**Enduring Understanding**

Identifying key attributes of a given problem can lead to the engineering and designing of an effective model that represents that problem.

**Lesson Description (Use for family communication and displaying student art)**

In this science, technology, and engineering lesson, students explore the theater concepts of collaboration, character, and action by copying a partner and creating statues. They use the science skills of engineering and design by building statues, with their partner's body, that represent a specific action. In small groups, they choose a science concept to make a tableau to show the concept. They describe and justify their scientific choices by making sketches of their designs and communicating their choices to their peers.

**Learning Targets and Assessment Criteria**

**Target:** Collaborates with a partner.
- **Criteria:** Communicates ideas to others; makes compromises; and incorporates input/feedback.

**Target:** Uses design to engineer a solution to a problem.
- **Criteria:** Creates a statue of an action by manipulating the gestures, stance, and posture of another student to represent attributes of that action.

**Target:** Analyzes design choices.
- **Criteria:** Develops a simple sketch to illustrate the function of his/her model (statue).

**Target:** Justifies design choices to peers.
- **Criteria:** Constructs and shares evidence-based explanations for design choices.

**Vocabulary**

**Arts Infused:** Attribute, Model, Science/Engineering Vocabulary: Design Solution, Engineering Problem

**Arts:** Action, Mirror, Mold, Neutral, Statue, Tableau

**Materials**

**Museum Artworks or Performance**

- Seattle, WA
  - Book-It Repertory Theatre
  - Living Voices
  - Seattle Children’s Theatre

- Tacoma, WA
  - Broadway Center for the Performing Arts

**Materials**

- Newspaper; Student worksheets and pencils; Classroom Assessment Worksheet; Arts Impact sketchbooks

**Learning Standards**

WA Arts Learning Standards in Theatre

For the full description of each standard, see: [http://www.k12.wa.us/Arts/Standards](http://www.k12.wa.us/Arts/Standards)

**Creating (Concepts: Character, Movement/Stance, Gesture)**

1. Generate and conceptualize artistic ideas and work.
2. Organize and develop artistic ideas & work.
3. Refine and complete artistic work.

**Performing/Presenting/Producing**

4. Select, analyze, and interpret artistic work for presentation.
5. Develop and refine artistic techniques and work for presentation.
6. Convey meaning through the presentation of artistic work.

continued
Responding
7. Perceive and analyze artistic work.
8. Interpret intent and meaning in artistic work.
9. Apply criteria to evaluate artistic work.

Connecting
11. Relate artistic ideas and works with societal, cultural, and historical context to deepen understanding.

Early Learning Guidelines, if applicable
For a full description of Washington State Early Learning and Child Development Guidelines see:

(Age 4-5) 3. Touching, seeing, hearing, and moving around: Using the large muscles (gross motor skills).
(Age 4-5) 6. Learning about my world:
Science: Ask questions and identify ways to find answers; try out these activities and think about what to do next to learn more.
Arts: Understand that different art forms (such as drama) can be used to tell a story; show creativity and imagination; perform simple elements of drama; participate in dramatic play activities.

Next Generation Science Standards
http://www.nextgenscience.org/next-generation-science-standards

Topic:
Engineering Design

Disciplinary Core Ideas:
ETS1.A: Defining and Delimiting Engineering Problems
ETS1.B: Developing Possible Solutions
ETS1.C: Optimizing the Design Solution

Variable Core Ideas are also explored depending on the Science Concept or Process that is specifically used.

continued
**Arts Impact Arts Infusion** — Theater: Designing and Building Statues

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**Relevant Foss Science Kits:**
PreK: Building Structures  
K: Animals  
1: Organisms, Weather  
2: Liquids  
3: Rocks and Minerals, Plant Growth and Development  
4: Circuits and Pathways  
5: Models and Designs

**Performance Expectations:**  
K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.  
K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.  
3-5-ETS1-1. Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost.  
3-5-ETS1.2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

**Crosscutting Concepts:**  
Structure and Function  
Influence of Science, Engineering, and Technology on Society and the Natural World

**Science and Engineering Practices:**  
1. Asking Questions and Defining Problems  
2. Developing and Using Models  
6. Constructing Explanations and Defining Solutions
Pre-Teach
The Arts Foundations lessons of “Expressive Body” and “Tableau” should be taught before this infusion lesson. Review the selected scientific concepts, if needed, before starting this lesson.

Lesson Steps Outline

PART ONE
1. Lead warm-up: Statues. Review the concepts of neutral and active freeze (statue).

☑ Criteria-based process assessment: Walks in neutral and freezes in a statue.

2. Demonstrate the concept of collaboration using the “Paper Mirror” exercise. After demonstrating, lead students in the “Paper Mirror” exercise.

☑ Criteria-based teacher checklist: Communicates ideas to others; makes compromises; and incorporates input/feedback.

3. Demonstrate how to build a model by “designing a statue” using a student volunteer.

4. Lead students as they collaborate in pairs “designing statues.” Assign the action of “throwing a ball” for all the pairs to work on. Guide the “molders” as they create a sketch to record the function of the statue they created.

☑ Criteria-based teacher checklist: Creates a statue of an action by manipulating the gestures, stance, and posture of another student to represent attributes of that action. Develops a simple sketch to illustrate the function of his/her model (statue).
5. Switch students so that the “molders” in step 4 become the statues for their partners. Repeat STEP 4.

☑ Criteria-based teacher checklist: Communicates ideas to others; makes compromises; and incorporates input/feedback. Creates a statue of an action by manipulating the gestures, stance, and posture of another student to represent attributes of that action. Develops a simple sketch to illustrate the function of his/her model (statue).

6. Lead small group reflections in which students compare and contrast the different design choices they made. Ask each student to construct explanations/justify the design choices he or she made.

☑ Criteria-based teacher checklist, self and peer reflection: Constructs and shares evidence-based explanations for design choices.
PART TWO

1. Maintain the groups of four established in STEP 6 (Part One). Instruct each group to design a tableau that represents a science concept or process.

☐ Criteria-based teacher checklist, self and peer reflection: Communicates ideas to others; makes compromises; and incorporates input/feedback.

2. Guide students as they present their tableaux. Lead a short reflection after each presentation in which each group shares its evidence-based explanation for the design choices it made.

☐ Criteria-based self and peer reflection: Constructs and shares evidence-based explanations for design choices.

3. Ask students to fill out Collaboration Self-Assessment Worksheet (at end of lesson).

☐ Criteria-based self reflection: Communicates ideas to others; makes compromises; and incorporates input/feedback.
LESSON STEPS

PART ONE

1. Lead warm-up: Statues. Review the concepts of **neutral** and active freeze (statue).
   - *In theater, we call movement without character added to it “neutral.” When you are acting as yourself, you are neutral. Walk around the room as yourself.*
   - *As you walk around the room in neutral. I will shout out “Freeze!” Freeze wherever you are. I will then call out a character or a feeling. Turn your body into a statue of what I call out.*

   [Criteria-based process assessment: Walks in neutral and freezes in a statue.]

2. Demonstrate the concept of collaboration using the “Paper Mirror” exercise.
   - Select a volunteer and have a page from a newspaper ready (blank newsprint paper is also excellent).
   - *We are going to start off with a theater game, but before we do, I would like to show you how it works. I need a volunteer. (Volunteer is chosen.)*
   - *Now, the volunteer will be partner “A” and I will be partner “B.” Partner A, pick up that piece of newspaper and hold it by the top corners in front of you, but don’t cover your face.*
   - *I will stand about two or three feet in front of Partner A and face him/her.*
   - *Now, Partner A, slowly begin to move the paper, and I will “copy” the paper’s movement with my body.*
   - *How can you make the paper move? You can fold it, swing it, drop it, crumple it up, etc.*
   - *In order to make this activity work, you must “collaborate” with your partner. Partner “A” will communicate his/her ideas to Partner “B.” Partner “B” will incorporate the directions of Partner “A” into his/her own movements.*
   - *In the theater, actors must collaborate every time they perform with another actor.*
   - *Scientists and engineers also collaborate on designing and testing their ideas.*

   **After demonstrating, lead students in the “Paper Mirror” exercise.**
   - Put students into pairs, with one student designated as “A” and the other as “B” (use other designators, if preferred, such as “Green” and “Yellow” or “1” and “2” etc.). Student “A” is given the paper.
   - *I would like all of the “A’s” to come up, take one piece of newspaper and return to your partner. Don’t do anything with the paper yet.*
   - *Now, face your partner with about two or three feet between you. “A’s” hold the newspaper up in front of you, but don’t block your face.*
• “A’s” begin to move the paper. “B’s” copy the paper’s movement with your body.

• A’s, don’t move the paper too fast, it should be slow enough for your partner to follow.

• B’s, move your body in a way that matches what you see the paper doing.

Students will switch being the leader and follower. When switching, use a fresh piece of newspaper, if needed.

Criteria-based teacher checklist: Communicates ideas to others; makes compromises; and incorporates input/feedback.

3. Demonstrate how to build a model by “designing a statue” using a student volunteer. Choose a simple action and show how a person’s body can be manipulated and articulated to demonstrate the attributes of that action.

• Today, we are going to be dramatic scientists and build a model that represents a simple action. We are going to use a partner to make our model.

• With my volunteer and your help, I am going show how we can design a statue of a simple action. The action we are going to show is “climbing a ladder.”

• I am going to mold the volunteer’s body by moving his/her arms, legs, fingers, back, etc. around to show the action.

• Let’s start. Raise your hand and tell me one thing that the volunteer’s body should be doing to show “climbing a ladder.” (Solicit several ideas.)

• Okay, first I am going to shape the volunteer’s hands to look like they are holding onto a rung of the ladder.

• Now, I’ll bend his knees, etc.

Continue to use the students’ ideas to mold the volunteer’s body until it successfully demonstrates the attributes of “digging a hole.”

Alternatives to “molding” another student’s body by touching them:
• The “molding” of the student’s body can be verbally directed by the “molder.” Instead of physically moving the volunteer’s arm, for example, you could direct him by saying, “Move your right arm by bending your elbow and lifting your shoulder.”

• The “molding” can be accomplished by the “molder” holding his/her hands about five inches from his/her partner. The student being “molded” would follow the movements of the “molder’s” hands with the appropriate physical adjustments.
4. Lead students as they collaborate in pairs “designing statues.”

Give each student a Design Worksheet for recording her/his design. The worksheet is at the end of the lesson.

- Now, I want you to each pick up a worksheet, grab a pencil, and rejoin your partner. You will take turns being the “molder” and being the statue. Decide who is going first. You will each get a turn being the designer and the model.

- “Molders,” remember that you should gently move your partner’s body. Also, tell them what you want them to do.

- “Statues,” remember that you must cooperate with your partner and hold the positions they put you in.

- You are collaborating — a 21st Century Skill!

Assign the action of “throwing a ball” for all the pairs to work on.

- The action you will use is the action of “throwing a ball”. What type of ball you are throwing is up to the “molder” of the statue. It could be a baseball, football, basketball, bowling ball, etc. The choice is yours.

- Be very specific that the positions that you are putting your statue in fit the type of ball your statue is throwing.

- You are now using “critical thinking” by making specific choices to reflect the function of “throwing a ball”.

- The amount of time spent “molding” should be closely monitored to avoid the student being “molded” from becoming restless and fidgety.

Guide the “molders” as they record the attributes of the statue they created.

- Once you have finished designing your statue, draw a quick sketch on your worksheet. It doesn’t have to be perfect, but it should contain two or three specific details of what your statue is doing.

- Your sketch shows the function of your statue – what it is designed to do.

- Be sure to choose the best angle to make your sketch from. The drawing should show as much detail as possible so that the function of your statue is clear. For example, it may be best to draw the statue from the side to show how your statue throws the ball.

- After you make the sketch, write a few notes describing the details, such as, “My statue’s left arm is bent at the elbow”.

- You should be able to recreate your statue from the sketch and the notes you write down.

Criteria-based teacher checklist: Creates a statue of an action by manipulating the gestures, stance, and posture of another student to represent attributes of that action. Develops a simple sketch to illustrate the function of his/her model (statue).
5. Switch students so that the “molders” in step 4 become the statues for their partners. Repeat STEP 4.

- Now, switch jobs. The “molder” will be the statue and the statue will be the “molder.”

- You are going to create a statue of the same action of “throwing a ball” but with a different ball. If you used a baseball last time, maybe this time you can use a football. Your choice.

- Draw a quick sketch on your worksheet and record a few important details about the function of your statue.

☐ Criteria-based teacher checklist: Creates a statue of an action by manipulating the gestures, stance, and posture of another student to represent attributes of that action. Develops a simple sketch to illustrate the function of his/her model (statue).

6. Lead small group reflections in which students compare and contrast the different design choices they made. Ask each student to construct explanations/justify the design choices he or she made.

- Have the duos pair up with another duo. Guide the students as they share out (in groups of four) their design choices and problem solving techniques.

  - Because there is always more than one possible solution to a problem, it is very useful to compare designs and learn from others.

  - Scientists and engineers usually work in teams so that they can collaboratively compare their ideas and designs to improve on them.

  - I want you to join up with another pair of students and take turns describing the design choices you made for your statue. Have your partner show the statue to your classmates and then, using your worksheet, describe and justify the design choices you made.

  - As you are justifying your choices, think of answering questions such as: Why did you position your partner’s hands the way you did? How does the position of your partner’s legs relate to the statue’s action or function?

  - What are the similarities in your designs? How are they different?

  - You are constructing explanations for your engineering and artistic choices! Engineers have to explain the reasons for the choices they make.

☐ Criteria-based teacher checklist, self and peer reflection: Constructs and shares evidence-based explanations for design choices.
A POSSIBLE EXTENSION: After the students share their sketches and designs, they could use feedback from their peers to go back and re-design their statue to make it more specific/effective.

GRADE LEVEL ADAPTATIONS: For K – 2 classes, the creating of statues could be done as an entire class activity with the Teacher leading (as in the demonstrating steps above). A student volunteer could be used and the Teacher can solicit ideas from the class on how to mold the student. The student could hold the pose while the class makes a drawing of him/her. If students do mold one another, the activity should be kept fairly brief.
PART TWO

1. Maintain the groups of four established in STEP 6 (Part One). Instruct each group to design a tableau that represents a science concept or process.
   - The Science Concepts used can vary, depending on what the class is currently working on. It could be a process (technical or biological), an organism, an engineering problem, etc.
   - You are now going to work as a group of scientists and design a tableau using science for your inspiration. Remember, a tableau is a frozen picture made up of more than one actor. All the members of the group must be in the tableau.
   - How can your group best communicate the concept of (for example) an electrical circuit?
   - What are the different elements of the concept that need to be present in the final picture?
   - You must use both collaboration and communication to design and “mold” yourselves into a tableau that represents (for example) an electrical current. Scientists often work in groups this way to generate ideas and solve problems.
   - Decide together how you will explain the design choices you make to express the scientific concept you are showing in your tableau. You will both show your tableau and justify the choices you made to the class.

☐ Criteria-based teacher checklist, self and peer reflection: Communicates ideas to others; makes compromises; and incorporates input/feedback. Constructs and shares evidence-based explanations for design choices.

2. Guide students as they present their tableaux. Lead a short reflection after each presentation in which groups construct explanations/justify the design choices they made.
   - Audience, what elements of the science concept did you see represented in the tableau?
   - Actors, give me an example of how you used collaboration in designing your tableau.
   - Actors, tell us why you made the design choices you did to express your science concept.

☐ Criteria-based self and peer reflection: Communicates ideas to others; makes compromises; and incorporates input/feedback. Constructs and shares evidence-based explanations for design choices.

3. Ask students to fill out Collaboration Self-Assessment Worksheet (at end of lesson).
   - We’ve learned how scientists, engineers and actors collaborate to make the best choices they can in designing models and sharing them with others.
   - On your Collaboration Self-Assessment Worksheet, please describe one idea that you shared with your group; one thing that you compromised on; and how you incorporated other people’s ideas.

☐ Criteria-based self reflection: Communicates ideas to others; makes compromises; and incorporates input/feedback.
Designing and Building Statues Student Worksheet

Name: ___________________________________________ Date: ______________________

STATUE of ______________________________

DETAIL #1. ______________________________________________________

DETAIL #2. ______________________________________________________

DETAIL #3. ______________________________________________________

SKETCH
Arts Impact Arts Infusion
Designing and Building Statues

Teachers may choose to use or adapt the following self-assessment tool.

**STUDENT SELF-ASSESSMENT WORKSHEET**

<table>
<thead>
<tr>
<th>Disciplines</th>
<th>THEATER &amp; SCIENCE</th>
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**COLLABORATION SELF-ASSESSMENT WORKSHEET**

Put a check next to each of the ways you collaborated with your group to create your tableau:

- ______ I communicated my ideas to the other members of my group.
  
  An example of an idea I contributed to our tableau is:
  ____________________________________________________________
  ____________________________________________________________
  ____________________________________________________________

- ______ I compromised with the other members of my group.
  
  I changed an idea I had to go along with the group by
  ____________________________________________________________
  ____________________________________________________________
  ____________________________________________________________

- ______ I incorporated feedback or input from other members of my group.
  
  I used someone else’s idea or suggestion to adjust something I did by
  ____________________________________________________________
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### CLASS ASSESSMENT WORKSHEET

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What was effective in the lesson? Why?

What do I want to consider for the next time I teach this lesson?

What were the strongest connections between theater and science and engineering?

Teacher: ___________________________   Date: ________________
Dear Family:

Today your child participated in an **Arts and Science, Technology, Engineering** lesson. We talked about how we can design and create statues to represent actions and tableaux to show scientific concepts and ideas.

- We discovered collaboration with a partner by both leading and following each other in a copying exercise.
- We created/engineered models out of our partners by molding and shaping their bodies into statues that represented specific actions.
- We sketched and described the attributes of our statue designs.
- We chose a science concept and showed the concept by making a tableau with a small group.
- We communicated and justified our design choice with our peers.

At home, you could practice molding each other’s bodies to make statues of ideas, characters, words, etc.

**Enduring Understanding**

Identifying key attributes of a given problem can lead to the engineering and designing of an effective model that represents that problem.