II. This lesson will help you understand how content material, literature, and reading all fit together to create a pleasurable learning experience.

A Literature-Based Lesson for mathematics students in elementary, middle or high school
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Activity Title: Manipulating Tangrams


Tangrams are ancient Chinese puzzles that are still used today by adults as well as children. The word tangram may have come from from the Tang dynasty, a great family of rulers in Chinese history. Gram means something drawn or written. A tangram begins with a square, which is cut into seven (7) pieces of different shapes and sizes. Each piece is called a tan. In creating a picture, all seven tans must be used. The pieces must touch but may not overlap. When tangrams are used to tell stories, the storyteller arranges the tans to show the shape of a character in the tale. As new characters or story elements enter the story, the puzzle pieces are rearranged to represent the new characters or elements. The fox fairies in Grandfather Tang’s Story are an integral part of Chinese folklore. They are believed to have magical or supernatural powers of transformations. Fox fairies are said to live for eight hundred to a thousand years.

Excerpt from Grandfather Tang’s Story

"Grandfather Tang and Little Soo were sitting under a peach tree in their backyard. They were amusing each other by making different shapes with their tangram puzzles.

'Let's do a story about the fox fairies,' said Little Soo.

So grandfather Tang arranged his seven tangram pieces into the shape of a fox. Then Grandfather Tang made another fox with Little Soo’s seven tangram pieces. Little Soo clapped her hands as her grandfather began. Although Chou and Wu Ling were best friends, they were always trying to outdo each other. One day this rivalry almost brought their friendship to a tragic end. They were sitting under their favorite willow tree beside a river talking about their magic powers.

'I can change myself into a rabbit as quick as a wink,' boasted Wu Ling.

'T'll bet you can't do that.'

'I can too,' said Chou.

'Can not,' said Wu Ling.

'Anyway, actions speak louder than words.' And he changed himself into a rabbit.

(Chou and Wu Ling take turns changing into different animals that will outdo the previous one. Order of animals: dog, squirrel, hawk, turtle, crocodile, goldfish, goose. Chou realizes that his friend Lu Wing as a goose is leaving in a flock of geese. He changes into a goose and flies after his friend.)

At last Chou found himself flying beside Wu Ling.

'I'm tired of our silly game,' he cried. 'Come back with me to our willow tree.'

Before Wu Ling could answer, something stung Chou's right wing. He sank toward the ground. A hunter had shot him. Wu Ling flew down beside Chou, placed his left wing under Chou's smashed right wing, and together they fluttered down to the edge of the forest. The hunter ran toward them.

'Fly away,' Chou urged Wu Ling. 'Save yourself. Fly! Fly!'

'I won't desert you,' cried Wu Ling.

And with a mighty roar, he changed into a lion. The hunter raised his bow. Wu Ling sprang toward him and knocked the bow from his hand. The hunter fled, leaving his bow behind. Wu Ling and Chou returned to their fox shapes. And Wu Ling helped Chou to his den, where he took care of him until he mended.
'Did they ever play that game again?' asked Little Soo.
'Many times,' said her grandfather. 'But they were very, very careful.'

'That was a good story,' said Little Soo. 'Let's do another.'

Grandfather arranged his seven tangram pieces.
'Is this story going to be about a man?' asked Little Soo.
'Yes,' said her grandfather. 'He's old and he's tired. He wants to sit under a tree and rest for a while.'
'Is he a grandfather like you?' asked Little Soo.
'Yes,' said her grandfather. 'Just like me.'

Little Soo arranged the seven pieces of her tangram beside her grandfather's.

'Is that a little girl?' he asked.
'Yes,' said Little Soo. 'Just like me. She'll sit and rest beside the man.'
'That will make him very happy,' said Grandfather Tang. 'And now, Little Soo, what will we do?'
'We'll sit and rest together until Mother calls us for supper,' said Little Soo.
'That will make me very happy,' said her grandfather.

I chose this read-aloud because I think it is a very good and entertaining story. It relates to Math in general and Geometry in particular. Many things can be done with this read-aloud.

The story itself is geared toward elementary students. The lesson can be designed for use in middle school Math and/or high school Geometry classes by using it to introduce a quadrilateral unit and/or by adding extra research assignments. Students can be assigned to find out more about ancient Chinese puzzles and/or more about Chinese folklore. The fox fairies fascinated me, so finding out more about these and other magical supernatural figures will appeal to some students. Arranging the tangrams into the shapes of the animals will be fun and thought provoking to students in all grades.

This book also has a social value to it. All students at one time or another, have found themselves in a similar situation. The ending of this story tells students that friendship should come before pride or selfishness. This is a lesson for all of us.

Objectives

The students will sharpen their visual problem solving skills by manipulating tangrams to create animal visuals for use with Grandfather Tang's Story.
The students will form special quadrilaterals using tangrams.
The students will analyze relationships among special quadrilaterals.
The student will demonstrate an understanding of the state of the world about 1000 A.D. by summarizing the location and culture of empires in India, China, and et al.
The student will analyze plane geometric figures (square, rectangle, triangle) and identify relevant properties, including the number of sides, corners, square corners, and others.
The student will classify angles and triangles as right, acute, or obtuse.
The student will compare and contrast the following quadrilaterals: parallelogram, rectangle, square, rhombus, and trapezoid.
The student will apply transformations (rotate, flip, slide, and dilate) to geometric figures.
The student will investigate and identify properties of quadrilateral involving opposite sides and angles, consecutive sides and angles, and diagonals.

Activity

This activity will be used to introduce a high school Geometry class to quadrilaterals. This will be a preparation activity. The class will be divided into pairs depending on the size of the class. There are 11
animals in the story so classes with more than 22 students will have several groups of three. If a class has less than 22 students, the teacher can decrease the number of animals to be manipulated.

**Activity Procedure**

Give the class a brief overview of what tangrams are, how they are formed, and where the concept originated. (Use Background Information above)

Pass out paper squares - one to each student. Have them mark the triangles on the squares and cut them out. Patterns will be prepared ahead of time for students to trace.

Read the story *Grandfather Tang's Story* by Ann Tompert aloud to the class.

Divide the class into 11 groups of two or more. Groups will vary depending on class size.

Assign each group a specific animal from the story and give them the signal to begin.

After each group completes this task, have them paste their animal tangram picture on a piece of colored construction paper. They may color and/or decorate their animal to make it more life-like. Upper level grades may wish not to color.

Teacher should be sensitive to likes and dislikes of the students.

Retell *Grandfather Tang's Story* using the students' finished animal tangram pictures.

Ask the class to write a paragraph in their journals to describe their thoughts on this activity.

**Assistance Activity Overview**

For my high school Geometry classes, the next step of this lesson would be an assistance activity consisting of a jot chart to use tangram pieces to construct different types of quadrilaterals and see how many tangrams it takes to make the figures. The students will sketch the figure constructed and record all information on the jot chart. Remind the students that some of the figures may not be possible to build. Quadrilaterals on the jot chart will include parallelograms, rhombi, rectangles, squares, trapezoids. This can also be used to review triangles by forming isosceles and equilateral triangles and reviewing their characteristics.

**Extension Projects**

Have the students write their own stories that incorporate tangrams figures that they have created.

Have the students research to find out about additional ancient Chinese puzzles and write a paper presenting this information.

Have the students research to discover more interesting facts about Chinese folklore and write a paper presenting this information.

Have the students research to uncover more about these and other magical supernatural figures in Chinese folklore and write a paper presenting this information.

**Suggestions for Instruction from a Content Area Perspective**

This lesson can be used to teach many concepts and topics in the content area. For lower grades, it can be used to introduce basic geometric shapes, such as squares and rectangles and basic angles, such as acute, right, and obtuse angles. Middle school classes can use tangrams to begin associating geometric shapes to their characteristics such as which have parallel sides, how perpendicular lines form right angles, and the comparison of the diagonals of each shape. High school Geometry classes can build on the concepts described for the middle school students leading up to solving problems based on the properties of each shape. As in my literature-based lesson plan, tangrams can be used to introduce quadrilaterals. With a little imagination and creativity, *Grandfather Tang's Story* can be read to introduce many topics and concepts to students at all grade levels.

**Suggestions for Instruction from a Language Arts Perspective**
From a language arts perspective, this read-aloud offers many opportunities to connect listening to reading to writing. Listening to the read-aloud provides many benefits for the students. It should be entertaining to most students. The story is in a magical make-believe setting, which in itself presents an air of mystery. The students are constantly trying to predict what is coming next, but never really know for sure until the events are revealed by the author. The students working in pairs have the chance to try different arrangements of the tangrams while talking to and listening to their partners. They discover alternate approaches to make the animal designs when the current arrangement fails. Listening will also occur when the students read their tangram-based stories to the class.

Many reading opportunities are present in this lesson. When the story is reread using the students' tangram pictures, the students in the class should be encouraged to read the story aloud to the rest of the class. Reading is a huge factor in the extension projects. To research the topics, the students must read texts from encyclopedias to websites. The more the student is interested in the subject, the stronger the reading to learn experience will be.

This lesson provides many writing opportunities. The students will write their own stories using other tangram illustrations. This is a chance to nurture creativity and improve writing skills. The extension projects are great chances for students to read about a unfamiliar subject and bring it all together in a writing assignment. These reports can be read in class providing more listening experiences for their classmates. Journal entries allow yet another personal thinking and writing opportunity. Listening, reading, and writing directly relate to each other. Once one of the actions occur, it opens the door for the others. It does not matter which happens first, the other two will follow.