Lesson Plans   CMST Institute

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Building a Predator-Prey Model using Agent Sheets

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Grade Level:	population growth (predator-prey scenario)

Objective: Students will explore the effects of predator-prey relations by adjusting and building a model using Agent Sheets

Science concept:

Population
Food Pyramid
Predator Prey

Standard 4

Key Idea 6:
Plants and animals depend on each other and their physical environment.

The fundamental concept of ecology is that living organisms interact with and are dependent on their environment and each other. These interactions result in a flow of energy and a cycling of materials that are essential for life.

Competition can occur between members of different species for an ecological niche. Competition can also occur within species. Competition may be for abiotic resources, such as space, water, air, and shelter, and for biotic resources such as food and mates. Students should be familiar with the concept of food chains and webs.

PERFORMANCE INDICATOR 6.1	Explain factors that limit growth of individuals and populations. Major Understandings 6.1a Energy flows through ecosystems in one direction, typically from the Sun, through photosynthetic organisms including green plants and algae, to herbivores to carnivores and decomposers. 6.1b The atoms and molecules on the Earth cycle among the living and nonliving components of the biosphere. For example, carbon dioxide and water molecules used in photosynthesis to form energy-rich organic compounds are returned to the environment when the energy in these compounds is eventually released by cells. Continual input of energy from sunlight keeps the process going. This concept may be illustrated with an energy pyramid. 6.1c The chemical elements, such as carbon, hydrogen, nitrogen, and oxygen, that make up the molecules of living things pass through food webs and are combined and recombined in different ways. At each link in a food web, some energy is stored in newly made structures but much is dissipated into the environment as heat. 6.1d The number of organisms any habitat can support (carrying capacity) is limited by the available energy, water, oxygen, and minerals, and by the ability of ecosystems to recycle the residue of dead organisms through the activities of bacteria and fungi. 6.1e In any particular environment, the growth and survival of organisms depend on the physical conditions including light intensity, temperature range, mineral availability, soil/rock type, and relative acidity (pH).

Please provide a rich **one-page, single-spaced**, description or a *vision* of your best thinking on a way or ways you might teach the planned lesson. (approximately ½ page for the teacher role, ½ page for the student role). Also, construct a tentative rubric that you might use with your students

Teachers and student role:

In this activity students will explore things that will make a population increase and decrease as well as adjusting parameters in the model and seeing its effects on predators and prey.

Students will create a basic model where they will have the following variables which they can adjust to see their effects:
Students already have a basic background on how to use Agent Sheets from a previous activity.
The teacher will help the students start the model by going over what agents they will need and what the actions and conditions for each one might be. With this he will break down the class in pairs and have those proficient in Agent Sheets serve as helpers during class.

Variable	Action	Modifications
Grass	a)**Grass grows** b)**grass disappears when rabbit eats it**	a)grass could dry up if no water is introduced
Rabbit	a)**rabbit moves randomly** b)**rabbit dies when it encounters a wolf** c)**rabbit reproduces when it sees another rabbit** d)rabbit dies if it does not eat	a)rabbit multiplies only when it sees a rabbit of opposite sex b)rabbits die if certain number of rabbits is reached
Wolf	a)**wolf moves randomly** b)**wolf eats rabbit when it is next to it** c)**wolf does not eat grass** d)**wolf reproduces when it sees another rabbit next to it**	a) wolf dies if it does not eat. b)wolf dies if certain population of wolves is reached

***Only bold options are currently enable in the Agent Sheets project

Questions students should be able to answer based on their simulation runs

1. What happens when the probability of mating for the rabbit is increased/ decreased?
2. What happens when the probability of mating for the wolf is increased/ decreased?

3. If the population of rabbits increases/decreases what happens to the population of wolves?
4. If the population of wolves increases/ decreases what happens to the population of wolves?
5. What factor those the grass play in the scenario?
6. What other variations could be introduced to the model that could affect the population sizes?
7. Pick one variable not included or presented in the class and modify the predator-prey model to represent that modification.

Assesment:

	5pt	*4pt*	*3pt*	*2pt*	*1pt*
Questions	All answered	1 missing	One missing and others incomplete	More than 2 incomplete	Pooly answered/completed/ missing
modeling	Student uses the model to answer the questions		Students uses model half the time		Student does not uses the model to answer the questions
programing	Students changes parameters effectively		Students is able to modify some of the variables		Students has no idea on how to modify the variables but understand what they will do if modified
Time	Student finish activity on allocated time		Student is one day late		Student is late more than 3 days
Creativeness	Students is creative in his/her ideas		Student ask for help from friends		Student copies ideas directly from friends