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Pretend Predators and Prey Populations

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CMST project Kendall Jr High School
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Abstract:

Our project this year was started by a class of students which meet during a study skills period. We decided to explore how groups of organisms are changed by the introduction of a predator. Our model focuses on a bug population would change when a predator was introduced that would eat bugs at different rates depending on the bug's color when compared with the background.

We started off with single or small groups of students creating their own models using agentsheets. We chose agentsheets because we wanted to see how individual bugs were affected rather than looking at how the whole population changed using software like Stella. We found agentsheets to be a lot of fun to use and enjoyed creating our own pictures of the agents. One problem we found was that our computers were not new enough to handle the software program and so the models frequently crashed, froze or failed to open properly.

Our last and greatest hurdle was that our school decided to change from a block schedule to the rest of the school had. Because of this change we lost the study skills class period. Individuals in our class were rescheduled and we had no common time to meet except after school. Unfortunately a lot of our team had after school commitments and so we could not meet with the whole group.

Our model was finally finished by a team of 4 students and from this team we selected models which best represented our models.

Model choice:
We decided to use agentsheets because it would give us a good way to visualize our model. We could have used Stella to generate data but wanted to be able to see our creation in action. We felt that the ability to visualize how the population changes would be more appealing when demonstrated in class as we discussed evolution which is based on a change in a population over time. This type of model, we feel, connects to students better rather than looking at data. We thought if we had more time it would be a great ideal to build a Stella model to generate data once the basic idea was understood by the audience.

Log:
10/11 we built a Stella model which showed raising money for buying a dirt bike
10/19 continued the Stella model
10/24 our first meeting we went and walked through building an agentsheets model
10/14 the class was turned loose to build their own models

10/27 met in the classroom and talked about what we needed to do to make our models more like real life, age of bugs from egg to larva to cocoon to adult; reproduction ; black would be BB and Bb grey and white would be bb. Need to have a food source for the bugs?
11/1 tried to have our bugs reproduce in our models.
11/4 met to start to write our papers for entry into the contest

11/8 continued to work on the individual models – we tried again to get our bugs to reproduce. Some where successful some had major difficulty with the computers and kept having to rebuild their models.

11/16 we were not able to have the computer lab so we talked about solving the problem of how to combine our models into one project. We decided to continue to work on our projects individually and choose later who's to pick as a final project

12/5 after school. We only had two people show up today. They worked on their models except Molly who had to rebuild hers again!

12/ 8 met after school discussed the new due date for the project. We will continue next week to work on our models. Brandon's is most advanced and we will probably use it

12/ 21 we started our poster for the competition

12/22 we have another couple of students working on the PowerPoint. After the break we will finish the poster and the power point. The notes and log will be typed by Ms. Schwartzmeyer

1/3 could not meet due to faculty meeting

1/ 4 met after school to finish poster and zip up the model

Pretend Predators and Prey

Our team consisted, at the start of the project, of a group of Kendall Jr/Sr High students who had Ms Schwartzmeyer for a Study skills class as well as for our 7th grade science class. We met approximately every 3rd day of our weekly schedule to work on the project. We were not able to meet all the time during our class because the computer lab in our school is shared by the whole school and so it was not available to us all the time. As you will read further on… we ran into more difficulties than just sharing the computer lab!

We were introduced to both Agentsheets and Stella modeling software by our teacher. We first learned how Stella works and built a model of fundraisers which would eventually earn us enough money to buy something we wanted. After seeing what Stella was like we built, as a class an Agentsheets model which showed how the agents can move around randomly and how they can interact with each other.

As a group we really liked the Agentsheets program better. Stella was cool but it didn't seem as creative as the Agentsheets program. Also we found it more interesting to see what happened to the individual agents rather than seeing a result in one lump or just as an ending value. Agentsheets lets you see better how the whole model progresses not just what you get at the end.

The problem we eventually decided to explore was to combine two of the concepts we were learning in science class; genetics and evolution. It seemed that with a population of organisms it would be easy to get rid of a "bad" trait since all those with it were likely to die out. We wondered why evolution would take so long to happen if there were a lot of pressure put on a certain species why wouldn't they change quickly to the better phenotype or appearance.

After learning how genetics works and how recessive traits can still show up if both parents carry one of the genes for the recessive trait we decided to see if this explains why it takes so long. We decided to use a couple colors and when these colors were crossed they would produce offspring according to Gregor Mendel's theories of inheritance.

For example, a red bug with a genotype of RR when crossed with a red bug whose genotype was Rr would produce all red bugs but a red bug with a genotype of Rr when crossed with a red bug with the genotype of Rr would produce a blue bug once every 4 times. Blue is a recessive trait in our model so shows up only once every 4 times unless two blue bugs mate and then they would produce all blue bugs.

Our ideas were good but we found as we went along that it was much more complicated than what we at first thought. Our computers in the lab are older and we found the Agentsheets program frequently crashed and many times it was to the point where we had to rebuild the model over again to try to simplify things in our model. Some computers

were a little newer and so some of our team just got lucky and didn't have to rebuild as often as the others. This was our first problem.

Our second problems as mentioned before was that in order to really model what we wanted to we had to include more factors that we at first though of and programming these things was not really easy. We could get our agents to move around easily enough and we could get a predator built and it could move around on the background but it was more difficult to get the predators to eat the prey based on their color and we really would have liked the predators to actually "chase" the prey but we could not find a way to do this.

The next hurdle was to get the prey to reproduce in the way we wanted them to. This was the most difficult of all. We found that the order you placed the rules in was very important and if you did not do things step by step and checked each step as you went it would likely not work at all. Not all members of our team were able to get to this point.

Our final hurdle was the schedule change. We could no longer meet at the same time during school hours and with the new schedule we did not have any spot in our schedule that would let us meet. Many of our team members had after school sports and other clubs or things after school that would not let them stay after to work on their models. Only 4 of our original group were able to meet to finish the model.

We met and quickly it became apparent the Brandon's model was far ahead of the other group. He had the predators eating the prey with a percentage of prey that would be eaten based on the prey's color. He soon had the bugs reproducing as well. He even put in an age that the prey would die if they reached. He also had a minimum age that the bugs needed to reach before they could reproduce. I suppose this showed that two heads are not always better than one when you are building a computer model. Dan, Joel and Kevin's model had to be rebuilt over and over and so they likely would have had gotten further along if not for this problem.

Our results were mixed we had hoped that our model would be more complex and would better demonstrate all the factors that would have gone into a realistic situation. Factors like the prey's ability to find food, the predator's reproduction and something that might eat the predator. Other factors that were left out were different stages of development for our bugs' different backgrounds that they could move on.

We were surprised to see how the blue bugs never did leave our population. It definitely allowed us to see why evolution can not happen fast. In fact we wondered how it could happen at all with a real population unless the predators were able to eat so fast that blue bugs had no chance at all to reproduce. It did help explain to us how things like recessive diseases can keep coming up generation after generation.

Our experience with the whole project was very good. We enjoyed creating our own world. We enjoyed making the agents act as we wanted them to and the satisfaction of having things finally work the way you want them to! We wish things like the computers

crashing and having our time taken out of the schedule so that the whole group couldn't get together had not happened. It made it a little frustrating to not be able to meet together and share ideas. We really liked working with the software and everyone had some success with some part of the project.

The New York State Standards met by this project were:

The Living Environment:

Standard 2: Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring.

- recognize that traits of living things are both inherited
- there is genetic continuity between generation for humans and other organisms

Standard 3: Individual organisms and species change over time

- describe how the structures of plants and animals complement the environment of the plant or animal
- Observe that differences within a species may give individuals an advantage in surviving and reproducing.

Standard 4: The continuity of life is sustained through reproduction and development.

Standard 5: Organisms maintain a dynamic equilibrium that sustains life.

- describe the basic life functions of common living specimens
- describe some survival behaviors of common living specimens