Module 3 Capstone Lesson

Lesson Author	Emily Borden
School/District	HM Jackson High School/ Everett Public Schools
Series Title (Only if it applies)	Biograph
Grades	9-12
Target Class	Biology and the Environment and/or AP Biology
Standard(s): NGSS	**HS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics** Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
Lesson Name	LESSON: Identifying Complex Systems
Short description (Less than 1500 characters)	Students will learn about the characteristics of a complex system. Then use those characteristics to identify whether given examples would be classified as a complex system or not.
Content Connection	It is important for students to understand the characteristics of a complex system, so that we can then apply those characteristics when we discuss concepts like ecosystems, the human body, or even evolution. This lays the foundation for many of the topics and interactions we discuss in biology.
Lesson Content	Start with whole class discussion or small group discussion. 1. Show the class the basic model of the spheres colliding. 2. Ask students the following questions as part of the discussion: a. What do you see happening in this model? b. How does this model represent the idea of a complex system? c. What do you think this model might represent? d. What might be some factors in a population that would cause the rate of infection to increase? 3. Tell the students that we are going to explore one factor, the idea of density and its impact on this biotic factor. 4. In small groups or individually, have students explore the 2nd model that focuses on how changing density affects the rate of infection in a population. 5. Students will record data for four different densities (starting # of yellow spheres, time it takes for all to be infected). 6. Students can choose the densities that want to investigate as long as they go through a range of densities. 7. Have a class discussion to talk through the following questions: a. How did the density of the beginning population affect the amount it took for all the organisms to be infected? b. What are some limitations you see with this model? c. How is this model a good representation of the real world? How is it not? d. What might be some other factors we would need to consider when looking at an infection rate?

	Extension: I would like to find an example from others for the three other questions. I think that it would be interesting to assign kids one of the other models as homework to play around with and make observations of. Then have them discuss in small groups (with the same model students) the questions posed in step 7 and then report their ideas out to the class.