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Using Tangrams to Teach Geometry to Young Children

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Unlike a jigsaw puzzle where a piece must fit in only one way to complete a picture, the seven pieces of a geometric tangram can be arranged in many different ways to make figures of birds, animals, people, and objects. This article presents a Tangram Teaching Guide to provide a five-step developmental sequence for teaching tangramming to young children. Teaching resources are included, and a checklist provides a summary outline of the teaching sequence. Tangram experiences help children develop positive attitudes toward geometry, further their shape identification and classification skills, and foster an understanding of basic geometric concepts and relationships.

KEY WORDS: early childhood; tangrams; geometry; mathematics.

INTRODUCTION

Seven is a special number. Seven days in a week. The seven dwarfs. Seven continents. Seven colors of the rainbow. The seven seas. Seven Wonders of the Ancient World. Seven letters in the word *tangram.* And, seven pieces in a tangram puzzle.

The tangram is an ancient Chinese geometric puzzle with seven pieces:

two large triangles
one medium triangle
two small triangles
one square
one rhomboid

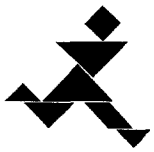
Unlike a jigsaw puzzle where a piece must fit in only one way to complete a picture, the geometric tangram pieces can be arranged in many different ways to make figures of:

a watchful cat

a soaring bird

a bubbling teapot

and children who run and play



The purpose of this article is to present a developmental Tangram Teaching Guide for teachers to use with young children to teach them beginning geometric concepts and relationships.

Tangramming

Assembling figures from the tangram pieces is called tangramming. Children's reaction to tangramming is one of surprise and amazement, surprise that manipulating the geometric shapes can be so much fun and amazement that the seven pieces can be arranged to make so many different figures.

Benefits of Tangramming

It is essential that young children have developmentally appropriate experiences to foster a positive attitude toward all mathematics. Experiences with tangrams actively involve children as they develop the skills of a geometry vocabulary, shape identification, classification,

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and discovering the relationships between and among the seven pieces. Such early experiences are especially important for young children for recognizing and appreciating geometry in their natural world.

Tangramming demands maximum involvement; children are challenged to arrange and rearrange the seven pieces. This creates high interest. Manipulating the pieces to create birds, animals, fish, people, and designs can be exciting to young children. The discoveries encourage communication, talking about the "what and how" fosters natural reasons for sharing. Also, some children are reluctant to draw illustrations to represent their language arts activities, and illustrating with tangram figures offers an interesting alternative.

The National Council of Teachers of Mathematics (NCTM) curriculum standards support the development of children's ability to combine, subdivide, and change shapes to develop their spatial sense. The benefits of using tangram activities help children reach those curriculum standards. Tangrams provide a concrete way to help students understand geometric concepts.

Getting Ready

This teaching guide provides a developmental sequence for teaching tangramming to help young children understand beginning geometric concepts and relationships. The References listed at the end of this article should be collected prior to beginning the work with tangrams.

Make an enlargement of the tangram square at the beginning of this article. Children ages three and under will need precut tangrams. Enlist the help of a parent volunteer or older children for this initial cutting. Give children ages four and older a lined tangram square and have them cut their own pieces, provide assistance if needed. Use tag board or construction paper. Provide an envelope or plastic bag to store the pieces so they can be used at any time.

As an introduction, read aloud *The Tangram Magician* (see Ernst & Ernst 1990). The book comes with plastic tangram pieces for use with the overhead so you can assemble some of the figures as you read.

Manipulating the Pieces

Allow the children ample time to freely explore the tangram pieces. Have the children manipulate the shapes, create designs, and become familiar with how the shapes can be moved around.

Talk about and name the shapes. Identify the distinguishing characteristics of each shape as children's vocabulary is developed. Ask questions which will lead children to discover that the two large triangles are the same size and that the two small triangles will fit on top of the square. Ask other relationship thinking questions. Encourage the children to use any number of pieces to make figures and share and talk about their discoveries. Remember, there are many ways to make figures and there are no wrong answers—the focus is on building geometric understandings, spatial sense, and mathematical reasoning. Continue to discuss the shapes and their characteristics as children work with the tangrams and begin to develop problem-solving skills.

Photograph 1

The Teaching Sequence

1. Cover-Up

Geometry Skills. Identifying and naming shapes, recognizing characteristics and relationships.

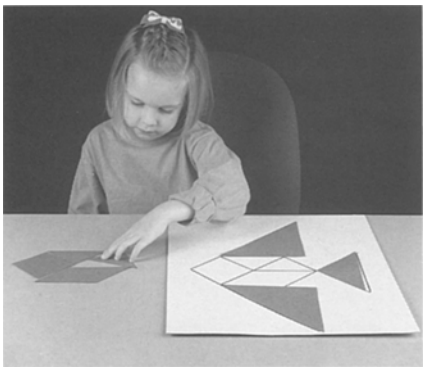
Task. Overlay the tangram pieces on top of a large outline of a figure (see Photograph 1). Have available large poster cards with outlines of figures; enlarge the figures in this article and use as outlines. We generated our outlines, and the figures for this article, using the computer (with Adobe Photoshop for either IBM or Mac). The Ford (1990) book has excellent examples.

- Demonstrate and model how the pieces can slide or be put into place by being turned (rotated) and flipped (front to back and from top to bottom).
- Use the overhead to demonstrate turning and flipping.
- Give verbal hints.
- Have the children work either alone or in pairs to assemble many cover-ups.

2. Slide the Cover-Up

Geometry Skills. Recognizing constancy of spatial planes.

Task. Build a figure the same size as the model by sliding the cover-up shapes on to a blank piece of paper next to the model. (see Photograph 2)



Photograph 2

- Have the children work alone or in pairs to cover-up the model and then transfer/slide the pieces to make the same figure on a blank piece of paper. The blank piece of paper should be to the right of the model, and then the tangram pieces can be slid on to it. For left-handed children, the blank piece of paper should be to the left of the model.
- Use blank construction paper for these so the children can later paste their assembled figures to the paper.
- Have children celebrate their work by making a class book. A good one to start with is an animal book. Each child can assemble a tangram animal, slide it on a page, paste, draw in a background scene, and label or write a sentence about the animal. Other good themes are the zoo, the farm, the circus, and ocean life.

3. Look-Find-Place

Geometry Skills. Recognizing form constancy—noting top, bottom, and sides of a shape.

Task. Build a figure the same size as the model by picking up and placing, not sliding, the shapes on a blank sheet of paper (see Photograph 3).

- Have children work alone or in pairs to cover-up the model and then pick up the pieces, one at a time, and move then to make the same figure on a blank piece of paper.
- The blank piece of paper can be either next to, above, or below the original model and the tangram pieces are placed on it.
- Once this step is mastered, the cover-up step can be eliminated. Children simply see the model outline and place the corresponding tangram pieces on a blank piece of paper that is next to the model; 4-year-olds will usually be able to eliminate the cover-up step, but not 3-year-olds.
- As with Slide the Cover-up, have children celebrate their accomplishments by pasting their figures on the blank piece of paper to create pictures of their environment—a home, school, nature, or favorite book scene.

4. Enlarge the Figure

Geometry Skills. Noting shape orientation, using visualizations.

Task. Build a figure to a larger scale than the one displayed on a tangram card. Provide outlines of tangram figures on index cards. Outlines of the tangram figures in this article can be enlarged and pasted on index cards as models for children's use, or generated with the computer. There are also many outlines in Ford (1990). Both 3- and 4-year-olds will need to have each shape on the card outlined in a different color as a visual aid (see Photograph 4).

- Demonstrate building a large figure following the shape outline on a card.
- Have the children start with the easy to identify pieces and build the tangram figure enlargement by looking at the shapes on the card.
- Give verbal hints about turning and flipping the pieces.
- Make a large mural scene of folk tales or nursery rhymes (The Three Billy Goats Gruff, The House that Jack Built, Jack Be Nimble, The Owl and the Pussy Cat, and others).

Photograph 3

Photograph 4

Photograph 5

5. On Their Own

After the children have an understanding of the steps—Cover-up, Slide the Cover-up, Look-Find-Place, and Enlarge the Figure—have them apply their tangramming skills. Language arts activities can be enhanced with tangram illustrations. Thank-you cards and self-authored books can be illustrated, flower designs can bloom as placemats and borders, and murals with animals and birds can show sequences of story retellings. Use several tangram sets of different sizes to show the relationship of larger and smaller. We have found that young children's enthusiasm for tangramming seldom wanes (see Photograph 5).

The Checklist

The Developmental Steps for Using Tangrams (Fig. 1) is a helpful outline for the teacher which can be used as a handy reminder of the teaching sequence for tangramming. It can also be used as a child's individual record of progress. Checkmarks can be used to indicate a child's mastery of a particular step.

DEVELOPMENTAL STEPS FOR USING TANGRAMS

Introduction to Tangramming:
- Manipulation of the pieces _____
- Explore the shapes _____
- Talk about the shapes _____
- Name the shapes _____

The Teaching Sequence:

1. Cover-Up Step _____
   - Demonstrate/Model _____
   - Verbal Hints _____
2. Slide the Cover-Up _____
   - Cover the Model _____
   - Slide the Pieces _____
3. Look-Find-Place _____
   - Cover the Model _____
   - Move the Pieces _____
4. Enlarge the Figure _____
   - Demonstrate/Model _____
   - Verbal Hints _____
   - Build an Enlargement _____

Follow-Up Activity:
- On Their Own _____

Fig. 1. The checklist.

SUMMARY

Children will be delighted to manipulate the seven tangram puzzle pieces to make all kinds of figures:

a beautiful swan 

a resting camel 

or a pirate ship 

In the process, they will be developing positive attitudes toward geometry, furthering their spatial sense, and developing a basic understanding of geometric concepts and relationships. Tangrams give children the fun of puzzle-solving without the restriction of a single right answer. Our advice: Any age is the right age for tangramming.

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