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Hypothesis Testing with NetLogo

Unit Concept Lessons

Revision Date: Aug 31, 2017
Duration: 45 50-minute sessions

Lesson Summary

Summary: In this lesson, teachers will learn about modeling and simulation with hypothesis testing using NetLogo.

Objectives:

- understand that models are abstractions of real environments and will recognize the rationale for, and limitations of, modeling techniques to analyze problems.

- compare abstractions in one programming language to another (Python vs NetLogo)

- develop and test hypotheses using an experimental approach in a modeling framework.

Outline:

1. Introduce the concept of models and simulation with hypothesis testing. (10 min)
2. Use existing simulations to discover patterns and answer questions in NetLogo (30 min)
3. Select preferred activities for students to engage with (5 min)

Total: (45 min)

Learning Objectives

Key Concepts

A model describes a real-world system.

A simulation runs a model to discover results.

Models and simulations provide a much more flexible and affordable solution to testing systems but are only as accurate as the information provided to them. These have many layers of abstraction that can be identified.

A hypothesis can be tested using data collected from multiple runs of a simulation with varying conditions.

Teacher Resources

Student computer usage for this lesson is: **required**

CLO8_Hypothesis Testing with NetLogo Folder (https://drive.google.com/open?id=0B1v7pcLSD-B5M2R1S2czNHVBSG8)

NetLogo:

http://ccl.northwestern.edu/netlogo/ (http://ccl.northwestern.edu/netlogo/)

NetLogo User Manual:

https://ccl.northwestern.edu/netlogo/docs/ (https://ccl.northwestern.edu/netlogo/docs/)

Modeling and Simulation 101 video:

https://www.youtube.com/watch?v=X-6zxImekOE (https://www.youtube.com/watch?v=X-6zxImekOE)

Comparison of Logo, PyLogo, and Python:

http://www.ianbicking.org/docs/PyLogo_lightning.html (http://www.ianbicking.org/docs/PyLogo_lightning.html)

New Mexico "Computer Science for All" bases entire course on modeling and simulation using NetLogo:

http://www.cs4all.org/NM-CS108L-Week3-Final (http://www.cs4all.org/NM-CS108L-Week3-Final)

PowerPoint detailing the abstractions in NetLogo:

http://www.cs4all.org/files/CS108L_Week3_Abstraction_in_Life.pptx
(http://www.cs4all.org/files/CS108L_Week3_Abstraction_in_Life.pptx)

Lesson Plan

TOTAL: (45 min)

1. Introduce the concept of models and simulation with hypothesis testing. (10 min)

Use the Session 1 presentation in the Lesson 4.6 folder
(https://drive.google.com/drive/folders/0Bzy3A1l8jB9efnFfR05wWTV4TnUxOWRpcnBlNDktTVRWR1N6OGlfaWNPc21wWl9mRTRmQVk)
to introduce the concept of a model and simulation. Play the first 3 minutes of the introductory video on slide 2, and explain the
components of the sample Party simulation.

2. Use existing simulations to discover patterns and answer questions in NetLogo (30 min)

Show participants how to load the Wolf and Sheep simulation. Do a test run, Demonstrate the student worksheet to accompany the
activity.

Highlight:

- how to create and test a hypothesis
- the random element in simulations
- how to uncover limitations of a model and simulation
- comparisons between the NetLogo and Python languages
- abstractions in the NetLogo language
- abstractions in simulations

3. Select preferred activities for students to engage with (5 min)

Demonstrate the variety of simulations available to interest students and allow them to create and test their own hypotheses.

Options for Differentiated Instruction

Students can investigate the simulations in a freeform manner or use the guided worksheets for a graded assignment
with guidelines.

Evidence of Learning

Formative Assessment

Evaluate existing simulations, modify their parameters and gather data from multiple runs.

Summative Assessment

Describe the evidence that you produced to determine if your hypothesis was supported by the model and simulation you used or not. In what ways was your model accurate or inaccurate? What would have made it a better model?

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