**LESSON PLAN TEMPLATE – Classroom Interactions**

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| **Teach Date:** 11/9/15 | **Names of Student(s) teaching:**  Tara Tough, Zachary Kingsak | |
| **Teach Time/ Per**  9:00 - 10:30, period 1 | **Big Idea/ Enduring Understanding for the lesson:**   * Successfully designing a product is a stepwise process with multiple trial and error. * The experimental process is not limited to a single “scientific method”; however knowing how to properly investigate and conduct an experiment are necessary for results to be valid. * See how different professions in STEM work together to create a product * (Our big ideas transverse the three lessons because they are so closely related) * Research is important in making design decisions. | |
| **TEKS for lesson:** | | |
| **Objective/s- Write objective/s in SWBAT form…**  The SWBAT:   * Represent the speed of their car by plotting points on a position versus time graph. * Choose one variable to change in the final design of their group’s solar car based off of their research and classmates presentations. * Calculate the speed of their car utilizing a meter stick and a stop watch. | | **Assessment:**  What will you accept as evidence of student progress toward your lesson objective?  In their groups, the students will be responsible for designing a poster board exploring their variable. Their poster boards will have the speed of their car without the variable change. The poster boards will also include their research on their variable and their hypothesis on how the change in variable will affect the speed of their car. |
| **Overview of Activities:** In the space below please provide a general overview of the various activities/events you will ask students to engage in during the lesson. *Please include the estimated time for each event*.  Ex. *Engage students by asking T/F questions about osmosis to pique curiosity and assess prior knowledge. Have students post their responses on the board (15 min)* | | |
| 1. *Engagement (10-15 min): Go around to each table and ask the groups to name the variable they opted to explore. Teacher will write these variables on the whiteboard. Teacher will circle the variables, solar panel size/number and wheel size and tell the students that because of cost and availability, these are the two variables that they will be focusing on. Students will then think, pair, share in their groups. “Focusing in on these two variables, think silently about all of the different combinations we could have when we changed wheel size and size of one large solar panel.” The teacher will tell the students to write some of these down on a piece of paper before discussing in their groups. The teacher will give the students 2-3 minutes to individually think about the question and create their own lists on a piece of notebook paper. The teacher will then give the students 5 min to share their responses with their groups and add to their individual lists. Teacher will then go around to each table and write down their group’s thoughts on the board along with the other variables. Teacher will then tell the groups to narrow down their list to one variable they want to explore further. The teacher will give the groups 2-3 min to discuss and decide on the variable they would like to research further. Possible student responses could be: 2 big wheels in the front, two small wheels at the back. One small and one large wheel at the front and one small and one large at the back. Cover half of the solar panel, cover a quarter of their solar panel. Cover the solar panel with colored saran wrap.* 2. *Instructions (10 min): Students will return to their same groups as last time and their name tents will have a number on them (either 1, 2, 3, 4). These numbers signify important roles which will be discussed below. Students will be told that half of them will begin researching their variable utilizing the class laptops. Each student in the group will be responsible for researching a different aspect (out of four) that will provide to their group some insight on how that variable could potentially affect the speed of their car. Each member will be responsible for summarizing their findings to share with their group on a notecard. The other half of the groups will be told that they will be measuring the speed of their car. The groups will be responsible for marking out three different spots with tape of increasing distance. Once the three spots are marked, one student will stand at position one with a stopwatch, another student will stand at position two with the stopwatch and the third person will stand at position three with the stopwatch. The fourth member in the group will be responsible for positioning the car to start and following the car with the flood lamp. The fourth member will be in charge of recording this data on the provided worksheet. To help accommodate to students that are either English language learners or have trouble reading and writing, the speed activity will be instructed as a demonstration. The teacher will utilize three of the students as volunteers to participate in the demonstration to the rest of the class.* 3. *Speed/research round 1 (15-20 min): Groups 1-4 will begin researching and recording their research while groups 5-7 will begin taking the speed of their car and recording their data. There will be four notecards on each table with a number matching the number of the student’s name tent. These will signify the roles that each student will have. Student 1 will be in charge of using the flood lamp to guide the car through the checkpoints and recording the data on the worksheet supplied as a rough draft. Student 2 will be in charge of checkpoint 1 and utilizing a piece of tape to mark their checkpoint along with utilizing a stopwatch to mark the time when the car passes their piece of tape. Student 3 will be in charge of marking a piece of tape at checkpoint 2 and using a stopwatch to record the time that the car passes. Student 4 will be in charge of marking checkpoint 3 and utilizing a stopwatch to record the time when the car passes their checkpoint. Students will also be in charge of recording at least two design decisions they made when taking the speed measurement of the car. “What are the limitations in taking the speed of your car?” “How did you decide on the distance you would like your car to travel?” “How did you decide on when to stop your stopwatch?” “What role is the light playing in effecting the movement of your car?”* 4. *Speed/research round 2 (15-20 min): The roles of the groups will switch. Groups 5-7 research their variables while groups 1-4 take speed of their car and record data. There will be four notecards at the research station for each member to summarize their research that they find. The group will be given 5-10 minutes for each member to individually find three interesting/important facts about their variable and why it could be important in affecting the speed of their car. The groups will then be given 5-10 min to share their ideas with their group. The same note card for the roles will also ascribe the roles for the students at the research checkpoint. Student 1 will be the discussion leader guiding the discussion of the individual student findings and making sure each student is heard. Student 2 will be the recorder, summarizing three important findings of the group’s total input. Student 3 will be the illustrator, illustrating a drawing of their group’s car with the changed variable. This work will be summarized on the presentation board. Student 4 will be in charge of recording a hypothesis on the bottom of the board on what the group thinks will happen to the speed of their car.* 5. *Pair with other group and debate: Once all of the student’s have completed their boards, the teacher will pair them with another group to present their findings to. Each student will be responsible for briefly summarizing what they recorded on the poster and student four will be responsible for reading the hypothesis. The other group will then have the opportunity to ask questions or concur the other group’s hypothesis. Each group will have five minutes to present and answer the questions of the other group. (10-15 min)* 6. *Clean up and conclusion: Teacher will have students leave their posters hung where they are and clean up their stations.* | | |

**Lesson Sequence Rationale / Things to Think About**

**Consider the questions below as you plan your lesson. Give a brief response to each to question as a way to clarify your thinking and provide your reviewers with insight into the reasoning behind your lesson planning**

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| 1. How did you decide on this lesson sequence and why do you feel this sequence will support student learning?   We decided on building solar cars because we really wanted the students to see all of the important elements that go into designing a specific product. Day one, we broke up the building into its important components so the students could see how they came together. Day two we will have the students research and explore a specific variable to provide them with more intel on each variable to help them in finalizing their design decisions. Day 3 the students will finalize their design and have time trials. This will encourage the students to really focus on the importance of the build and design and give them a proud feeling when they see their cars actually utilized.   1. What are the big ideas of this lesson and how/when will they be expressed?   In the first lesson we had the students explore different variables that they found important when building their solar cars. We had the students choose a variable that they wanted to explore later in more detail for the following lessons. In this lesson the students are researching their chosen variable and reporting on the consequences of that variable's effect on speed. The students will measure the speed of their car before and after changing their variable to discern if any comparable difference is there. The students will share out their findings to the rest of the class. By doing this, the students get to make design changes to their car for day 3 for which they hope will effect their cars speed.   1. How will you introduce the lesson and task(s)? Engage students? Find out about prior knowledge?   In this lesson, the students will be engaged by a question asking them to calculate the speed of a rolling marble. The students have not been introduced to speed yet so this activity will be a good start to have the groups explore the concept and see if they can derive a formula for calculating speed.     1. How will you maintain engagement of all students? For example, consider students who:    1. -struggle with task   For students who struggle with the task, I would enlist the help of their peers in the student’s group to help clear the confusion. Sometimes it is better for these students to hear an explanation from their peers to boost their confidence and make them feel more comfortable sharing their ideas.   * 1. -race through task   For the students that race through the task, it would be best to slow them down by having them explain an idea to their peers in the group or even an idea to the teacher. This is an important place to have guided questions ready.   * 1. -express an idea that is hard to understand   If students express an idea that is hard to understand, maybe drawing a picture or diagram could help them better understand or maybe one of their students could explain it in a more understandable way.     * 1. -express an idea that is different from direction of lesson If possible, relate the idea expressed to the task at hand and if not maybe reference it to a future topic or a different class.   2. -are learning English If there was an ESL student, we would spend extra time with the student to speak slowly, give clearer, more broken down instructions, and continuously check on the student’s progress. We will also have written instructions so that the student can refer to them when needed.   3. -are off task   We will be asking the students to keep their cell phones away during our activities unless otherwise stated, and if students get way off task during the lesson we will address them personally and ask what they’re working on to add a little pressure and get them refocused on the task at hand.   1. How will you set up/pose the task(s)? How will you communicate your expectations?   We will have written tasks on PPT displayed, as well as verbally communicate the tasks at hand. We will ask the students to repeat the instructions at each junction which will include what we expect after each activity (“post in your blog… write in your notebook… build… discuss… etc”)  We will periodically check in with the students to see how their builds are going. If some groups are struggling getting the circuit to work, we will ask a group to explain it. If only one group needs help, we will ask them to compare the circuit to a battery powered circuit. “Can you put a battery in either way?” “Why not?” “How do you think that is similar to this solar panel?” If no one understands, we will have the powerpoint slides ready.   1. What questions will you ask to find out how students are thinking about the task(s)? What questions might you ask to extend students’ thinking? 2. How will you transition from one lesson segment to the next? How will your wrap up the lesson at the end and help students summarize the main idea/s?   We will end this lesson by asking the groups to narrow their variables to one that they would like to test. We will ask for materials they think they will need, and will tell them that we will be back for the next lesson with their required materials as well as ways to test them. We will ask them why this process is important.   1. How will you facilitate a discussion of the big ideas that reveals student thinking? What is the structure of this discussion? Groups? Pairs? Whole class? Combination?   The discussion of the big ideas will happen within each group as they think of ways they want to change the solar car design. Once they have come up with a list they will share with the class, and from there, the class will learn together different ways to affect speed of the car. Working together with different tasks within the group will also encourage students to collaborate and think outside their comfort zone. We plan to have groups of 3, with each member assigned a different role. 2. What kinds of artifacts will you require? How will those artifacts be used in the lesson?   We will require the students to create a poster board presentation with their data and research and conclusions to present to the class. We will also require the students to complete a worksheet of their finalized design with their identified variable and why the designed it in that fashion.   1. Work through (solve the problem, conduct the experiment, explore, etc.) the task yourself and predict what students might do. Play around with it. See if you can find alternative, viable pathways through the task. Describe what you learned from doing this.   The students might have trouble positioning the axel and the gears because that is what I had the most trouble with. After playing around with the design, I found that the width of the card board was very important in that it had to be a width to the point where the axel wouldn’t move back and forth. If the axel was loose then the gears would not align and the wheels would not rotate to move the car. I also found that engine placement is variable along with distance between the two sets of wheels. |
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**LESSON EPISODES (In segments. No set number.)**

**In writing a description of your lesson, it should be detailed enough that someone else can read this document and envision the lesson as it is going to play out in the classroom. *Please add more rows as needed.***

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| **Estimated Time** | **Segment title/ description** | **What teacher is doing step by step (*Include specific questions that the teacher will ask*)** | **What students are doing (*consider transitions to the next segment and grouping*)** |
| **10-15 min** | **Engagement** | ***The teacher asks students table by table to call out the variable they opted to explore. Teacher will write these variables on the whiteboard. The teacher will then explain that because of the limitations in availability and the cost of the materials, the two variables that the students will explore are wheel size and solar panel size. The teacher then asks students to individually think about how wheel size and solar panel can be varied with their cars.* Be creative! *The teacher will then ask the students to write these ideas down. (2-5 min) The teacher will then have the students discuss with their tables and add to their individual lists (2-5 min). Teacher will then gather ideas from groups and add to the list on the board. Teacher will then give the students 2-5 min to decide on one of the variable changes on their list. “What are the different ways we could change the wheel size on these cars?” “How could we change the solar panel?” “Could we use something to cover it up?” “What could we use?”*** | **In their groups, the students will first think individually about how the number of wheels and the solar panel can be varied. The students will write down their ideas on a piece of notebook paper. The students will then share their ideas with their groups and add to their individual lists. The groups will then discuss and decide on one variable they would like to explore and research further.**   * ***“Maybe we could use saran wrap to cover up the solar panel and see how that affects the car’s speed.”*** * ***“We could put two large wheels at the front and keep two regular size wheels at the back.”*** * ***“What if we had two big wheels on one side and two small on the other side?”*** * ***“What if we covered up half of the solar panel with cardstock?”*** * ***“What if we used four big wheels instead of four small wheels?”*** |
| ***Resources for this segment &***  ***SAFETY considerations*** | | ***whiteboard, piece of notebook paper*** | |
| ***10 min*** | ***Instructions*** | ***The teacher will then explain that the students will be researching their changes and taking a speed measurement of their cars. The teacher will explain that groups 1-4 will research their changes first. At the research station, each member will be given a notecard and asked to find something important/interesting that will contribute to how their variable change will affect the speed of their car. This could be anything so be creative! The teacher will then explain that groups 5-7 will be taking the speed of their car first and recording the necessary data. The group will mark out three spots along a line with a predetermined distance that their car will travel. One student will stand at spot 1 with a stopwatch, student 2 will stand at spot 2 with stopwatch and student 3 will stand at spot 3 with a stopwatch. The distance will be measured by the students. Student 4 will be in charge of positioning the car and using the flood lamp to guide the car along the line. The students at each position will collect the time at which that car passed their mark. To better accommodate to English language learners and to students who struggle with written instruction, the speed activity will be instructed as a demo. The teacher will ask three students to volunteer and act out what will be happening in the activity.*** | ***There will be numbers on the student’s name tents signifying their roles. The roles will be outlined on a numbered note card. The numbered note card will match the name tent of the student.***  ***Research station roles:***   * ***Notecard 1 (student 1) will outline that this student is in charge of guiding discussion. This student is the discussion leader and will be in charge of making sure that each student is heard and that they share their ideas.*** * ***Notecard 2 (student 2) will outline that this student is in charge of recording the research and summarizing it to three important points. This student is the recorder.*** * ***Notecard 3 (student 3) will outline that this student is in charge of illustrating the car’s new design with the changed variable.*** * ***Notecard 4 (student 4) will outline that this student is in charge of writing the hypothesis at the bottom of the presentation board on how this variable change will affect the speed of the car.***   ***Test track station roles:***   * ***Notecard 1 (student 1) will be in charge of guiding the solar car with the flood lamp and recording the collected data by making a position versus time graph on the presentation board.*** * ***Notecard 2 (student 2) will be in charge of marking checkpoint 2 and taking the time at that checkpoint when the car crosses.*** * ***Notecard 3 (student 3) will be in charge of marking checkpoint 3 with duct tape and recording the time with the stopwatch of when the car passes.*** * ***Notecard 4 (student 4) will be in charge of marking checkpoint 4 with duct tape and recording the time with the stopwatch of when the car passes their piece of duct tape.*** |
| ***Resources for this segment &***  ***SAFETY considerations*** | | ***powerpoint slides, whiteboard, meterstick, stopwatch, laptops***  ***The flood lamp produces a lot of heat and it is very important that the students handle these instruments with care and caution.*** | |
| ***15-20 min*** | ***Activity part 1*** | ***The teacher will tell groups 1-4 to go to the research station where they will find four notecards. Each member is responsible for researching the chosen variable utilizing the class laptops and recording something important/interesting about the variable that could help explain why it affects the car’s speed. The students will have five to ten minutes to do so. Afterwards the students will utilize their roles to record important information on their presentation boards. Student 1 will be in charge of leading the discussion and making sure each student presents their findings. Student 2 will summarize the research on to the presentation board. Student 3 will be in charge of illustrating the design of the solar car with the changed design. Student 4 will help write the hypothesis at the bottom of presentation board. Teacher will tell students to utilize a different color marker for each role.*** | ***The students will grab laptops and research the variable and record their findings on a notecard. The student’s will have 5-10 minutes to do so. The students will then share their findings with the groups. The students will then fulfill their designated roles and record all the necessary criteria on the poster board. This criteria includes an illustration of their design with the variable change and three bullet points of research that explains how they came to the illustration.*** |
| ***Resources for this segment &***  ***SAFETY considerations*** | | ***Markers, presentation board, note cards, laptops*** | |
| ***15-20 min*** | ***Activity (switch)*** | ***Groups 5-7 begin researching while groups 1-4 move on to the test track station to take the speed measurement of their car. The students will utilize their roles once again at this station. Student one will be in charge of utilizing the light to guide the car as it travels through the checkpoints. Student 2 will be marked at checkpoint 1 with a stopwatch and take the time of the car as it passes this checkpoint. Student 3 will be marked at checkpoint 2 and will take the speed of the car as it passes their checkpoint. Student 4 will be at checkpoint 3 and will take the time of the car as it passes their checkpoint. The groups will be responsible for completing two trials with similar data. The students will also be responsible for writing down any limitations or problems they come across. Student number 1 will be responsible for creating a position versus time graph and copying it onto the board. A worksheet will be recorded for a rough draft of the graph and data. Possible teacher questions at this station: “What does the graph tell you about the speed of the car?” “What is happening at checkpoint 1 (2, 3)?” “What issues did your group come across?” “WHy do you think this happened?” “How did your group decide to fix these issues?”*** | ***Groups 1-4 move on to the test track station and utilizing their role descriptions begin with taking the speed of their cars. The students are responsible for writing down any problems they come across on the worksheet provided. Student one is responsible for guiding the light and recording the data on a position versus time graph. Students 2-4 are responsible for representing the checkpoints and utilizing their phones to take the time at these checkpoints. The group is responsible for setting the distance of their car and choosing the distances of the checkpoints as well.***   * ***“We chose this distance because we didn’t think our car was capable of traveling that far.”*** * ***“The car is speeding up at checkpoint 1 but slowing down at checkpoint 3.”*** * ***“Maybe the car has limitations in its build and functions best at the beginning hence why it’s the fastest at the beginning.”*** * ***“Our group had issues with the light. We found that when the light was too far away the car would not travel as fast.”*** |
| ***Resources for this segment &***  ***SAFETY considerations*** | | ***meterstick, stopwatches, colored markers, presentation board, duct tape*** | |
| ***5 min*** | ***Check in and instructions to presentation*** | ***Teacher gathers students attention and tells students to finalize their presentation boards and asks student four to draw a new line on the graph of how the speed will change with the variable change with a different color marker. The students are then told that they will be presenting their findings to another group and that each student will be responsible for sharing their responses. The teacher will pair groups 1 and 2, 3 and 4, and 5,6,7 as a trio.*** | ***Student number 4 will use the hypothesis to draw a new line on the graph after the variable has changed to represent their prediction. The student will do this with a different color marker.*** |
| ***Resources for this segment &***  ***SAFETY considerations*** | | ***presentation board, marker*** | |

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| **Estimated Time** | **Segment title/ description** | **What teacher is doing step by step (*Include specific questions that the teacher will ask*)** | **What students are doing (*consider transitions to the next segment and grouping*)** |
| **5 min** | **First round of groups present their findings to another group.** | **Teacher will walk around and observe as the first round of groups present their findings to another group.** | **The first round of groups present their findings. Each student must present their assigned role. After they have finished presenting, the students in the opposing group can debate and ask questions.** |
| ***Resources for this segment &***  ***SAFETY considerations*** | | ***presentation board, different colored markers.*** | |
| ***5 min*** | **Second round of groups present their findings to another groups** | **Teacher rings bell and announces that it is time for the other groups to present their findings. The teacher tells the students they have five minutes.** | **The second round of groups present their findings to another group. Once they have finished presenting, the listening groups can pose their questions and/or concerns that they possibly have.** |
| ***Resources for this segment &***  ***SAFETY considerations*** | | ***presentation board*** | |
| **10 min** | **Clean up** | **The teacher tells students to return laptops and gather up the supplies that are at the speed station.** |  |
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