DDT and the Environment

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Host Organization: Stanford **ETP Type: Lesson plan**
Subject/Grade: Biology/9th grade

Abstract (~150 words)

DDT and the Environment introduces the detrimental phenomenon of biomagnification using the example of DDT. After learning about the history of DDT and effects to the environment, students will be given data to analyze about how DDT flows through a food chain/food web in an ecosystem. After making conclusions based on the data given, current research on solutions will be discussed. Students will be given data and information about the research I worked on at Stanford. Just like I did, the students will look at how activated carbon is a potential solution to reduce the bioavailability of DDT. Students can compare data between the original contamination and after activated carbon (the solution) has been added. Students will have the opportunity to collaborate, analyze and evaluate data and communicate their findings.

Focal Content & Supporting Practices

NGSS 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.
DCI: Ecosystem dynamics, functioning, and resilience
SEP:Engaging in argument using evidence; Analyzing and interpreting data
CCC: Scale, proportion and quantity

21st Century Skills and Applications (1 - 2)

Communication and collaboration:
Students will be working in partners to analyze data. Students will communicate their findings through a written CER paragraph.

Measurable Objective(s)

1. Students will be able to analyze the given data about DDT and biomagnification.
2. Students will be able to answer the essential question (EQ) in a claim/evidence/reasoning (CER) format using 3 pieces of evidence and reasoning.

Formative Assessment(s)

Students will answer questions in a class discussion after they watch a video and read an article about DDT and its effects on the environment.
Students will graph data and answer analysis questions about data and DDT.

Summative Assessment(s)

Students will write a CER including a Claim, Evidence, and Reasoning about DDT and its effects on the environment.
Students will graph and analyze data about DDT in the environment before and after activated carbon is

added to the sediment in a handout.

Fellowship Description (300-500 words)

My fellowship is at Stanford University in the Luthy lab. This lab focuses on water contamination and treatment research. The project that I am working on is focusing on DDT contamination located by Richmond. DDT was used as a pesticide but it has detrimental effects on the organisms in the environment. Since DDT is hydrophobic, it collects in the sediment and needs to be removed. Initial remediation effort focused on removing the sediment from the bay but this failed due to incomplete dredging. The Luthy lab is working on researching alternative treatment options.

Activated carbon has been researched extensively as a very promising way to reduce risk of contaminated soils and sediment by hydrophobic compounds like DDT. We are testing different brands and grain sizes of activated carbon to identify the best choice to use in the decontamination of DDT. We are using a passive sampler to simulate tissue of benthic organisms (the organisms that live in the sediment). After the DDT contaminated sediment, activated carbon and the polymer have been on the shake table for 4 months, we are testing the amount of DDT that the polymer has absorbed. We are then going to retest with a 4 week period to see if there are any differences in the amount of time the activated carbon was in contact with the sediment and passive sampler.

Throughout the fellowship, I have learned different lab techniques and processes in order to effectively test for the DDT without contamination. I have experienced many skills that are needed for success,like team work, dedication, attention to detail, and communication.

Fellowship Connection to School/Classroom (300-500 words)

I teach Biology and one of the topics that we cover is energy flow and food webs. As energy flows through the food web, only 10% is transferred between organisms. Unlike energy, as contaminates like DDT flow through the food web, most of the DDT will be transferred to the next trophic level. This biomagnification causes many issues with the organisms at the top of the food chain/web. Students will look at data of the amounts of DDT at different levels of food chains within a food web. After they analyze their data, they will be answering the essential question in the form of a CER paragraph. They will need to use their data to support their answer.

Essential Question: How do environmental conditions of the lowest trophic levels affect the highest trophic levels?

After their CER, I would like to give them simulated data of DDT in the same organisms after activated carbon was introduced into the sediment. They would compare the 2 data sets to come to some conclusions of the outcomes of using the activated carbon solution.

My hope is that I can help them see what scientists are doing right now to come up with solutions to problems in our ecosystem that we are facing right now. I also want to connect to growth mindset when discussing what the EPA tried the first time, and subsequent discoveries because of their failure.

Instructional Plan (This is the bulk of your ETP and may take several pages.)

Unit Title: Ecosystems ● **This lesson will be at the end of the unit after learning about energy flow through food chains and food webs.**	**Lesson Title: DDT and the Environment (Block schedule-100min)**
ESSENTIAL QUESTION(S) in lesson: How do environmental conditions of the lowest trophic levels affect the highest trophic levels?	

HOOK for lesson: **Video on DDT from the 1940s. The video is an advertisement for DDT and all the ways it can be used to kill insects.** **5 min DDT Video link**	
CHUNKS for lesson:	
Lesson Segment 1 **Activities: Background information on DDT** **25 min**	**Think-pair-share: After watching the video, students will share what stood out to them from the video.** **Article interactions: Students will be led through the steps of interacting with the article: The DDT Story** **1. Write the reading focus on the top of their article** **a. How does DDT impact the ecosystem?** **2. Number the paragraphs** **3. Circle key words in one color** **4. Underline the main ideas that pertain to the reading focus in a different color** **5. Write 3 questions about the article in the question column** **6. Write a summary of the article answering the reading focus question** **a. *this may be homework** **After about 10-15 minutes students will share with their elbow partner 2 things they learned about DDT. Then I will call on a few students to share out what their partner shared with them to the class.** **Main takeaways from discussion:** **-DDT was used a lot as a pesticide** **-DDT is still found in the environment even though it is not used anymore** **-DDT has detrimental effects on birds** **-DDT can cause many health issues in humans**
Lesson Segment 2 **Activities: Analyzing Data** **25 min**	**Students will be given the DDT Data Analysis sheet. They will work in their lab groups to diagram the data and answer the analysis questions.** **DDT data analysis worksheet** **Formative Assessment:** **Students will need to get the Data analysis sheet checked off by the teacher before moving on to the CER. (If at the end of the class period, collect the worksheets to check them before returning the next day)** **-Indicate which questions the students did not answer correctly. The students can then work with their group to correct their answers.** **DDT data analysis KEY**
Lesson Segment 3 **Activities: Writing CER** **20 min**	**Summative Assessment:** **After students finish their DDT Data analysis sheet, they will need to individually write a CER answering the EQ. They should be using the background information, and the data analysis sheet to help them.** **EQ:** How do environmental conditions of the lowest trophic levels affect the highest trophic levels?

	The CER needs to be highlighted before it is turned in. (Green = claim, Yellow = Evidence, Red = Reasoning) **CER Rubric**
Lesson Segment 4 **Activities: Evaluating Solutions** **20 min**	**I will discuss the research I did at Stanford University with the students. During my fellowship program, we researched about using activated carbon as a way of binding to DDT and preventing it from entering the food web. We studied different brands, types and grain sizes of activated carbon to see which would work the best. I will refer to my poster. Stanford Fellowship Slides** **Summative assessment:** **Students will be given Data and graph about the amount of DDT in the ecosystem after activated carbon is added to the ecosystem.** **They will need to evaluate the effectiveness of the solution by comparing the new data to their previous data.** **Activated Carbon and DDT worksheet** ****The students will use LENSES to analyze the data. They will have already been taught this and practiced it. I have attached the notes below for reference.** **Activated Carbon and DDT worksheet KEY**
Closure: Final takeaways **5 min**	**Students share out their final takeaways from the lesson.**
Homework/estimate time to complete:	**If they need more time to write their CER, they can finish it at home.**

Supply List

DDT Background Article copies
Highlighters
Data and Data analysis worksheet copies
CER rubric copies
Extension activity information copies

References

Camorris. (2016, January 14). Home. Retrieved June, 2019, from http://naturalresources.anthro-seminars.net/concepts/ecological-concepts-biomagnification/

Markdcatlin. (2010, December 20). DDT Let's Put It Everywhere 1946. Retrieved from https://www.youtube.com/watch?v=-UiCSvQvVys

The DDT Story. (n.d.). Retrieved June, 2019, from http://www.panna.org/resources/ddt-story

Water. (n.d.). Retrieved June, 2019, from http://www.medicalecology.org/water/w_intro.htm

Keywords

DDT, Biomagnification, CER, Data Analysis, Food chains, Ecosystems, Contamination

Links to Files in this ETP

DDT video link
The DDT Story article
DDT Data Analysis worksheet
DDT Data Analysis worksheet KEY
CER Rubric
Activated Carbon and DDT worksheet
Activated Carbon and DDT worksheet KEY
Graph analysis LENSES notes