

8.4 STUDIO INVESTIGATIONS

Investigating Paper Engineering

Prepare

PACING

One 45-minute class

STUDIO OBJECTIVE

Students will explore and practice paper engineering methods.

MATERIALS/SUPPLIES

- Process journals or drawing paper
- Pencils or pens
- Various types of paper
- Glue or tape
- Scissors or utility knives (with teacher supervision)
- Pop-up books and other examples

Teach through Inquiry

ENGAGE Review what students have learned. Show physical examples or videos of pop-up books. Prompt students to consider how the pop-up components are created. Ask, *Do you notice similarities in the techniques?* Explain that artist Colette Fu often combines several of these simple paper engineering methods to create intricate and beautiful works of art.

LOOK AHEAD TO THE STUDIO EXPERIENCE

In this activity, students will investigate techniques for paper engineering. In the Studio Experience that follows, they will combine paper engineering methods and photography to create a pop-up structure that shares their ideas about beauty.

READ THE TEXT Instruct students to read the text up to As You Practice. Define the term *spread* as a set of two pages in a book, left and right. In order for pop-up structures to work correctly, they must adhere to both pages in a spread. Review some of the examples you showed at the beginning of the lesson. Have students read the remaining text on pages 354–355 and invite them on an exploration of various paper engineering techniques.

EXPLORE THE IMAGES Refer to **Fig. 8-47** and discuss the questions posed in the caption. Ask, *Can you identify any paper engineering techniques Fu used in this book? How do you think she went about creating the pop-up sections?* The book is laid out in an accordion style, which allows the viewer to see all of the pages at once. Ask, *Why do you think Fu chose this style of book?*

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Investigating Paper Engineering

Studio Objective

Explore and practice paper engineering methods.

You have learned:

- Colette Fu sees beauty in cultural customs and traditions.
- Artists use paper engineering methods to create sculptural forms.

Now, to grow as an artist, practice paper engineering methods.

Investigate and Document

Collette Fu creates intricate pop-up books using paper engineering techniques. Her pop-ups appear very complicated, but they are created by combining several simple processes.

Explore. Look closely at the construction of pop-up books. Notice how the sections that pop up are folded so they open and close as the page moves. The pop-up is connected to the two pages of the book called a spread. This is so the pop-up moves as the pages open and close.

Practice. Try to recreate some of the techniques you observed by folding, cutting, and gluing or taping paper into your process journal.

One simple technique is called a V-fold (**Fig. 8-48** on page 355). You will need two pieces of paper, one smaller than the other. Start by folding the large paper in half to create a spread. This will be your base.

Next, fold the small sheet in half. Open the small sheet to form a spread. Cut a small slit in the fold line, about ¼" long, from the bottom. Fold each side of the slit up ¼" to form a tab. You now have a small paper with a tab on each side of the fold.

Stand the small paper up, folded on an angle, with its center fold lined up with the middle fold of the base. Glue or tape the tabs to the base paper on either side of the center fold.

As You Practice

- Explore variations. What happens if you glue the pop-up with the fold facing you? Away from you? Could you add multiple pop-ups to one spread?
- Cut into the pop-up to create shapes like the top of a castle or a heart.



8-47 Colette Fu investigates the accordion book form and Chinese paper-cutting tradition in a pop-up book about a traditional fishing contest. What do you think she is working on in this picture? How can you tell? Courtesy of Colette Fu.

Digital Option

As students explore various methods of creating pop-up structures with paper engineering, encourage them to assemble a digital collection of their favorite patterns. Have students flatten and scan successful pop-up forms into a digital file format that can be resized, reproduced, and reprinted using illustration or computer-aided design applications (such as Adobe Illustrator, Sketchpad, Blender, or AutoCAD). Their pattern collections can be used as an important resource in the Studio Experience that follows.

Differentiated Instruction Station Exploration

Pop-up paper engineering is a great topic for stations, which allow students to explore several related concepts in a short amount of time. Using stations is a nice way to transition into a new topic at the start of a unit or lesson or change the pace at any time. Start by creating five or six different stations where students can explore concepts around one theme in small groups. You can also create three stations that are duplicated, for a total of six stations in the room, keeping the station groups small. Each station should be self-contained, including supplies, directions, and the task. Students will stay with their small group as they rotate through the stations. Determine how much time a group will get at each (typically 10–12 minutes) and provide time warnings so students stay focused.

GUIDE THE STUDIO INVESTIGATION

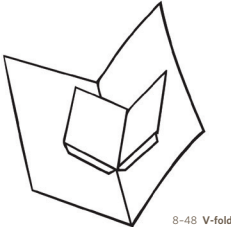
- Instruct students to research pop-up books and make notes in their process journals about what they find. Consider finding inexpensive examples of pop-up books that they can deconstruct and examine to see the components of the structures.
- Demonstrate a V-fold pop-up (Fig. 8-48) and allow students time to create and explore other pop-up methods, such as the simple box-fold and variations, as well as other paper engineering methods.
- Explain that creating pop-ups requires precision, so they must ensure that the folds in their paper match up with the fold in the spread of their process journal. Suggest that they use their writing tool to crease any folds they make.

Assess

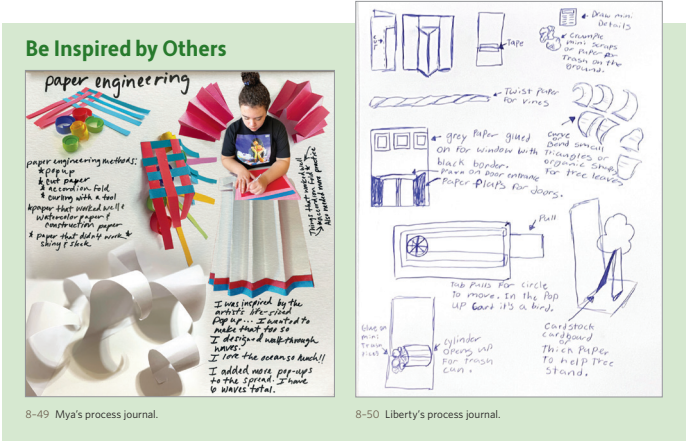
Refer to the rubric for Strand 4, page 363b, row 3, to determine the extent to which students' investigative work reveals their purposeful exploration of paper engineering methods.

Close

Colette Fu uses pop-ups to tell stories about things she finds beautiful—her cultural heritage, traditions, life, and family. The pop-up components are a way for viewers to be drawn into her work instead of looking at two-dimensional photographs. Ask, *How might you use paper engineering methods to tell stories about beauty in your life?*



- Glue images to the small piece of paper before folding, cutting, and gluing to the base.
- Could you create a pop-up by cutting and folding the pages of your process journal?
- Explore making pull-tabs and wheels to create movable shapes.
- Experiment using different types of paper.



Reflect

- What paper engineering methods did you investigate?
- What worked well? What steps need more practice?
- What types of paper worked well? What types didn't?
- Discuss your findings with your peers and show them your work. Did they discover any techniques that you didn't? If so, try them in your process journal.

Differentiated Instruction
English Learners

Check students' understanding of how to make pull-tabs and wheels to create movable shapes.

Choice Center Origami and Design

Establish a center for making origami, a form of paper engineering. Provide paper of different sizes and colors and instructions for creating origami. Provide history and fun facts about origami. If possible, show these videos about how origami is used by NASA engineers to design future spacecraft (www.youtube.com/watch?v=Ly3hMBD4h5E) and also has medical uses (www.youtube.com/watch?v=L_9BDZ6ZBwk). Include the following prompts:

- **Your challenge:** Become an expert in at least one form of origami. Practice until you can create the form in a variety of sizes. See how small you can make your origami structure.
- **Your choices:** What origami form will you try? How small can you make it? Will you become an expert in other forms as well?