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Teaching the 5E model of Instruction and NASA Engineering Design Process

Students in 6th grade physical science will soon embark upon an annual national engineering design challenge, known as the Kidwind Challenge (adapted from Kidwind.org). The event is a culmination of our study of energy resources including the promise and limitations of wind energy as a sustainable source of energy in the state of Delaware. The goals of the Kidwind Challenge include the following:

- **Apply** the STEM design process to solve a real world energy crisis
- **Design** a functional wind turbine based on their knowledge of wind energy
- **Create** a wind turbine of their own and test its performance
- **Compete** against peers for the most creative and functional turbine

As students work to design a windmill based on predetermined criteria and constraints, they are rewarded not only for the amount of volts they can produce in their final testing, but also for the creativity and craftsmanship of their design. The Kidwind design challenge will be modified for this PD to factor in the one hour time constraint.

Using the 5E model of instruction and a visual timeline posted in the front of the room, I will walk staff members through the process of solving this problem. Using NASA's Beginning Engineering, Science and Technology (BEST) resources, teachers will explore the Engineering Design Process (EDP) and activities that they can implement for their classrooms. While there is much to explore online, we will be focusing our time and energy on using the EDP to develop a solution to the questions in the engage step of the 5E model.

Below is a rough outline of how I see this PD unfolding:

Engage	Show a 2-3 minute video of the Bluewater Wind offshore wind farm project proposed to be built off the coast of Rehoboth Beach in the next year. <ol style="list-style-type: none">1. If you were a Rehoboth beach resident or a weekend beachgoer, how would the presence of a wind farm off the coast impact your experience at the beach?2. How receptive do you think most Delawareans will be to offshore wind energy?3. If you could design a windmill capable of powering as many homes as possible, what variables would you consider in your design? Have teachers participate in a quick 2-3 minute interview where they gather information regarding each other's responses to the questions above.
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Explore	Direct the participant’s attention to the 5E model of instruction posted on the visual timeline in the front of the classroom (Each step will be posted on cardstock along with a description and hung on a clothesline which will stretch across the front of the room) . Ask if anyone has used this method before and see what they remember as the key pieces to each step. As participants identify the components of each step, explain that this PD will model this method of instruction. To help keep everyone on track with the process as well as time allotted for our challenge, we will place an arrow over each step as we move through the model throughout the 1 hour PD.
Explain	Review the NASA Engineering Design Process using resources available on the BEST website. Remind participants that although we will mainly focus on the EDP to address our particular questions, they can explore the website in more detail later on as there are many activities that can be implemented that are engaging and teacher ready.
Extend	Have participants work in small groups to combine ideas from their initial interview to begin the work of designing windmill blades. Provide dry erase boards and window markers so they can begin designing their blades. Once designs have been agreed upon, provide participants with materials necessary to build a mockup of their designs (cardboard, plastic hubs, wooden dowels, exacto knives, meter sticks, pencil, hot glue guns, markers). Provide participants with a few examples of different cardboard cutting/bending/folding techniques that they might employ to build their blades. As blades begin taking form, remind participants to stick to the EDP to ensure that their blades meet all the criteria outlined in the challenge. In addition, they should be sure to test and modify blades as necessary using testing towers and fans set up around the room.
Evaluate	Place each set of completed blades on a hub and tower for the entire staff to evaluate using the criteria developed in the group brainstorm. In addition to voltage, evaluations will be based on creativity as well as craftsmanship. Provide surveys to all faculty members to use as they rate each design. Participants should also take a moment to reflect on how well they worked through the EDP in addition to the things they would change if they were to do this again for another design challenge.

The audience for my PD would be about 12-15 members from the entire faculty at Wilmington Friends School. The grades/subjects taught would vary depending on the number of participants that sign up as well as their division. Participants might teach preschool-12 grade English, Science, Math, SS, Art, Language, ITL. Each teacher teaches roughly between 15-60 students overall. My guess, however is that most participants will come in with a science based focus. My goal would be for teachers to be exposed to the 5E model of instruction, available NASA resources including but not limited to the engineering design process and some takeaway activity that they could implement in their own classrooms regarding energy resources and sustainability. My expectation would be for teachers to not only use these resources in their classrooms but to also share their experiences using them with the respective division

colleagues in future faculty meetings. This PD will be presented during the in-service day upon our return from spring break and will last 1 hour. I will distribute a brief online survey for faculty to evaluate the effectiveness of this PD immediately following the session.