Books that POP!

Paper Engineering Meets the Principles of Design

(art + math)

Books with movable portions first appeared before the age of printed text — back when books were made individually by hand. Most often used in textbooks, this genre of illustration began as a means for instruction rather than entertainment.

Publishers in the 1930s coined the term "Pop-Up" books to market children's literature where the illustrations lifted off the page, but their success was short-lived due to the expense of producing them. In the 1960s, however, advances in the printing industry brought the books back into popularity, and talented "paper engineers" have since been exploring new ways to awe viewers with elaborately designed pop-up mechanisms.

While most students love looking at Pop-Up books, the idea of designing one might seem unattainable. This lesson plan breaks the process into three very basic techniques — spirals, zig-zags, and boxes — each increasing slightly in difficulty. It also removes the pressure of realistic illustrations by focusing only on design elements: color, form, shape, and space.

A simple hinging technique using the ever-popular, colorfully patterned DuckTape allows the book to open and lie flat for the most eye-popping and paper-popping look!

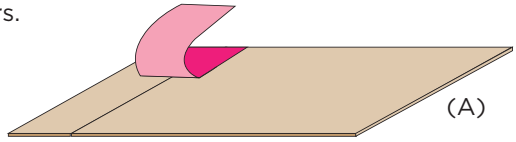
GRADES 3-12 Note: instructions and materials are based upon a class size of 24 students. Adjust as needed.

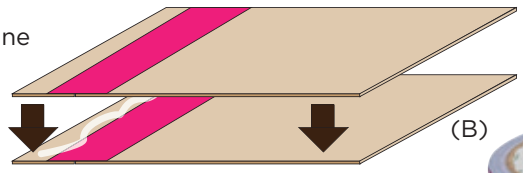
Preparation

1. Using a paper trimmer or teacher's shears, cut chipboard pieces in half to 8-1/2/" x 5-1/2" pieces. Need four pieces per book.
2. From each of the four book board pieces, cut a strip for binding. Measure 1-1/2" from the short side and cut with a paper trimmer or shears.

Process

1. Assemble by applying tape between each binding strip and the larger piece of chipboard, forming a flexible hinge, see (A). Only one side needs to be hinged.





2. Join two panels by applying glue to the binding strip and pressing together, see (B). To accommodate the thickness of the chipboard, pages will not align exactly. Open the panels as the glue is applied to make sure the alignment will allow the pages to lie flat. Any excess can be trimmed away after the glue has dried completely.
3. Using decorative and colorful paper, design pop-up pages one at a time. Choose no more than two patterned papers and 2-3 colors that complement them well.

Materials

Grafix® Chipboard, assorted, 8-1/2" x 11", package of 15 (13141-1011); divide 1 package among seven students

ShurTech® Duck Tape®, assorted colors and prints (34140-); share two rolls across class

Paper for decorating and creating pop-ups, recommend:

- Hygloss™ Bright Sheets, 8-1/2" x 11", package of 96 sheets (12906-1096)
- Roylco® Retro-Pop Decorative Paper, 8-1/2" x 11", package of 32 sheets (11262-1190)
- Hygloss™ Holographic Self-Adhesive Paper, assorted, 8-1/2" x 11", 5-pack (12493-)

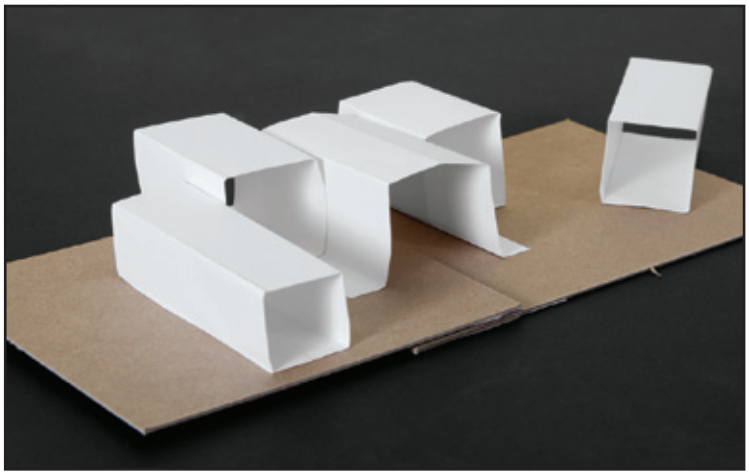
Elmer's® No-Wrinkle Double-Ended Glue Pen (23829-0001); share one among three students

Fiskars® Schoolworks Scissors, 8" (57602-1008); need one per student

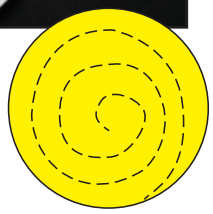
Blick® Plastic Ruler, 12" (55403-1012); share one among three students

Optional Materials

ProMAG® Magnetic Buttons, 1/2", package of 50 (61413-1006)

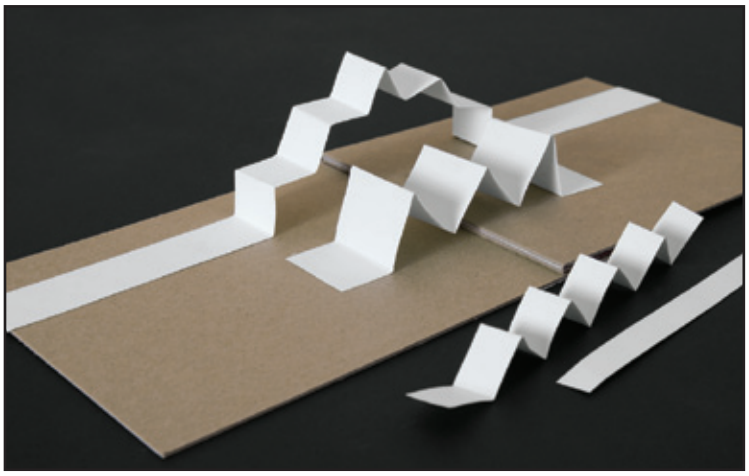


Pop-Up Page 1 — Spirals



(C)

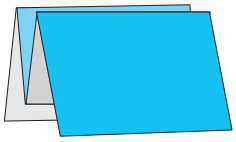
1. Cut circles from paper: one 4″, one 3″, and two 2″ in diameter. Cut a spiral from the edge of each circle all the way inward, see (C).
2. Open the book to the first panels and center the largest circle on either side so it is completely on the panel. Glue the center of the spiral down, then place a glue drop on the tail of the spiral and close the book to stick it in the proper place.
3. Repeat with remaining spirals. Test placement before gluing each one by closing the book and reopening.
4. Fill remaining space by gluing down cut-paper shapes, such as more spirals.



Pop-Up Page 2 — Zig Zags

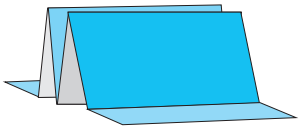
1. Cut a strip of paper the length of an 8-1/2″ x 11″ sheet of paper, approximately one inch wide. Make accordian-style (zig-zag) folds. Position it so that the center fold is over the middle where the two chipboard panels meet (it doesn't matter if the center fold goes up or down). Make sure the folds on either end are flat (you might have to trim one side off), and glue just the end folds down to the chipboard.
2. Repeat with three or four more strips. Vary the widths and colors. Strips can even go on top of one another. Test by closing the book and reopening.
3. Fill the remaining space with strips of the same colored papers, glued flat to the panels.

Pop-Up Page 3 — Boxes



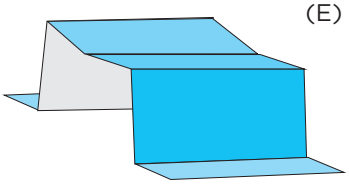
(D)

1. Begin with a rectangle cut from the leftover scraps of paper, approximately 4″ x 6″. Fold it in half vertically. Next, take one end and fold it down, so it extends further than the first fold. Turn it over and fold the other side. It will look like (D).
2. Next, fold the ends up so they are even with the first fold and form a flat tab on either end; see (E).



(E)

3. Lastly, pull the center fold up so that it is flat. Position the center over the middle, where the two chipboard panels meet, then glue just the end folds down to the chipboard, see (F).



(F)

4. Create boxes by folding rectangles in half, then folding them again. Glue them to the sides of the first box, then to the chipboard panel. Making cutout openings in the boxes will allow color to show through beneath.
5. As always, test as the pop-up design is being built by closing the book and reopening it.

Options

— Design for the outside of the book using the same paper and colors. Design a closure with magnets and a paper flap that glues to the back and magnetizes on the front (see example below).

Options, continued

— For a complete guide to pop-up and movable page techniques, see "The Elements of Pop -Up" by David A. Carter and James Diaz (68020-1001).

National Standards for Visual Arts Education

Content Standard #2 — Using knowledge of structures and functions
K-4 Students describe how different expressive features and organizational principles cause different responses.
5-8 Students employ organizational structures and analyze what makes them effective or not effective in the communication of ideas.
9-12 Students create artworks that use organizational principles and functions to solve specific visual arts problems.

Content Standard #6 — Making connections between visual arts and other disciplines
K-4 Students identify connections between the visual arts and other disciplines in the curriculum.
5-8 Students describe ways in which the principles and subject matter of other disciplines taught in the school are interrelated with the visual arts.
9-12 Students synthesize the creative and analytical principles and techniques of the visual arts and selected other arts disciplines, the humanities, or the sciences.