Agent Based Modeling as an Educational Tool

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Motivation is a key element in high school education. One way to improve motivation and provide content, while helping address critical thinking and problem solving skills, is to have students build and study agent based models in the classroom. This activity visually connects concepts with their applied mathematical representation. “Engaging students in constructing [models] may provide a bridge between frequently disconnected conceptual and mathematical forms of knowledge.” (Levy and Wilensky, 2011)

Introduction

We decided to be test subjects to verify that agent based computer modeling was viable as a classroom tool. We wanted to know the following:

- How well would a simulator fit our requirements for classroom use?
- How long would it take for a novice to become a functional modeler?

Approach

- Conducted literature review on research of the use of agent based models and computer modeling in education.
- Selected NetLogo as our vehicle and developed working knowledge of the agent based modeling software. We found the NetLogo product suitable for this purpose because it is robust, well documented, easy to learn and use, runs on multiple platforms, is easily extensible, and is free.
- Introduced NetLogo to high school students for a variety of open-ended modeling applications in an applied science class.

Results

We were able to do a basic simulation after a couple of hours and in a week and a half were able to do the simulations shown in fig. 3 - 7. In a classroom setting student outcomes varied with skill and interest levels. One of the better models and associated poster are shown below.

Discussion

We went through the progression of tutorial 3, simple model 4, 5, a real data model 6, and multi-agent real data model 7 that a student might be expected to complete in a year. Neither of us had any previous modeling experience. We were able to quickly move from learning the development environment to content modeling with real data. This progression was very similar to that experienced by students in an applied science high school class.

While there is no conclusive evidence as yet, initial indications are that students are more engaged when using a model based curriculum. Student comprehension of complex topics in the sciences is augmented. Models, rather than pure simulations, allow a “glass box” approach which lets students create, modify, and explore. Our own experience with modeling leads us to believe that the use of modeling in the classroom should improve student outcomes.

More research is needed to determine how effective this approach will be in practice.

References


Hunger Games Simulation

Simulation using GIS data

Simulation using aerial photograph on top of terrain value map.

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