CONCEPT-BASED LESSON PLANNING PROCESS GUIDE-DONNELLY LESSON

Classroom Context:

This was presented to an 8th grade science class of 27; however, the content of this lesson was presented to all of my 8th grade science classes, which total 112 students. At our school we have a very diverse population where we have roughly 44% white, 22% African American, 28% Mexican, 6% other. Over 50% of our population is labeled free and reduced lunch. Our school is sometimes classified as a disadvantage school, because we don't have some of the same accesses to technology or tools that other schools do. However, three out of four teachers, on a team, have chrome book carts in their room. If teachers write grants then our students are able to experience more 21st century technology. Last year, six out of nine science teachers wrote grants in hopes to provide our students with the same opportunities as many of the other schools. Aside from the technology piece, our school is currently working with a CRE (Culturally Relevant Education) Advisor. Dr.Yemi Stembridge works with three focus teachers, me being one of them, to help them design lessons that build engagement, develop relevancy, and works on the six tenents of CRE. Other teachers observe the focus classrooms to work on building a stronger community within the building. Within CRE as a main focus, we also use AVID strategies and ELA co-teaching opportunities. Therefore, this lesson envelops many of the CRE tenents as well of AVID strategies in hopes that engagement and learning are kept at high number of students.

Shift in Instructional Design	***Lesson Elements and Design***	***Metacognitive Reflection***
The Unit Generalization and Focusing Lens asks students to … Design a solar cooker that can heat water to the temperature of 70'C	**Lesson Focus:** (*Connection to Generalization and/or Focusing Lens in the District Sample Curriculum Project)* The sun's radient energy is often transformed into many other useful forms of energy, which is used in Africa to help people have clean, safe drinking water. Through this process students will gain a general understanding of how convection, conduction, and radiation work, which will later be applied to the causes of weather. PS8.2c: Use research-based models to describe energy transfer mechanisms, and predict the amounts of energy transferred. (CAS GLE MSPS8.2, NGSS PE MS-PS3-3)	*How does this specific lesson advance the big idea or generalization of the unit? What connections might be made between other content areas?* *This specific lesson allows for students to solidify their understanding of energy/ heat transfer, and the amount of radient heat needed to generate thermal heat.* *The cross content areas are math through the graphing of data, and social studies because of having to know where Sudan and Ghana and having to understand the*
This lesson objective / learning target is critical to student understanding because… because if they can see how the three main	**Objectives / Learning Targets:** *(Key knowledge & skills students will master in the lesson)* *(Language may be pulled from the task in the Learning Experience:"…so that students can…")* **The students will be able to analyze initial data to understand how the principals of heat transfer**	*In what ways does the learning target support the generalization?* *It supports the generalization by allowing students to see how their*

mechanisms of heat transfer work. Then they will be able to have a stronger knowledge base of radient energy and how it drives temperature changes, which leads to variations in our local and global weather.	**work within solar ovens.** **"I can" use my initial data to redesign my solar oven so it will heat 100mL of water to 70'C.**	*initials thoughts and designs worked by analyzing their very own data. It will also help then develop the "why" of what their data is telling them about their solar ovens.*
Instructional strategies	**Instructional Strategy Menu** • **Gallery Walk** • **Give One, Get One** • **Think-aloud** • **Teacher modeling** • **Collaborative groups** • **Teacher/ Student generated questions for redesign process.**	*Which instructional strategies will foster learning the lesson's skills, processes, or content?* *The following strategies each allow for students to develop the ability to make objective observations, provide constructive feedback, which is often challenging for any student, and to work together to create the most effective design to meet the given task.*
In the first 3-7 minutes of the lesson, students will look at class data showing the highest initial temperatures collected during their field work the day before.	***Opening (hook / anticipatory set / lesson launch)*** ***ENGAGE*** **Instructional Strategy: Students share out their highest temperature from their initial testing day on 10/11/2016** **Why is this strategy impactful:** (*In what ways does this strategy move the learner toward meeting the learning target?)* This drives student curiosity and allows for students to develop questions as to why certain solar ovens achieved specific temperatures. **How does this strategy support meeting the "just-right challenge," or "building relationships," or "creating relevancy," or "fostering disciplinary literacy"?** **This strategy allows for me to spark student curiosity and develop questions as to what allowed for certains teams to achieve the their given temperatures.**	*In what ways does the chosen strategy work toward a larger purpose at the beginning of the lesson (e.g., engaging students, increasing curiosity, stimulating student-generated questions, etc.)?* *When sharing out data, it allows for students to question why that data occurred. It also drives their natural curiosity because people naturally want to understand how specific designs can do a better job than others. That leads to a instinctual competiveness that pushes them to do the best job possible. When students are driven by a peer challenge, they strive to learn what is necessary to succeed in the challenge.*
The Learning Experience will provide them with the opportunity to learn from	***Learning Experience / Lesson***	

one another while also learning through my modeling of data analysis. It also gives them the chance to be reflective about their design process and ask questions that lead to effective change.	***EXPLORE AND EXPLAIN*** **Instructional Strategy: Gallery Walk that will feed into the next strategy of Give One, Get One.** **Scientific Practices: Obtaining, evaluating, and communicating information. Also engaging in argument from evidence.** **Individual Performance Expectations for Gallery Walk:** **1. To silently walk around the differently designed solar ovens and make specific observations while recording those observations in their notebooks.** **2. To develop specific questions about the specifics used on certain solar ovens and why other groups used their design to achieve the ideal temperature of 70'C.** **Group Expectations prior to the Give One, Get One:** **1. Students had to work together to decide which heat transfer process within their solar oven could use modification in order to achieve 70'C.** **2. As individuals, they had to make a independent decision on how they could modify a specific element of their solar oven to make it effectively transfer enough heat to warm the water to optimal temperature.** **Individual Expectations for Give One, Get One:** **1. Students took their group/ own ideas and found a different student from another group to share their idea about how they could modify their solar oven, and then the other student would share an idea that could help the initial student.** **Explain Portion:** **1. Teacher lead questioning on their data. Students will briefly review their data to interpret what their results really mean and why the variations existed within their data.** **2. I will model my results and my thinking for the reason why I got the results I did.** **3. Then have them briefly discuss the class results, so students can hear others ideas and thoughts and even challenge one another using evidence.** **Why is this strategy impactful:** (*In what ways does this strategy move the learner toward meeting the learning target?)* This allows for the learner to move towards more independent work by having them develop their own questions from observations, their own thoughts about modifications after group discussions, and finally allowing for them to see if their modification reflects that of their data. The give one, get one strategy allows for students to receive constructive feedback from a different source outside their group. Finally, the class discussions provides the teams with various explanations they possibly didn't think of. Through all of this work time, students are actively engaging in the scientific practices of obtaining, evaluating, and communicating strategies that will lead into redesigning their solar	*In what ways does the chosen strategy(ies) work toward a larger purpose (e.g. increasing collaboration; interacting with complex texts; situating students in real-life, relevant experiences; increasing student agency; stimulating student discourse; etc.)?* *By allowing students to participate in a gallery walk, I wanted them to have a chance to compare and contrast design methods based on the process of heat transfer and being able to obtain the highest temperature possible. (This is based on Hess's Cognitive Rigor Matrix for Evaluate DOK 3). The Give One, Get One allowed for students to understand which part of their solar ovens needed modification and share with their peers their thoughts about how to modify their ovens. (Hess's Rigor Matrix: Understand, DOK 3) Many students get blinded when they don't see other ideas or hear other suggestions, and in the scientific community scientists tend to learn more from others and possibly their mistakes.* *In what ways does the chosen strategy cement the learning?* *These strategies help cement the learning by going their the process, seeing their failures, and sharing those throughout the scientific community so they can learn from one another. When students can go through the process via hands-on learning and student lead, they're more apt to learn the material versus just regurgitating material.* *What evidence will show that the strategies impacted student learning? Were the strategies effective through the learning process?* *When students are able to explain what*

	ovens to solve the problem of being able to pasturize water. **How does this strategy support meeting the "just-right challenge," or "building relationships," or "creating relevancy," or "fostering disciplinary literacy"?** **These strategies provide students with a way to understand the need of scientific communities and how no one scientists solves a problem. It helps them develop the skill set of safe collaboration as well as being able to receive and give constructive feedback.** **The rigor comes with them evaluating their group's data and determining which part of their solar oven will need modifying in order to effectively transfer heat through the three main transfer mechanisms.**	*their data means in terms of which heat transfer mechanism affected the outcome of their solar oven temperatures is a large piece of evidence that supports that idea of them learning the given concept.. As students are able to communicate their understanding to other students using strong academic vocabulary as well as sharing it with the adults in the room, it demonstrates their ability to process through the material and apply the learning process throughout the design build.* *I feel confident that the strategies were effective because students were able to improve their initial designs. They also built working relationships that allowed for them to test each others' ideas without the fear of failing.*
The closing activity reinforces the learning by having them reflect on what worked and what needed modification. Then it allows for them to bring their ideas to fruition.	***Closure*** ***EXTEND AND EVALUATE*** **Instructional Strategy: Teacher lead questioning, group collaboration, affirmation statements, and redesign time.** **Scientific Practices: constructing explanations and designing solutions.** **Group Expectations:** **1. Groups will have a final chance to answer their initial predictions of whether or not they were able to get their solar oven temperature to 70'C.** **2. Finally, students needed to celebrate their successes by writing an affirmation statement about what worked in their solar oven.** **3. Once students have completed their reflections they will work together to finish their redesigns.** **Why is this strategy impactful:** (*In what ways does this strategy move the learner toward meeting the learning target?)* This strategy was effective because it made them look at what worked on their solar oven and celebrate those successes. It also made them think about what didn't work so they focused their thinking on those specific areas instead of wasting time once the redesign process started. It gives the students the opportunity to create new ideas from initial data and collaboration. It also develops the skill of having to work with a group to develop a concensus, which isn't always easy when you don't necessarily agree with the final design. **How does this strategy support meeting the "just-right challenge," or "building relationships," or "creating relevancy," or "fostering disciplinary literacy"?** **Being able to effectively communicate their ideas through the process of reflection and collaboration. They also need to be able to identify and reference areas of need from their physical model in order to make specific and**	

	focused modifications.	
Technological resources that will support student learning and move students toward the learning target.	***Technological Resource and application:*** ***Students will need access to their digital data on the Google drive and an internet connection as well as their observational data from their notebooks.*** ***They will also need materials to complete their redesign.*** **How: In what ways does this chosen resource support meeting the "just-right challenge," or "building relationships," or "creating relevancy," or "fostering disciplinary literacy"?** **Having access to their data helps them connect the meanings of their data to their redesign.**	*How will my students and I strategically use technology resources to enhance the learning experience (and support "meetingthe just-right challenge," "building relationships," "creating relevancy," and/or "fostering disciplinary literacy")?* *My students had access to digital probes and access to Vernier Graphing Analysis app, which allowed for them to save their data to their Google Drive so they could analyze it the next day. This was very helpful because not all students recorded their data In their notebook. It also gave them access to 21st Century tools working in real time, which is more relevant to today's jobs as compared to using simplistic tools such as a alcohol thermometers.*

Formative assessment will be a quick Check for Understanding in which students will demonstrate they are or are not on track.	***Formative Assessment*** **Formative Assessment tool/method:** This will come the following day when students retest their solar ovens to see if their modifications allowed for them to success warm water to 70'C. They will also write a CER on Monday to demonstrate their understanding of how heat transfer successfully worked within their solar ovens. **Learning indicators of success:** *(What evidence will show that the learner is moving toward mastery of the learning target?)* *For me the learning indicators of success is when the students can tell me which areas of heat transfer are at work within their solar ovens.*	*What "indicators of success" will show that the stiudents are gaining mastery?* *Indicators of success for me where seeing them collaborate as to which part of their solar oven needed modification because it wasn't effectively transferring heat to the water. Other indicators of success where the use of academic vocabulary. I was observed that day by a group of teachers, and they shared about students using their notebooks to review their initial designs. They were able to tell the other teachers which modifications were more important than others, and they were able to explain why they thought their initial design didn't work as well as it could've.*

Reflection: (What are the *strengths in the lesson plan? What changes would I make in the lesson plan for next time*?)

I felt my strengths in this lesson were the ability to allow for students to learn from one another. I tried to remove myself from the teaching role and more into the facilitator role, so this became a more student-centered experience. I also felt as if I didn't really have an opportunity to help them understand what their data was saying, but when it came to the classroom discussions students were very aware as to why some of the variations existed. However, most understandings came from the clear limitations they encountered such as cloud coverage, inability to trap the heat, and either lack of proper reflection or absorption within their ovens. They weren't able to fully connect as to which heat transfer mechanism was key to making their ovens more effective. However, they knew how explain it using words or phrases such as "trapping the heat" or "this area isn't getting hot enough to heat up the water". So in general they knew what was happening, they weren't always able to use the academic vocabulary to describe the process. One of the areas I hope to improve in are to better prepare them in interpreting data from a graph or data table and being able to explain what the data really mean.

Participant reflections (questions in bold were projected on the screen and asked of all participants):

1. **Did your solar oven reach the ideal temperature of 70'C?**
2. **Why or why not?**
3. **Write an affirmation statement stating what worked.**

Based on the last statement, many students felt that writing an affirmation statement was ineffective, because why should they celebrate failure? However, I tried to explain to them that if their solar oven showed temperature increase then some heat transfer process was working, and they should celebrate that. Some students tried to think of what worked well, but I feel that many teachers have unconsciously guided students in what they were doing wrong versus what they were doing right. Though it pushed their thinking limits outside the box, so they could actually see what worked for them or other students and they could focus on other areas of need when doing the redesign.

Connection to Performance Goal: (*What did I do in this lesson that gives evidence or may be used as an artifact for my professional growth plan?)*

As for my professional growth plan, they were starting to develop logical arguments from evidence, whether is was between the group or class. They were able to question one another and challenge their classmate's responses pushing their thinking to critical level.

Student Feedback: (*What did students say about the lesson? Did they find it engaging, interesting, appropriately challenging? Did their feedback confirm my own perception of the the lesson?)*

Based on what the teachers shared during the debrief by quoting student responses, I would say students were more actively engaged in this type of lesson because they had to produce an end product that others saw. They felt accountable because they wanted to do better than their classmates. When students are more involved with their learning, they are more willing to strive for success and endure struggle. Failure is more acceptable because they process it differently than being feed the material and then failing a test. I'm always harder on myself, but the students wanted to keep going until they were able to heat the water to 70'C. For me, that affirmed that they valued they learning experience because they wanted to go until they get it right.

Time Suggested	This particular piece of the lesson occurred in one day; however, this was part of a PBL for heat transfer to build background knowledge of causes of weather.
Materials Needed	Chrome books, digital probes, cardboard, foil, construction paper, tape, 500 mL beakers, and whatever else the students needed for their solar oven.
Co-teaching Opportunity	This particular lesson didn't necessarily need a co-teacher because students did prior research on the 5 main vocabulary terms.
Cross-Content Connections	This particular lesson didn't offer a strong opportunity for cross- curricular elements aside from graphing and interpreting the graphs.

Description of the Lesson Implementation:

- **Teacher facilitates results and discussion**
- **Students engage in science performances**
  - *Students Observe and share out*
    - *Gallery walk*
    - *Give One, Get One*
  - *Students Reason*
    - Analyze data and evaluate information as a group
    - Construct explanations for areas of modifications
    - Develop arguments for how or why the evidence demands redesign
  - *Students Redesign*
    - Collaboration
    - Celebrate
    - Group work to modify their solar oven for final test day
- **Teacher and students reflect on reasoning as to why data is so important when it comes to redesigning initial models in order to meet the given requirements.**
- Students finish their solar oven and prepare for final testing day.

Reflection: Students were asked to reflect on their process prior to redesign, so they could focus soley on what areas needed modifications. Students will also be asked to complete a PBL team collaboration rubric so they can see the importance of working together even when they don't always agree.