Teaching Policy Modeling with Simulation Software

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Workshop Goals, Methods, and Materials

This workshop will demonstrate an instructional method that enables students from diverse cultural backgrounds to use simulation modeling software as a tool for policy analysis. The facilitator teaches the ***modeling process*** course and the ***policy design and implementation*** course at the University of Bergen in Norway. About 40 graduate students come from 20-30 different countries each year, and they learn to use simulation software such as *iThink* (www.iseesystems.com) to model problems as diverse as illegal drug-use in the U.S., fertility in Uganda, unemployment in Spain, stray dogs in Taiwan, and pension programs in Germany.

The primary objective of the modeling process course is for students to learn to build explanatory models; i.e., models that use causal, operational variables to simulate problematic behavior that has been observed historically (e.g., trends in unemployment, a flu epidemic, migration, pollution). Such historical modeling typically includes an analysis of pre-existing policies that have failed to alleviate the problems. Simulation experiments permit testing new policy options and evaluating alternative scenarios. An explanatory model seeks to answer three questions: *What has been happening? Why has it been happening? What can we expect in the future if we continue to conduct business as usual?*

The primary objective of the second course is to design and test feasible policy options. Students learn to craft new policies in simulation models, compare alternative policies in terms of expected costs & effects, and create interactive simulators to aid communication of model-based policy options to policy-makers and staff. The central motivating question is *How can we achieve a more desirable future?*

While demonstrating the essential outcomes of the two courses—building an explanatory model and then redesigning that model to test new policy options—the workshop will focus on *small* models that can be used in classrooms by both professors and students. Participants will also learn how the models can be posted and simulated online with only browser software. They will receive a free, fully functional version of *iThink* software that can be used for 30 days, sample models for later exploration, and links to online tutorials. They will also see how to communicate a model to others with the software's presentation tools (http://blog.iseesystems.com/tag/storytelling/). Those who want to be fully engaged in the learning activities should bring laptop computers to the workshop.

Learning Objectives for this Instructional Method

The goals for an introductory workshop are necessarily more limited than the learning objectives for the two courses at the University of Bergen. Nevertheless, awareness of the desired student learning outcomes puts the workshop in a useful context. These learning objectives can be grouped into five categories:

Express knowledge and understanding

Students should be able to (1) describe in detail the system dynamics modeling process, from problem definition to policy design; (2) demonstrate proficiency with the equation, simulation, and presentation tools of at least one system dynamics software package, while having some familiarity with at least two others; (3) recognize the political, organizational, and cultural influences on policy feasibility; and (4) learn the theory and method of cost-benefit analysis.

Apply knowledge and understanding

Students should be able to (1) define the dynamics of a problem; (2) formulate hypotheses as tentative explanations of problematic dynamic behaviour; (3) analyse a model's structure to discover the endogenous source of particular dynamic behavior; (4) analyse and test a model to improve its reliability and usefulness; (5) test a model's sensitivity to parameter assumptions; (6) identify and evaluate potential leverage points for improving model behaviour through policy parameter analysis; (7) conduct policy design and evaluation with modifications in the structure of an explanatory model;

(8) develop and analyze a simulation model that provides a useful explanation of a given problematic behaviour in a narrowly-defined task; (9) identify a real-world dynamic problem and conduct a 6-week empirical and theoretical investigation, culminating in an explanatory model, a policy model, a written report, and an oral presentation; (10) estimate cost and effectiveness of policy options, including feasibility assessments; and (11) design interactive learning environments to facilitate communication of policy insights and implementation requirements.

Make judgments

Students should be able to (1) use a client's perspective to assess the definition of a problem, the boundary of a model, and the model's reliability and usefulness; (2) establish and evaluate criteria for evaluating how well a model structure contributes to the explanation of an observed or hypothesised dynamic behaviour; (3) assess data requirements in light of a model's sensitivity to parameter estimates; (4) assess whether simulated policy options are cost-effective and feasible in the real world; (5) evaluate policy implementation obstacles and modify expected benefits accordingly; (6) evaluate the impact of an interactive learning environment as a tool for communicating policy insights and implementation requirements; (7) take ethical considerations into account when conducting research and developing models, and when interacting with clients, stakeholders, and colleagues.

Communicate

Students should be able to (1) ask and answer questions and engage in discussion and debate in a classroom setting; (2) organize a written discussion of a modeling project in a way that highlights the research problem or question, the hypothesis, the method of analyzing and testing the hypothesis, and the policy implications of the investigation; (3) make oral presentations of their work; (4) design and present models in a way that facilitates communication and understanding; and (5) translate technical information into language that clients understand.

What Participants will "Take Away" from the Workshop

In addition to the more tangible take-aways (software, sample models, etc.), participants will form judgments about how students' mental models of policy issues can be transformed and improved with easy-to-use-but-powerful simulation modeling methods. Whether or not they subsequently use the simulation method in their own teaching, participants will take away a heightened sensitivity to the question of how to narrow the gap between their conceptions of policy problems and those that students bring to their classrooms.

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* The workshop facilitator is an associate professor of system dynamics at the University of Bergen in Norway. He is also a visiting professor of economics at ISM University of Management & Economics in Lithuania. He received his PhD in system dynamics at the University of Bergen and his master's degree in public policy at Harvard's Kennedy School. He served on the White House staff during the Nixon and Ford presidencies.