, and together they produced a polished professional model which students could use. They also learned several broader lessons about system dynamics in K-12 education:

- Building a model focuses attention on the core of the academic content of a unit. As you define the purpose and scope of a model, you define what students will learn. With the journalism unit, for example, you need to define the most important thing you would want students to remember. Would it be the margins, or the layout? Probably not. The important thing about journalism is the content of the paper--what makes people buy the newspaper and read it. In running their own newspaper businesses on the model, students learned that the quality of a newspaper determines its viability.

- System dynamics is more than just building computer models. It is a discipline of thinking, forcing you to ask big questions. Uncovering causal loops can yield important lessons. There are many positive and negative loops imbedded in the newspaper model. Playing with the model and in debriefing, students find the feedback loops and learn to work within them. They learn that the loops are all interconnected and that obvious solutions may actually make things worse.

- Students need to think about the causal loop structure of a system before they try to construct a computer model of it. Students need to identify the feedback loops in a system using discussions, causal loop diagrams and behavior-over-time graphs, before they begin on the computers.
• Teachers can use system dynamics as a tool to improve what they are already teaching—there is no need to drop anything from a curriculum in order to fit it in. Gary helped Dan and Leah deepen the learning in their journalism unit by integrating the model into it. Attempts to teach system dynamics on its own were not very engaging or successful for the students, but using a model to enhance an existing lesson worked very well as a way to teach both journalism and system dynamics. It was also very productive when Gary coached students using the model.

• To teach system dynamics well, teachers must take steps to understand it themselves. It may be difficult at first, but building models is the only way to learn to build models. It takes lots of practice, starting with simple models. Watching a skilled model builder at work gave Dan and Leah the motivation to keep at it on their own.

In conclusion, Dan would advise other teachers never to pass up the opportunity to work with a system dynamics expert, no matter how time-consuming or inconvenient it may seem at first. It is a valuable chance to learn so much about the techniques of model building and the broader ideas of system dynamics. Gary would encourage fellow system dynamicists to get involved in their schools and contribute to the fundamental improvement of education for children. They would both suggest, however, that teachers and system dynamicists work together to find the most efficient way to combine their modeling and classroom expertise in order to successfully integrate system dynamics into the curriculum.

[Note: "Create and Run Your Own Newspaper, A Journalism Unit with a Simulation Game" by Dan Barcan, Leah Zuckerman, Gary Hirsch, and Debra Lyneis is available for free through the Creative Learning Exchange at http://www.clexchange.org. It has three parts: Publish a Newspaper, Play the Game, and Examine the Model. It was prepared with the support of the Gordon Stanley Brown Fund, 1999.]

Jay Forrester has suggested that we could speed the spread of learner-centered-learning and system dynamics in K-12 education by sharing tales of “what it’s like to be a pioneer.” It might help others who are starting out, or just curious, to know about other teachers’ experiences, positive student outcomes, pitfalls, political issues, responses of administrators and fellow teachers, student and parent feedback, triumphs and tribulations. Forrester has long experience in pioneering, first as an early inventor of the digital computer, then as the founder of system dynamics, and now as an education reformer. This paper presents just one little vignette. Please let me know (LyneisD@clexchange.org) if you have other tales to share. Thanks.