

Mathematics: The Language of STEM

Design an Art Box Case

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CONTENT AND TASK DECISIONS

Grade Level(s): first – can be adapted for any grade level

Description of the Task: Students will create a fabric case that will carry their school box to art class and keep the box from dropping or spilling its contents. They will work with a partner or in a small group to decide the size and design of the case by using a paper pattern.

Indiana Mathematics Content Standards: 1.M.1: Use direct comparison or a nonstandard unit to compare and order objects according to length, area, capacity, weight, and temperature.

Indiana Mathematics Process Standards: PS.1: Make sense of problems and persevere in solving them. Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway, rather than simply jumping into a solution attempt. They consider analogous problems and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" and "Is my answer reasonable?" They understand the approaches of others to solving complex problems and identify correspondences between different approaches. Mathematically proficient students understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

Mathematics Content Goals: Students will determine the size, in inches (or centimeters), the size of fabric pieces needed to create a case that will carry a school pencil box.

Language Objectives: This lesson aligns with the Indiana WIDA (World-class Instructional Design and Assessment) standards by using real-life objects (realia), manipulatives, and the creation of illustrations, and tools that will help English Learners to understand the directions and complete the assignment.

Science- Engineering Content Standards: K-2.E.1 Pose questions, make observations, and obtain information about a situation people want to change. Use this data to define a simple problem that can be solved through the construction of a new or improved object or tool.

K-2.E.2 Develop a simple sketch, drawing, or physical model to illustrate and investigate how the shape of an object helps it function as needed to solve an identified problem.

K-2.E.3 Analyze data from the investigation of two objects constructed to solve the same problem to compare the strengths and weaknesses of how each performs.

Materials:

- A school box for each group (a traditional 5x8 pencil box will do)
- Large pieces of paper (old roll paper or scrap paper will do fine for this project)
- Glue, staplers, tape, markers, pencils, scissors
- A ruler with inches marked on it (alternative – use the project for centimeters instead)
- Pieces of fabric – at minimum two pieces of 12" X 8" for each group
- Access to a sewing machine (This can be done at the school where the kids can see it happen, or it can be done away from school. Check with parents or friends who like to sew to see if they will help you on this – unless you are interested in doing the sewing.)
- Thread – at minimum enough to sew a single stitch around the case
- A sewn project – maybe a small shirt – cut out and pinned to a pattern, and the same shirt that is finished
- If desired, buttons, or ribbons, nylon or fabric handles

THE LESSON

Before: Discuss with the children problems that they have at school with their school box falling on the way to art class or elsewhere in the building. Guide them to see that a case or carry case would help them carry the box without dropping things:

- **Activate prior knowledge** – *Raise your hand if you have ever dropped your box as you go down the hall to art? What happened to your crayons and pencils? Can you think of a solution to this problem? What could you use to make a carrier for your box? What do you need to know to create it? Have you ever seen a pattern that is used to make things out of fabric?*
- **Be sure the problem is understood** - Today you are going to create a carrier for an art box so that it will not fall and spill your things on the floor. You need to create a pattern and directions for a case. You will be turning in:
 - A paper pattern that shows what the case looks like
 - The record sheet with measurements and drawing of the case (the sewing pattern)
- **Establish clear expectations** - Students will record their thinking on the form and will turn in the paper pattern they create. The class seamstress/tailor will sew it together. If the sewing is done at a separate location, the finished project will not be available the same day.

During: Begin by giving the students a little information on a sewing pattern and the process of sewing something together. Then describe that they are going to create a bag/case/case that will hold a school box securely so that it does not drop or allow the crayons to scatter across the floor. They will record their measurements on the record sheet and draw a picture. Also, they will turn in their paper pattern to show what it will look like. :

- **Let go** - Students begin working.
- **Listen actively** – Move around and notice the dialogue students have over the project. Ensure that each child is involved and participating.
- **Provide appropriate support** – *Tell me about your thinking for the project. What makes this design work well? What problems are you encountering that will need more thought?*
- **Provide worthwhile extensions** – *What might make this easier to carry? (handle) What will happen if this does drop on the floor? Will the sack still protect my crayons? (strap or flap over opening) After they are completed, run a test of your finished projects to see if they keep the art box and its contents safe.*

Extensions: If you have the resources to do so, have your volunteer make enough for the whole class, or the whole grade level. To make it even more exciting, have some made for the school store and help students create an advertisement to that can be read over the PA system so they can encourage other students to buy them.

After: After most students have a pattern started, bring the class together and look at a few examples. Have students describe their thinking:

- **Promote a mathematical community of learners** Ask: *What measurement did you use on your sack? Why did that measurement make the best bag?*
- **Listen actively without evaluation** If you see a problem in a design, ask leading questions to help students to realize the problem. *Will my box fit in this sack? What will happen if I do drop this as I am walking?*
- **Make connections** - *What kind of bag do you use that might help you think about a good design for the case? What is alike about the examples that make them good sacks for an art box?*
- **Summarize main ideas** - *Will the seamstress/tailor be able to use your pattern to make a case? Do you still like your measurements?*

NOTE: One very likely problem the students will encounter is that they will not make allowance for the seam. They will make the case exactly the size of the box. You may need to refer them to their own backpack or even the finished project you showed them at the start.

Conclusion: Give students a few minutes to finish and tweak their assignments after the class discussion.

ASSESSMENT

Observe:

Students are successful in this activity if they:

- Provide a measurement that will create a case and a drawing that resembles their case.
- Provide a paper pattern that matches their dimensions on the record sheet.

Activity:

Run a test to see if each box will do the things below and compare the designs.

- Can successfully carry a school box in their finished project.
- Have a case that will not lose the contents of the box if dropped.

Art Box Case

Names of designers:

Measurements for the case:

_____ long

_____ wide



Our Design