Table 3
Summary of Year 1 Core Activities

Day	Short Description of Core Activities	Standards Addressed
1	**Crash Course** (Vernier) - This activity made use of Vernier LabQuests with the motion detector probe. This lab was a modification of the labs found in the Vernier labs. Our activity, however, provided a contextualized problem to solve to get students to understand motion. The problem was to determine was at fault for a sledding accident. We provided teachers with two graphs that used different scales to determine who was at fault for a sledding accident. Teachers had to understand how to interpret the (distance v. time) graphs in order to justify their decisions. **Basics of Force and Motion -** As an introduction to force and motion, this activity utilized rolling chairs to allow students to understand the factors that relate to force. By pushing chairs at different strengths and with different loads, students are able to come up with relationships between force, velocity, mass, and acceleration in a qualitative manner.	MS-ETS1-4, MS-PS2-2, MS-PS3-1, MS-PS3-5, HS-PS2-1
2	**Engineering concept maps** - To get teachers thinking about engineering and for us to assess their current understanding, teachers drew concept maps of what they thought engineering was. This was done first individually and then shared across the group, where participants noticed similarities and differences in their maps. This led to discussion about engineering design processes and their varied nature. **Tabletop Hovercraft** - After a quick review of balanced and unbalanced forces, we tasked teachers to work in pairs to design, build, and test, tabletop hovercrafts using plastic bottle caps, DVDs, hot glue, straws, and a balloon. We provided other items as well, since past experience showed us that in order for the hovercrafts to balance, sometimes teachers used index cards. We encouraged “corporate espionage” here where teams could walk around and “spy” on what others were doing. A formal share-out of designs through an Engineer’s Roundtable was also part of the process before final designs were created and tested. During the final testing, each pair was asked to assess their design and justify whether or not it met the challenge. **Pasta Cars** - We adapted this activity from Angle (2011) to make cars out of various types of uncooked pasta. For this activity, we introduced effective teamwork through cooperative	MS-ETS1-2, MS-ETS1-3, MS-ETS1-4, MS-PS2-1, MS-PS3-5, HS-PS2-1

	learning and once more encouraged corporate espionage. In this activity, we asked the teachers to come up with a design challenge using the NGSS standards as a guide to determine both the scientific content as well as the engineering design practices. We encouraged through brainstorming and sketching of designs, challenging teachers to consider whether or not another team could build their design based on their labeled sketches.	
3	**Pasta Cars Revisited** - In the morning, we finished the pasta cars from Day 2 before talking about assessment and providing example rubrics of assessing student learning in performance assessment. We revisited the Pasta Car Challenge, but instead of providing teachers with a specific challenge, we tasked them with first coming up with a challenge that they might ask their students to do. This meant that they needed to come up with standards and a way to assess; they then had to give this assignment to another group, which provided an opportunity for feedback from their peers (which was expected since this was written fairly quickly).	MS-ETS1-2,4, MS-PS2-1, MS-PS3-1, MS-PS3-2, MS-PS3-5, HS-PS3-3, HS-PS3-1, 2, 3
4	**Save the Penguins** - The activity that we shared with our teachers was an abbreviated version of (Schnittka, 2009) in which the engineering design challenge is to create a well-insulated habitat for penguins. In going through some of the pre-cursor activities to understand insulators and heat transfer, we introduced the concept of storyboarding as a novel way to assess student thinking. This includes multiple modes of representation including pictures, symbols, words, and data. **Wind Turbines** - Using the Vernier KidWind WindTurbine kits, we engaged teachers in designing a blade and blade arrangement that would generate the most power. We provided a variety of materials and teachers could have anywhere from 2-12 turbine blades. This activity started with first testing controlled variables to create class menu of options, but then groups made decisions based on this data set to create their own design. The emphasis on this was placed on determining a best solution through data analysis. Because of time constraints, this activity was completed in the morning on Day 5.	MS-ETS1-1,2,3,4, MS-PS3-3,4, HS-ETS1-1,2,3, HS-PS3-3,4
5	**Runaway Train** - This culminating activity was one that the first two authors had previously designed (Ellis, Dare, Voigt, & Roehrig, 2015) and centered on rethinking the class egg drop that is so often used in physics classes. For this culminating activity, teachers were asked to first select standards, identify the	MS-ETS1-1,2,3,4, MS-PS2-1, MS-PS3-5, HS-ETS1-2,3, HS-PS2-2,3

	core content being used by unwrapping the standards, and draft up an activity with their team. Teachers then used their own guidelines to design, build, and test their creations.	