Teaching strategies that encourage success for all

Use Student Groups. Engineers work in teams. Use pairs or groups to model this engineering practice, and to create an environment that supports student success. Doing so:

- Ensures that there will be more than one idea to record in the Imagine step (even if a single child has difficulty imagining multiple ideas);
- Creates a peer support system for reading, writing and drawing tasks; and
- Provides assistance with construction tasks in the Create and Improve steps, which can be especially helpful for children with fine motor challenges.

Help Students Document their Ideas. Engineers record notes and drawings in notebooks. Similarly, students should write and draw throughout the design process. To help students with documentation tasks:

- Implement effective differentiation strategies used during literacy instruction.
- Write essential information (e.g., in the Ask step) for all students to see and record.
- Provide reading and writing assistance to individual groups when documentation tasks are more group specific.
- Ask students to explain their drawings, encouraging them to draw clearly to communicate their ideas.

Provide Scaffolding for Spatial Tasks. Engineers need to think and act in three dimensions (3D). For some students, thinking and acting spatially is easier than for others. To help students navigate the spatial challenges of engineering:

- Present the engineering problem in 3D (e.g., show the actual testing apparatus and model its operation). Do this as early as the Ask step.
- Make suggestions in 3D during the Create and Improve steps:
  - Use your hands or body to demonstrate motions or positions.
  - Use materials to demonstrate a suggested design feature.
  - Pick up and even alter students' designs, modifying students' designs as little as possible.
  - Refer to objects or pictures of objects (e.g., wind turbines) to illustrate key design features.
- Encourage students to show one another or you "what they mean" using similar 3D approaches.

Emphasize Good Reasoning. Good engineering designs are based on sound reasoning. To encourage well-reasoned designs:

- Elicit from students the relevant concepts to be considered in the design process.
- Record and post relevant concepts in the classroom for students to reference.
- Ask students during the Plan and Create steps to explain their design ideas.
- Ask students during the Improve step to share their testing results and how they plan to improve their designs. Questions to pose to students might include:

    - What about your blade design worked well? How do you know?
    - What do you think you need to improve?
    - How did the material you chose help or hurt how well the windmill functioned?
    - Did your blades seem to catch the wind? Why or why not?
    - Did catching the wind help to turn the axle? If not, how can you modify your design to both catch the wind and turn the axle?
- Encourage those with less well-reasoned responses to reconsider their designs. Use leading questions like those above, refer to relevant concepts, and make more or less direct suggestions.