Lesson 5: Introduction Computer Model- developing StarLogo Nova Model

Problem statement:

Imagine you are an epidemiologist--someone who studies the spread and control of diseases. You work for the Centers for Disease Control and Prevention in Atlanta, GA. Reports of middle school students out sick have been pouring in from all over the country at an alarming rate. Few things are known about this mystery disease: victims are experiencing chills and high fever, and the disease is spreading quickly. There are no recorded fatalities, but there are reports of more extreme symptoms such as paralysis. Your team has been tasked with understanding and containing this new infectious disease. Your director has handed you a document with notes to start with, but it is up to you to come up with a plan to prevent, contain, or cure the disease. Time is of the essence, as symptoms are starting to appear in adults and high school students as well.

Learning objectives: Students will be able to understand how computer modeling can help us understand the spread of diseases

Lesson standards (NGSS, CCSS, CTE): MISSING MATH STANDARDS

What standards (content and practices) are you addressing in this unit/lesson(s)?

Ex. NGSS HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

CCSS Math HS N-RN. Extend the properties of exponents to rational exponents.

Computer Science K–12 Learning Standards

6–8 Level 1

2-A-2-1 Solicit and integrate peer feedback as appropriate to develop or refine a program.

2-A-7-4 Interpret the flow of execution of algorithms and predict their outcomes.

[Clarification: Algorithms can be expressed using natural language, flow and control

diagrams, comments within code, and pseudocode.]

2-A-5-5 Design, develop, and present computational artifacts such as mobile applications that

address social problems both independently and collaboratively.

2-A-5-6 Develop programs, both independently and collaboratively, that include sequences

with nested loops and multiple branches. [Clarification: At this level, students may use

block-based and/or text-based programming languages.]

2-A-3-9 Decompose a problem into parts and create solutions for each part.

2-A-6-10 Use an iterative design process (e.g., define the problem, generate ideas, build, test,

and improve solutions) to solve problems, both independently and collaboratively.

2-C-6-13 Use a systematic process to identify the source of a problem within individual and

connected devices (e.g., follow a troubleshooting flow diagram, make changes to

software to see if hardware will work, restart device, check connections, swap in

working components).

2-D-5-16 Revise computational models to more accurately reflect real-world systems (e.g.,

ecosystems, epidemics, spread of ideas).

6–8 Level 2

2-I-7-18 Summarize negative and positive impacts of using data and information to categorize

people, predict behavior, and make recommendations based on those predictions

(e.g., customizing search results or targeted advertising, based on previous browsing

history, can save search time and limit options at the same time).

2-I-1-20 Provide examples of how computational artifacts and devices impact health and

wellbeing, both positively and negatively.

Next Generation Science Standards NGSS

MS-ETS1-1 Engineering Design

Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2 Engineering Design

Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 Engineering Design

Analyze data from tests to determine similarities and differences among several different design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4 Engineering Design

Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

If relevant to a single lesson, include:

Soft skills:

Habits of mind and ways of working together help students build their capacity for workplace expectations. What 21st century skills will students be applying in this lesson or unit (e.g. Communication, Collaboration, Critical Thinking, Creativity)?

1. *Learning and Innovation -* Creativity and innovation, Critical thinking and problem solving
2. *Information, Media and Technology - Information literacy, Media literacy,Technology literacy*
3. *Life and Career -* Flexibility and adaptability, Initiative and self-direction, Social and cross-cultural skills, Productivity and accountability

Locally and/or personally relevant for students:

How do students build on their understanding of their school community or on what matters to students? Are there ways to make a strong connection to women or underrepresented minorities in STEM fields – to increase proportionate representation of those groups in STEM?

Connections to career and educational pathways:

1. Apply appropriate academic technical skills
2. Attend to personal health and financial well-being
3. Communicate clearly, effectively and with reason
4. Consider the environmental, social and economic impacts of decisions
5. Demonstrate creativity and innovation
6. Employ valid and reliable research strategies
7. Use technology to enhance productivity
8. Work productively in teams while using cultural/global competence

Materials: Internet Access

Lesson preparation:

* Print student tutorial worksheet
* Setup Teacher account for student access in Starlogo Nova
* [Swine Flu video](https://vimeo.com/4401730)

Time required: 45-55 min (2 class period)

Grouping of students for instruction:

Describe how students will be divided into groups, if applicable (random, ability, interest, social purposes, etc.) Will students have roles? If so, how will roles be assigned? How will students learn their roles?

* Students will work

What is the instruction? Consider the PBL Procedure that is being addressed here: See the PBL procedure on page 2. Are the students understanding, exploring, or resolving the problem? Or, are they doing all 3 in this lesson? Explain what the teacher is doing and what the students are doing. This section should be written as if you were writing very detailed substitute plans. Teachers should be able to teach this lesson from all the information you provide without having to ask the author questions

Essential Question: What does it mean to model?

Understanding the Problem

|  |  |  |
| --- | --- | --- |
| Time | Teacher | Student |
| 3 min | Introducing the problem launch using a video.  [Where is George.com](https://vimeo.com/4401730) - Model Swine Flu  Teacher ask students to pay attention what information was needed to model? | Students will watch the video |
|  | Show a basic Starlogo model that demonstrates a population becoming infected by a contagion. Initially nobody is infected, gradually everyone becomes infected. Explain that as agents (people) become infected they turn from blue (not infected) to red (infected).  Eventually (fairly quickly) every agent becomes infected.  Questions: Is this a real - life situation? If a single individual becomes infected, does the entire population ‘catch’ the disease. |  |
| 5-10 mins | What information needed?  What is the benefit of using computer modeling?  How does this work impact science and engineering? | Students will pair/share their ideas about the video per the questions that are on the display |
| 5-10 mins | Teacher will ask students what factors contribute to the spread of the disease? From your research, what is needed to stop the spread of disease?  Teacher will record student responses on a large pad to keep posted in the room for later use | Students will share their response out |
| 20 mins | Teacher will begin showing other computer based models (3-5 need research other models) - “[Stupid Simple Model](http://www.slnova.org/natalie.murray26/galleries/223986/)” | Students will identify similarities and difference from the computer based model using a (Venn diagram?) |
| 1 min | Teacher will introduce StarLogo to students  Students ...We will now take a look at a web based program, that we will use to model an infectious disease  Teacher will direct students to the website: www.slnova.org | Students use technology to access the website: www.slnova.org/ |
| 10 min | Teacher will guide students to first explore the base model  Teacher will prompt students think about cause and effect, variables, | Students will explore the base model independently.  Students will record how they think the base model works by listing characteristics of the base model and in their own words describe what is happening/observation. |
|  | Teacher will prompt students to write their ideas in their notebooks and plan to share and compare responses with students | The student pair will share their initial ideas of the model and come to a consensus of how the base model works |

Accommodations: Describe special accommodations for any students with significant exceptional needs (i.e. visual impairment, deafness, physical impairments, etc.) Consider special groups like ELL, SPED, and Highly Capable when possible.

Students can work in pairs.

Encourage students to use previous research about diseases

Teacher will print the population graph and provide each group with a graph to explain what the model is doing.

Extensions: Students can research other models and compare the Starlogo base model.

Assessment:

How will you assess student learning during the problem? Will there be a final product? Will the final product criteria be clear for students from the beginning? Will there be both whole group elements and individual accountability? Attach appropriate rubrics

Formative Assessment in the Lessons

Summative Assessment for the Unit

Exit Ticket: Once you are cured have you developed an immunity?

Resources used for the whole unit can be captured at the end. Resources used only in one lesson should be noted individually for that lesson plan and at the end.

References/Resources:

Attach any materials students will use during the lesson; e.g., handouts, questions to answer, and worksheets. Acknowledge your sources. Give credit to the person who created the idea for the instructional plan, including yourself. You might use language such as "Instructional Plan adapted from \_\_\_\_\_”; “Instructional Plan Consultants (not responsible for the content of this instructional plan): \_\_\_\_\_\_\_”; and/or “Instructional Plan Created by \_\_\_\_\_” Cite scripted materials/curriculum if appropriate.