Building a System Dynamics Model with an Expert

Jim and Deb Lyneis
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In this workshop, participants will build a model of student motivation and performance. Led by a professional system dynamicist, they will proceed step by step:

- Conceptualizing the model and drawing reference behavior modes
- Drawing a complete stock/flow diagram on the board
- Writing equations for the computer
- Running and fine tuning the model
- Using the model to analyze behavior

Jim Lyneis has been building system dynamics models for over 30 years. He is currently Sr. Vice President of Pugh-Roberts Associates/PA Consulting, a management consulting firm that uses system dynamics models to help clients make business decisions. Formerly part of the System Dynamics Group at MIT, Jim continues to teach occasional system dynamics classes at MIT, the London Business School, and other programs. He has published a textbook on using system dynamics for policy design and many articles in the *System Dynamics Review*. In recent years, he has been "on call" at the Carlisle Public Schools.

Deb Lyneis has been interested in system dynamics for over 30 years too but has only begun to learn model-building itself in the last few years. Formerly a special education teacher, she stayed home with their three children and became active in their school. Deb served two terms on the school board in Carlisle. Currently she works as part of the Waters Foundation team in Carlisle, and she writes up system dynamics curriculum in Carlisle and elsewhere through the Gordon Stanley Brown Fund for publication through the Creative Learning Exchange.

The Model: Student Motivation and Performance. We chose this topic because it is near and dear to teachers. We will have a room full of experts. To build a good model, you have to know the subject well enough to accurately describe its inner workings. The idea is never just to "build a model" but to use the process to understand the causal relationships within a system, and then to use the model itself to explore alternative policies.

Modeling Skills. This workshop will focus on four particular skills:

- **Modeling Soft Variables.** Motivation and effort, unlike dollars or population counts, are soft variables. They are real, they are important, and they are often the most interesting variables to study. System dynamicists model them all the time.
- **Drawing Graphic Functions.** System dynamicists use graphic functions to capture non-linear relationships without using complex equations. If you can describe a relationship between two variables, you can draw it and use it.
- **Dimensional Consistency.** A model's equations *must* all balance and hang together. You insure this one equation at a time.
- **Exponential Averaging.** This is a tool system dynamicists use frequently to represent delays in a system.