ME AND MY SHADOW

Performance Standard 12F/11A/11B/13 A.A

Students will apply the process of scientific inquiries or technological design to explore the explanations of the daily patterns of the Earth's rotation.

- *Knowledge*: Recognize the relationship of shadow-making and the daily path of the sun in our sky over time.
- *Application:* Record different shadows lengths showing the apparent movement of the sun through a day.
- *Communication:* Predict shadow lengths and directions.

Procedures

1. ***In order to understand the concepts that explain the composition and structure of the universe and Earth's place in it (12F) and concepts, principles and processes of scientific inquiry (11A) or technological design 11B and know and apply the accepted practices of science (13A),*** students should experience sufficient learning opportunities to develop the following:
   - Recognize patterns about the daily path of the sun in our sky.
   - Comparing shadows during a day.
   - Propose ideas to measure the shadows 2-3 times a day.
   - Select a constant measuring process and record data accurately.
   - Communicate their results and predictions.
   - Apply appropriate principles of safety.

   Note to teacher: This activity relates to knowledge associated with standard 12F, while addressing the performance descriptors for stage A within standard 11A or 11B. Applying scientific habits of mind noted in standard 13A are foundational to these activities. Using various technologies to estimate, measure and record data address some performance descriptors in 13B.
2. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
3. Begin guided inquiry by having students ask questions about shadows -- how they happen, how they change and How can they be measured? Guide students toward answering their questions using applicable scientific vocabulary terms and resources. Initially, as a group, the teacher and students could observe that the sun makes shadows differently throughout the day. Some times the shadows are longer and shorter; sometimes they are on one side and then the other of the shadow-maker. (Depending on facilities and conditions, pairs of students could take turns on the playground to be the shadow-maker and the shadow-recorder, by using chalk, etc. on sidewalks/playground surfaces.) Classroom experiments can be composed of a shadow-maker (vase, upright ruler, etc.) placed on large enough sheets of paper to accommodate tracing the full shadow of the object at different times during the day. Establish 2-4 measuring times during the day (early and/or mid-morning, noon and early and/or mid-afternoon), depending upon scheduling possibilities. Record and compare these shadow pictures over several days.
4. Continue the guided inquiry by asking students to suggest ways to measure shadows. Depending on student experience with measurement during the school year, they could or should be asked to suggest ideas for the measuring process (technological design). Standard and non-standard measurements and units are appropriate. Students should test their proposed process to measure, recording their shadow lengths and directions at the various times of the day for the testing, and communicate their results. The students should report how well their measuring process worked. Allow students to modify their measuring process, if time is available. Students could be asked to predict the location and length for upcoming shadow time(s), infer which time of the day the shadow is the longest or shortest or what causes the shadow to move, deduce the pattern of the movement of shadows or the changes during the day.
5. Evaluate each student's work with the Science Rubric as follows and add the scores to determine the performance level:
   - *Knowledge*: The pattern of the sun's path was recognized and correct.
   - *Application*: Shadows were compared and measured at like times and were complete and correct.
   - *Communication*: The explanations and predictions were thorough, well-reasoned and well-detailed.

Examples of Student Work not available

Time Requirements

- 15 - 20 minutes for initial shadow measurement discussion and practice
- 5 – 10 minutes for measurements at each time of the day
- 5 -10 minutes for measurement comparisons and predictions

Resources

- Shadow-maker (students, themselves, classroom or playground objects, etc.)
- Measuring devices: Rulers, string, non-standard measurement resources.
- Large enough sheets of paper for recording multiple shadow tracings.
- (If playground spaces are used, chalk or other materials may be needed as markers for shadow-makers footprints and shadow-tracing.)
- NASA Space-Link (http://spacelink.nasa.gov) offers many activities and extensions to this shadow-making activity, for example:
    - http://science.msfc.nasa.gov/newhome/headlines/ast23Feb98_1.htm
    - http://windows.arc.nasa.gov/tour/li...er_resources/shadows_sheet_edu.html
- Science Rubric