It's Go Time
November 7, 2017
OCM BOCES Regional Lesson Study Science Conference
Instructor: Tyler Cooper
Lesson Plan developed by: Heidi Busa, Tyler Cooper, Mary Jo Hoeft, Ellen Spencer ,
Sue Tavolacci
Marcellus CSD

1. **Title of Lesson**

   What is the cause of honeybee colony collapse and what can be done about it?

2. **Brief description of the lesson:**

   Students will look at various forms of data from states in the US regarding: honey bee populations, urban settlement, pesticide use, varroa mite infestation, and land use and bee transportation by commercial beekeepers.

3. **Research Theme:**

   Teach scholars to construct claims supported by evidence through authentic data sets, peer discussion and graphic representation.

   Teach scholars to analyze and critique data presented by others.

   Teach scholars to compare data in order to reach viable solutions to problems.

   Explanation of the research theme:

   If scholars examine multiple forms of data on a topic such as those listed above, they can interpret such data and make viable claims related to the topic.
   Through discourse, scholars can share and critique each other's claims and evidence to determine the most important reason for a phenomenon such as honeybee colony collapse.

   Giving students multiple forms of data to analyze and interpret provides a basis for discourse with other students who have data that is different, but related. Students then have a venue to engage in argumentation about the data presented by all parties, leading to a consensus on what data is most important, what data is still needed, and what decisions can be made based on the data presented and the rationale behind those decisions.

Goals of the Unit:

Students will be able to:

a. Analyze data in various forms
b. Interpret data in various forms
c. Find relationships between topics represented by data
d. Engage in discourse
e. Make claims based on data
f. Use evidence to support claims
g. Use argumentation supported by evidence to promote one solution over another
h. Understand how human impact can affect species' populations

Goals of the Lesson:

Students will use argumentation supported by evidence to explain their analysis and interpretation of multiple forms of data on a topic.

Students will engage in discourse with other students who have different data for the purpose of determining what data presented by group members is the most important, what data still needs to be examined and what data is irrelevant.

Relationship of the Unit to the Standards

Related Prior Learning Standards	**Standards for this unit**
MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.	**HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.**
MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. **MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.**	**HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.**

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.	**HS-ETS1-3. Evaluate a solution to complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts**

Background and Rationale

In researching the topic of analyzing different modes of data for the purpose of identifying trends, interpreting relationships among species, and interactions between ecosystems, the research team first consulted the Achieve website for posted sample tasks. The team wanted a task that related to the current NYS Living Environment curriculum while also addressing the new New York State Science Learning Standards in Life Science for High School. We determined that it was timely to address standards HS-LS2-2, HS-LS2-6, and HS-ETS1-3. The Achieve website offered the sample task *Colony Collapse Disorder and an Analysis of Honey Bee Colony Numbers-High School Sample Classroom Task*. The team felt this sample task could serve as the basis for the unit we were constructing. It was determined that analyzing and interpreting graphs and other forms of data was an area in which our students need to be proficient. This is important in both for developing science literacy, as well as being successful on the Living Environment Regents exam. Further, the task also addressed CCMLS MP.2, MP.3, MP.4, HSS.ID.6, HSS.IC.6 as well as CCLS-ELA RST.11-12.2, RI.11-12.7, RST.11-12.7, RST.11-12.9, W.11-12.7 and WHST11-12.7.

While the data in the sample task compared bee colony populations over time in two states in the US, the team determined that the material was somewhat limited in the scope of possible learning activities. The team decided to find other data to supplement the activity and allow students to delve into possible causes for colony collapse. This would give students access to a broader picture of bee colony populations and allow the team to alter the existing task so students could analyze different sets of data and construct claims and arguments based on that data for a more in depth experience. Students could then share their data-based claims with other students who had examined the same data sets. Followed by this collaboration, students then share their claims with students who had examined different data. This would be done to support the ultimate goal of coming to a consensus on which of the causes of bee colony collapse was the most important.

Research and Kyozaikenkyu

It is important for high school students to be able to interpret information in many forms and use evidence to support a claim based on that information. This is a key element of science literacy and the basis for making informed decisions as a citizen.

The team began by looking at the data presented in the sample task. A portion of the Achieve data was determined to be useful, and the team decided to collect more data to enhance the task. The data retained from the Achieve task included data about bee population in South Dakota and California. From there, the team determined that a day doing research in the library about causes of honey bee colony collapse would allow students to find possible causes of honey bee colony collapse. After further discussion, it was determined that the media specialist in the high school could be consulted about creating a lesson on Internet research which would dovetail nicely with the goals of the unit. It was then determined that since the focus of the unit was not on Internet research skills, but on data examination and analysis, the library research time was determined to be extraneous. In addition, when team members searched the Internet for available data, they encountered many difficulties with the data collection that took away from the focus of the research theme. It was determined that a better use of the students' time was to supply data relating to a few select possible causes of colony collapse. These possible causes were found on the EPA website. The group chose to focus on: land use, urban sprawl, pesticide use, nutrient availability, varroa mite infestation, and transportation of bees for pollination services. This would eliminate the possibility that students would not find viable and pertinent information or that students would find an overwhelming amount of data to sift through. It also ensured that students would be focused on the research theme of analyzing data, as opposed to collecting data.

It was determined that students would receive the data sets and view an introductory video a day prior to our first iteration of the research lesson. This would allow students time for analysis and interpretation so the entire research lesson class could be used for group sharing and discussion.

After the first iteration of the research lesson, it was noted that students had presented their group findings by referencing information learned in the video and not specifically to the data sets. It was also noted that students were not correctly reading the axes on the graphs provided, nor were they making correlations between sets of data. It was decided that in subsequent research lessons, the students would be instructed to reference the data specifically and therefore we would number the data set materials i.e. figure 1, 2 etc. We want students to be supporting connectivity across data sets and supporting claims by supporting evidence with data. In subsequent lessons, students will be directed to do so.

Unit Plan

Lesson	Learning goals and tasks
1	Introduction to Colony Collapse Disorder using a video from NY Times which is a collage of news articles and broad overview of colony collapse. Students begin to look at data about bee colonies in California and South Dakota.
2.	Students individually analyze data sets and annotate relationships that they observe. What do you notice? What do you wonder?
3	Students share analysis of data with others in topic groups. Students will add to their own observations as others share. Students will outline a comprehensive claim to share with jigsaw groups.
4 Open Research Lesson	Students move to groups where each member has different data sets (and his/her analysis) and explain their observations. The group determines the most important data set, what data is still needed and what data is not supported. Students present group findings, using argumentation from evidence to provide rationale for their claim.
5	Students return to initial groups and propose solutions to each of the issues raised based on the research they've done and the data they've interpreted.
6	Students individually were given the task to propose five strategies that they would use to combat Colony Collapse Disorder based on what they've learned.

Open Research Lesson Plan- This is lesson 4 of 6 lessons.

1. **Students have been previously assigned to a jigsaw group and will already have analyzed the data sets they were assigned during a previous lesson.**

2. **Each member of the group will have 5 minutes to present their information to the group. Students must make connections between the information they hear and the initial information they received in the initial lesson.**

3. **Students will have 10 minutes when all have presented to determine as a group which topic has the strongest and weakest correlation between data presented and the initial data.**

4. Final 10 minutes: Group spokesperson will present the group's findings to the full class, using at least two pieces of evidence to support their claim. Specific reference to figures from data sets will be required.

Points to look for:

1. How are students using their graphs and charts while discussing their cause of colony collapse?

2. In their groups, how do students make connections between the data sets?

3. How do students contrast between the data sets?

4. How are students interpreting the data? Are they describing only the trend line (i.e., it increases), as compared to describing the relationship between variables (i.e. once varroa mite infestation rises beyond 4 mites per bee, survival of workers drops to zero).

5. When students present the group's determination, how are other groups of students listening?

The skills of analyzing and interpreting data from multiple sources, identifying causal relationships among data sets, and then constructing arguments based on that data have been carefully scaffolded over several days of the unit.

Cognitive Demand

This unit has been carefully designed to allow students to use skills previously developed in mathematics such as reading graphs and diagrams; then expanding on those skills using relevant data to construct claims regarding a real-world problem. This focus on using authentic problem solving strengthens students' ability to analyze data on any topic and make informed decisions as citizens. The opportunity to engage in discourse based on interpretation of information, as well as to critique arguments presented by other students based on data interpretation, adds to the students' ability to express beliefs based on scientific evidence. The fact that students have not engaged in such strenuous analysis makes this task cognitively demanding.

Equitable Access to Content

This lesson was designed to maximize the participation of all students. Each student was given ample time to think about the data presented to them. They were also grouped in ways that allowed for group discussions about student individual topics. The second groupings allowed students to present their observations visually and engage in discourse with peers, ask clarifying questions, and gain a deeper understanding of the real-world problem.

Agency, Authority and Identity

This lesson was purposely designed to allow students to have the authority over the material once the teacher distributed the data sets. The task is designed to have no singular right or wrong answer and the focus is on how students can use the evidence from the data to support their claims regarding how to best address the issue of honey bee colony collapse. The teacher's role becomes that of coach and facilitator of the activity so students can draw their own conclusions.

Uses of Assessment

The use of student created note sheets provide instructors with valuable information about their understanding of the data presented to them. Additionally, listening to group discussions allow instructors to assess student ability to interpret the correlation between the data sets. Providing students with the opportunity to participate in two different groups allows instructors to formatively assess student collaboration skills as well.