2-D Shapes: Do We Have an Identity Crisis?

Ellen Shackelford

Introduction

Geometry has existed a very long time. In fact, Euclid's Elements was first published in 300 B.C. 13 books that defined, explained, and proved Geometric Principles. Many Greek mathematicians actually wrote the contents of Euclid's Elements. Euclid organized the information into distinct areas that he termed books. While some of the content has been rearranged and some proofs have been altered, Euclid's writings are considered the basis of Geometry. Most educated people, in the early centuries, were expected to know Euclid's Elements, whether they were mathematicians or not. It was determined to be part of an essential educational background for all learned people. [1]"Indeed the motto of Plato's academy 'Let no one ignorant of geometry enter within these walls' was fitting for the scene of the great minds who gathered here."

Today, we take a much different view. While a one-year study of Geometry may be required in high school, nothing beyond the basics is required, unless the student is majoring in mathematics or other mathematical endeavors. In fact, I am not aware of any advanced placement high school courses in geometry. So, it's not too surprising that Geometry is not well represented. In fact, the Geometric Standards in the Common Core State Standards for Mathematics for 5th grade are minimal. When did we as a society decide to give Geometry such short shrift? Within the study of geometry is a process of logical thinking that the Greeks appreciated. Perhaps we should look again and reevaluate its prominence.

Rationale

I teach 5th grade in a Title 1 school in Delaware. We are preparing to implement the Common Core State Standards for Mathematics in 2012-2013. As far as geometry is concerned in 5th grade, the Delaware Prioritized GLE's for geometry are very similar to the Common Core State Standards. Both are minimal- there isn't much there. The Delaware Prioritized GLE's for math don't contain standards for any of the attributes that the students need to classify shapes in 5th grade, yet they expect students to categorize geometric shapes using the attributes. In 4th grade the geometric standards are limited to angles, and their classification. The Common Core will correct this somewhat in the grades before 5th, but the transition will be several years. Beyond the standards, I have witnessed my students' misconceptions regarding shapes for many years. I still have students calling a rhombus a diamond. Students don't believe squares are rectangles as well. Triangles are all expected to be equilateral. Unfortunately, I believe that many

elementary school teachers without a good grasp of mathematics have perpetuated some misconceptions. Elementary Mathematics Teachers need to learn as much as they can about the mathematics they are teaching, not just what the children should learn at the grade level. Performance of students has been linked to the level of mathematical education a teacher has. In a recent study in Delaware conducted by Brian Erskine, greater mathematical proficiency corresponded with greater test scores of students. [2]Misconceptions prevail beyond shape recognition, students have difficulty creating a logical classification of the shapes. They need help to organize their thoughts and make logical conclusions. As I look at the math textbook that my district uses, there are two lessons for categorizing shapes, and very little instruction to guide the students. There is a lesson to help the students make connections between categorizing zoo animals, and then the students are asked to classify a selection of geometric shapes. There is no instruction of shape attributes, and no guidance as how to do this. I used this lesson before with very disappointing results. While the children enjoyed the exercise, it was very difficult to see any logical reasoning beyond very obvious attributes- such as quadrilaterals versus triangles.

Students need guidance to persevere and test their initial ideas. They need additional reflection to create new incites to their geometric schema. I believe that my students need this before they advance to middle school. Students will be expected to know the attributes of shapes in 7^{th} and 8^{th} grade for the general mathematics course. If they test out of the general mathematics classes, they will take Algebra I and II followed by a high school Geometry course. I find it very frightening to think of most students entering Geometry with little formalized knowledge of 2-dimensional shapes and their attributes, let alone the thought processes of categorizing them. So, I see a great need to do a good job of it in 5^{th} grade. It will be the last chance many students will have to encounter it before taking high school geometry.

Objectives

My objectives are to meet both the Delaware Prioritized GLE's and the Common Core State Standards of Mathematics standards to "Classify two-dimensional figures into categories based on their properties". I understand that to do this, I need to provide background to my students of the properties or attributes of two-dimensional figures, such as parallel lines, perpendicular lines, acute, obtuse, and right angles, and line segment congruency.

For the purposes of this elementary unit, definitions are paramount. Students must understand them with mastery. I will guide my students to both construct and identify geometric figures in order to extend their understanding of them as more than a definition. It is also important to expose the students to a wide variety of shapes. Otherwise, the students form misconceptions about them. For example, if students always use an equilateral triangle, they might not recognize a scalene triangle as being a triangle.

If students never see a parallelogram except for a rhombus, they will assume that all parallelograms have equal sides. In addition, I will guide my students to a logical thinking process to analyze their information, in order to classify the shapes. The challenge will be to get them to persevere enough to complete a thorough analysis, not stop early. Only then, will they be able to let go of some of their misconceptions. Finally, I want my students to apply what they learn in a real-life application, since it is only when students make connections to their previous schema that they internalize the new information.

Tools

I plan to use some basic mathematical tools in the classroom. Students will use rulers to measure line segments and protractors to identify angles as acute, obtuse, or right. Students will use paper folding to explore and compare relationships of shapes. When they construct their final project, they will use rulers. Most of the students have never used protractors accurately, and they will need to do this in order to classify the angles as acute, obtuse, or right. In addition, I will use a website that provides the figures with tools to manipulate them. For the definitions of the geometric figures I will use many from Book 1 of Euclid's Elements.

Strategies

As far as classroom strategies, I will use constructivist theories as often as possible. I believe that the students learn much more when they discover and build their understanding rather than listen to a teacher tell them. I will use pair groupings of students to work on investigations. I believe that the students learn better with another to support and encourage them for the times when they don't have the answers. Fortunately I have a Smart Board, so I can project images from the computer on a screen that the students can see well. The websites I will use have shapes that can be easily manipulated by the students and I think these images will be memorable for them.

To begin with, I will limit the figures or shapes to those that are convex and closed. If I don't limit the figures, this unit will be too large to accomplish the objectives. Vocabulary is extremely important to an understanding of geometry. However, I don't suggest treating it like vocabulary in literature. It's best to let the student discover much of the vocabulary, and then use traditional vocabulary reinforcement activities to encourage mastery of the terms. As Michael de Villiers suggested, [3]"Constructive *(a priori)* defining takes places when a given definition of a concept is changed through the exclusion, generalization, specialization, replacement or addition of properties to the definition, so that a new concept is constructed in the process ." As Oerdorf and Taylor-Cox mention, [4]"This discovery-oriented approach involves looking at the similarities and differences between and among shapes instead of memorizing specific descriptors of individual shapes." I concur with Pierre M.van Hiele's concept of five levels of

geometric understanding of children and at the fifth grade level, my students can rise through the first three levels. He described the first level as [5]"the "lowest" is the visual level… figures are judged by their appearance." So, the initial activities ask the children to identify as many different convex, closed geometric figures as they can. Shape names should be given and corrected as necessary. Hiele's next level is Analysis, [6] "the descriptive level, figures are the bearers of their properties." Next, the various properties must be taught or reviewed, such as parallel lines, right, acute, and obtuse angles, equal lines, perpendicular lines. Then the next activities would involve student discussions, definitions and identification of the above mentioned properties or attributes.

Finally, the fifth grade students can experience the Van Hiele's Abstract level described as,[7]"the informal deduction level, [where] properties are logically ordered. These properties are deduced from one another; one property precedes or follows from another property. Students use properties that they already know to sort the geometric figures to fit the definitions." At this point, students will add to the definitions they have begun, as they notice the comparisons with other figures. The students will explore the complexities of their definitions at this point. These definitions should be recorded and illustrated in student developed work-in-progress booklets. This should be in addition to a classroom word wall, with terms and pictures. Terms should be reinforced often, at this point, throughout the day. The teacher should continue to provide additional examples of shapes to the students, beyond the most common or regular, and ask them to name them. The ensuing discussions for their conclusions are important. An exception to the above would be the terms "figures", "closed", and "plane figures". These terms are important to the understanding of many of the other terms and most likely, the students are not familiar with them. The teacher should present these terms.

Euclid defines "figures" as "that which is contained by any boundary or boundaries". Clark clarifies Euclid's definition, stating,[8]"In order to be a figure, a region must be bounded, that is, held in by a boundary." Students can be introduced to a plane. They may not fully understand it at the elementary school level, but the introduction is not detrimental, as the student will be introduced to it again later in school. Euclid says a plane surface is "a surface which lies evenly with the straight lines on itself". Most elementary text books do not define figures or planes. Another activity that would be beneficial is to take a school-wide field trip with cameras for the students to document as many two-dimensional shapes as possible. These can be added to a growing bulletin board. Additional origami activities can be used to additionally reinforce the previous vocabulary. After some experience with the vocabulary, the children could learn to construct some of the basic quadrilaterals and other shapes, reinforcing such vocabulary such as equal and unequal sides, equal angles, acute, obtuse, and right angles.

At this point the students need to think how they would categorize the shapes. First students should grapple with the problem themselves, encouraging perseverance with the problem, and supplying the rationale they used. (For this activity, I would limit the

geometric shapes initially to just quadrilaterals.) Finally, I would give them a dichotomous key and let the students classify the quadrilateral figures using that. They would then be asked to identify the large groupings, such as parallelograms, etc. As a final project I would give the students the challenge to use a variety of shapes to design their "dorm" room, within the parameters of the space.

Activities

Preassessment

Give the students a pretest of the basic geometric shapes. The test should show images of various geometric shapes, both regular and irregular polygons, with labels to match. (See Appendix E.) This will give you a good idea of their misconceptions about the basic shapes.

Identifying geometric figures and attributes

Essential Question: How do we identify geometric shapes? Tell the students that you will be focusing on convex polygons, not concave polygons or circles. You can illustrate the difference between convex and concave polygons on the following website for the students: convex ,[9] http://www.mathopenref.com/polygonconvex.html and concave, http://www.mathopenref.com/polygonconcave.html. Be sure to show both regular and irregular by unchecking the regular box on the website. You can also manipulate each figure, expanding, contracting, and rotating the figures to illustrate the concept. It is not imperative that the students have the definition mastered, but it will help the subsequent discussions if the students know which figures will not be addressed in the unit.

Based on the pretest, you can focus the initial visual instruction on shapes the students confuse. Use the shapes from the pretest and let students work in partner groups to correctly match labels with shapes.

Essential Question: What attributes do geometric shapes have? How do we identify them? At this point, the students need a list of attributes to describe and compare the geometric shapes. Let the class brainstorm the attributes they might need. (Let students will pair-share first, then they report out to the class. The attributes they will need are: parallel lines, perpendicular lines, right angles (or 90 degree angles), acute angles, obtuse angles, line segments, congruent line segments, and number of sides. Make a chart for the classroom identifying the attributes. The students will begin their geometric shape books with pages that illustrate the attributes. The students should have a working definition of the attributes from previous grades, however review is paramount to identify, compare, and categorize the geometric figures.

You can use the Smart Board, the Geometer's Sketchpad software, or the following web site to illustrate perpendicular, and parallel lines, as well as acute, obtuse, and right angles. The Smart Board and the website both allow you to manipulate these attributes so the students can see them from all perspectives.

Essential Question: How can we create some attributes by folding? Students will explore and gain experience with some of the geometric figures and geometric attributes by folding paper. Tell the students to fold a piece of 8 ½ inch by 11 inch paper by folding the top left corner to the long right side. They should cut off the excess and then they will have a square. They have parallel lines, equal side lengths and perpendicular lines. They have 4 right angles they can measure with the protractors. When folded, they have an isosceles triangle. If they fold the bottom left corner of the triangle up to the top point of the triangle, and then fold the top point down to the bottom of the triangle, they will have a parallelogram. Another paper folding activity is to create a tangram. This activity is described in detail on the [10]Utah Education Network website, http://www.uen.org/Lessonplan/preview?LPid=11079 . By creating the tangram many of the geometric figures vocabulary can be reinforced.

Students will create a geometric shape booklet. (The booklet can be created by using a notebook, blank pages of paper stapled together, or other ways to make booklets by folding and stapling paper together.) Print out pages with spaces for polygon, convex polygon, parallel lines, and perpendicular lines. Then, print pages with identifying sentences for geometric figures, based on attributes, (two on each page), as well as copies of geometric figures- both regular and irregular polygons. You can print these from the websites listed in Appendix E, most word processing programs, Smart Board programs, or the Geometer's Sketchpad software. After the activity, have a class discussion, correct the student work, discuss their impressions, and compare figures. Go to the websites for each geometric figure, or display it on the Smart Board, or from the Geometer's Sketchpad software and project on a screen where the students can view it. Allow the students to manipulate the figure, expanding, contracting, and rotating each figure. Show both the regular or irregular figure if applicable.

Classify figures

Give pairs of students pictures of all 8 types of quadrilaterals, (trapezium, right trapezoid, trapezoid, kite, square, rectangle, rhombus, and parallelogram), along with rulers and protractors. Ask the students to physically sort the shapes into 3 groups and write down the criteria they had for each group using shape attributes such as, number of acute angles, obtuse angles, right angles, pairs of congruent sides, parallelism of sides, length of diagonals, or symmetry. As time permits, you might then let groups switch their criteria and see if they are able to create the same sort. As a class, discuss the activity, what was hard and what was easy and how well they think their categories work to sort the figure.

Give the students the dichotomous key in Appendix F to sort quadrilaterals. Give them pictures of each of the 7 figures, however give 2 squares, and 2 rhombi, and ask them to use the key to sort the figures. Two of the categories accommodate two figures: parallelogram and rhombus and rectangle and square. After the students have sorted the figures, discuss as a class. Confirm that 2 shapes will fit in the category for rectangles and parallelogram and make sure the students understand and prove that this is accurate. Direct the students to make generalizations from the key about groups of the shapes, such as: squares and rectangles are related, because they both have four, 90 degree angles, and how parallelograms and squares and rectangles are related because they both come out of the group of having two pairs of parallel sides.

Student pair groups will be given shapes for all four types of triangles. Students will work with their pair to determine which attributes separate the type of triangle. Make sure each pair group has a protractor to measure angles. In class discussion, findings will be shared and labels will be given for the triangles. Students will add these to their geometric figure booklets.

Students will add the shapes of all of the rest of the convex polygons, both regular and irregular. By going to websites[11], (see Appendix D), or using Geometer's Sketchpad software, students will manipulate the figures to see how their shapes can change while still retaining the label they have.

Analyze the classifications

There are several Smart Board lessons available on Smart Exchange[12] that are good review and follow up for students to make some of the logical generalizations about the shapes, (i.e., a square is also a rectangle). These may be used to reinforce the concepts taught. Also, students will analyze various solids such as prisms and pyramids focusing on the shapes that give the object's faces. This assures that students understand the difference between a two dimensional object and a three dimensional object.

Student Project

Essential Question: How can I use geometry in real life? Students will complete a project to fit a variety of shapes provided, (representing sides of furniture objects), into the parameters of their "dorm room". They will not be able to fit all of the shapes into the room. Students must fit a desk, dresser, and a bed into the room. The rest of the shapes are optional, but they must fit with a walkway for the student in the room. Figures may not overlap each other. (A discussion will be held, reinforcing that the furniture object is a three-dimensional solid, however the figures used to plan the space on a diagram are two dimensional shapes.) After cutting out the shapes, fitting them into the diagram of the room, students will write a paragraph explaining their choices and why

they made the choices they did and how these figures represent the best choice. (See Appendix G.)

[1]"Quickies Math!" ThinkQuiest: Library. http://library.thinkquest.org/C006354/ (accessed November 12,2011).

[2]Erskine, B. "Raising Mathematical Achievement Starts with the Elementary Teacher: Recommendations to Improve Content and Pedagogical Achievement Starts with the Elementary Teacher" Recommendations to improve content and pedagogical knowledge of elementary math teachers. D.Ed. diss., University of Delaware. *"Dissertations and Theses @ University of Delaware"* ED520657 (2010). http://www.proquest.com (accessed November 11, 2011).

[3]Villiers, Michael. "The Role and Function of the Hierarchical Classification of Quadrilaterals." *For the Learning of Mathematics* 14, no. 1 (1994): 11-18.

[4]Oberdorf, Christine, and Jennifer Taylor-Cox. "Shape Up!" *Teaching Children Mathematics* 5, no. 6 (1999): 340-345.

[5]Van Hiele, Pierre. "Developing Geometric Thinking through Activities That Begin with Play.. "*Teaching Children Mathematics* 5, no. 6 (2011): 310-316.

[6]*Ibid.*

[7]*Ibid.*

[8]"Euclid's Elements" – Euclid's Elements – http://aleph0.clarku.edu/~djoycde/java/elements.html. (accessed November 12,2011).

[9]"Math Open Reference." – Math Open Reference. http://www.mathopenref.com/index.html (accessed January 2, 2012).

[10]"Utah Education Network." – Making Tangram Pieces by Folding Paper. – http://www.uen.org/Lessonplan/preview?LPid=11079 (accessed January 3, 2012).

[11] "Math Open Reference." – Math Open Reference. http://www.mathopenref.com/index.html (accessed January 2, 2012).

[12] "Smart Exchange" – Smart Exchange. http://exchange.smarttech.com/#tab=0 (accessed January 4, 2012).

Appendix A: Resources

Erskine, B. "Raising mathematical achievement starts with the elementary teacher: Recommendations to improve content and pedagogical knowledge of elementary math teachers. D.Ed. diss., University of Delaware. "*Dissertations and Theses @* University of Delaware ED520657) (2010). http://www.proquest.com (accessed November 11,2011).

Euclid. *The Elements*

"Math Open Reference." http://www.mathopenref.com/index.html

Oberdorf, Christine, and Jennifer Taylor-Cox. "Shape Up!. "Teaching Children Mathematics 5,no. 6 (1999): 340-345.

"Quickie Math!." ThinkQuest: Library. http://library.thinkquest.org/C006354/ (accessed November 12,2011).

Villiers, Michael. "The Role and Function of the Hierarchical Classification of Quadrilaterals. "*Teaching Children Mathematics* 5, no. 6 (2011): 310-316.

"Utah Education Network." – Making Tangram Pieces by Folding Paper. – http://www.uen.org/Lessonplan/preview?LPid=11079 (accessed January 3, 2012).

Villiers, Michael. "The Role and Function of the Hierarchical Classification of Quadrilaterals. "*Teaching Children Mathematics* 5, no. 6 (2011): 310-316.

Appendix B: Implementing State Standards/Delaware State Standards/Common Core State Standards for Mathematics

Delaware State Standards

Content Standard 3 (5-8) - Geometric Reasoning: Students will develop Geometric Reasoning and an understanding of Geometry and Measurement by solving problems in which there is a need to recognize, construct, transform, analyze properties of, and discover relationships among geometric figures; and to measure to a required degree of accuracy by selecting appropriate tools and units.

5.3.1 Classification: Analyze and classify two-dimensional shapes according to their properties and develop definitions for classes of shapes (e.g., a square is a rectangle is a parallelogram is a quadrilateral).

Students will create their own classification system according to attributes and will follow a dichotomous key to classify two-dimensional figures by attributes and later will make conclusions about the groups of figures.

Standard 6 – Reasoning and Proof: Students will develop their Reasoning and Proof ability by solving problems in which there is a need to investigate significant mathematical ideas in all content areas: to justify their thinking; to reinforce and extend their logical reasoning abilities; to reflect on and clarify their own thinking; to ask questions to extend their thinking; and to construct their own learning.

Standard 7 – Communication: Students will develop their mathematical Communication ability by solving problems in which there is a need to obtain information from the real world through reading, listening and observing; to translate this information into mathematical language and symbols; to process this information mathematically; and to present results in written, oral, and visual formats.

Students will solve problems throughout the unit to develop definitions and categorize two-dimensional geometric figures; They will communicate their results both formally and informally in the classroom.

Common Core Standards for Mathematics

Classify two-dimensional figures into categories based on their properties.
5G 3. Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.

5G4. Classify two-dimensional figures in a hierarchy based on properties.

Students will create their own classification system according to attributes for quadrilaterals and will then follow a dichotomous key to classify shapes by attributes and later will make conclusions about the groups of figures.

Mathematics/Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them.
2. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.

Students will persevere in solving problems throughout the unit to develop definitions and categorize figures. They will communicate their results with models and viable

arguments, critique the reasoning of other classmates in the classroom. Students will use rulers, and protractors to identify attributes of shapes.

Appendix C: Two-Dimensional Shape Definitions

Polygon: A geometric figure with many angles.

Convex Polygon: A polygon with all its interior angles less than 180°.

Concave Polygon: A polygon that has one or more angles greater than 180^{o}.

Regular Polygon: A polygon whose sides are all equal in length. All angles in a regular polygon are also equal.

Quadrilateral: A 4-sided polygon. The sum of the angles is 360 degrees.

Parallelogram: A quadrilateral with two pairs of opposite parallel lines.

Rhombus: A quadrilateral with two pairs of opposite parallel lines all equal in length.

Rectangle: A quadrilateral with two pairs of opposite parallel lines with 4 right angles.

Square: A quadrilateral with two pairs of opposite parallel lines all equal in length with 4 right angles.

Kite: A quadrilateral with 2 pairs of adjacent line segments, each pair being equal in length.

Trapezium: A quadrilateral with no parallel lines.

Trapezoid: A quadrilateral with one pair of parallel lines.
Right Trapezoid: A quadrilateral with one pair of parallel lines and one right angle.

Pentagon: A polygon with 5 sides.
Regular pentagon: A polygon with 5 sides equal in length.

Hexagon: A polygon with 6 sides.
Regular hexagon: A polygon with 6 sides equal in length.

Heptagon: A polygon with 7 sides.
Regular heptagon: A polygon with 7 sides equal in length.

Octagon: A polygon with 8 sides.

Regular octagon: A polygon with 8 sides equal in length.

Nonagon: A polygon with 9 sides.
Regular nonagon: A polygon with 9 sides equal in length.

Decagon: A polygon with 10 sides.
Regular decagon: A polygon with 10 sides equal in length.

Undecagon: A polygon with 11 sides.
Regular undecagon: A polygon with 11 sides equal in length.

Duodecagon: A polygon with 12 sides.
Regular duodecagon: A polygon with 12 sides equal in length.

Appendix D: Geometric Shape Websites

parallel lines: http://www.mathopenref.com/parallel.html

perpendicular lines: http://www.mathopenref.com/perpendicular.html

right angles: http://www.mathopenref.com/angleright.html

convex polygons: http://www.mathopenref.com/polygonconvex.html

concave polygons: http://www.mathopenref.com/polygonconcave.html

kite: http://www.mathopenref.com/kite.html

parallelogram: http://www.mathopenref.com/parallelogram.html

rhombus: http://www.mathopenref.com/rhombus.html

rectangle: http://www.mathopenref.com/rectangle.html

square: http://www.mathopenref.com/square.html

trapezium: http://www.mathopenref.com/trapezium.html

trapezoid: http://www.mathopenref.com/trapezoid.html

pentagon: http://www.mathopenref.com/hexagon.html

hexagon: http://www.mathopenref.com/heptagon.html

heptagon: http://www.mathopenref.com/octagon.html

octagon: http://www.mathopenref.com/nonagon.html

nonagon: http://www.mathopenref.com/decagon.html

decagon: http://www.mathopenref.com/undecagon.html

undecagon: http://www.mathopenref.com/dodecagon.html

duodecagon: http://www.mathopenref.com/tocs/triangletoc.html

triangles: http://www.mathopenref.com/triangle.html

acute triangle: http://www.mathopenref.com/acutetriangle.html

obtuse triangle: http://www.mathopenref.com/obtusetriangle.html

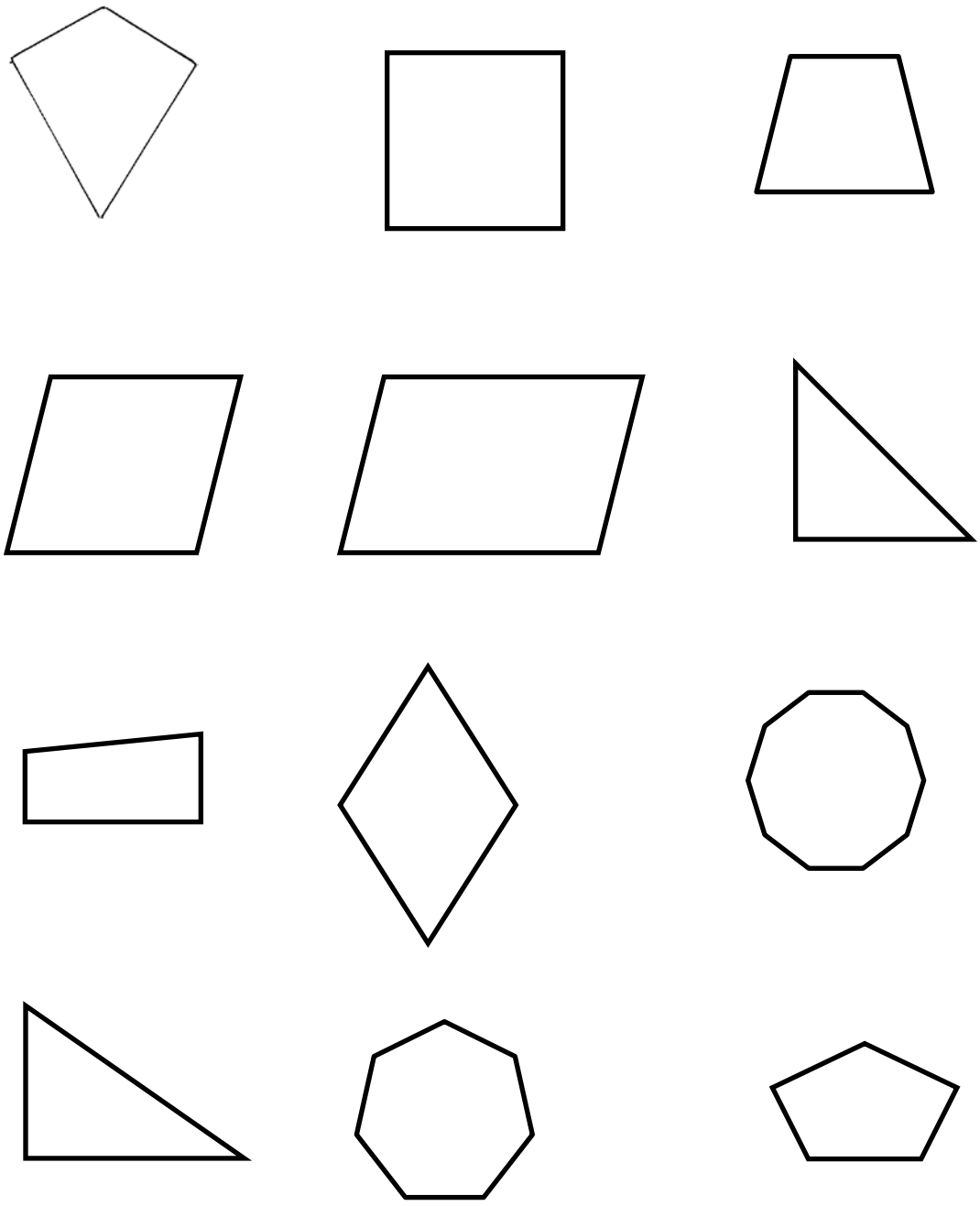
isosceles triangle: http://www.mathopenref.com/isosceles.html

scalene triangle: http://www.mathopenref.com/scalene.html

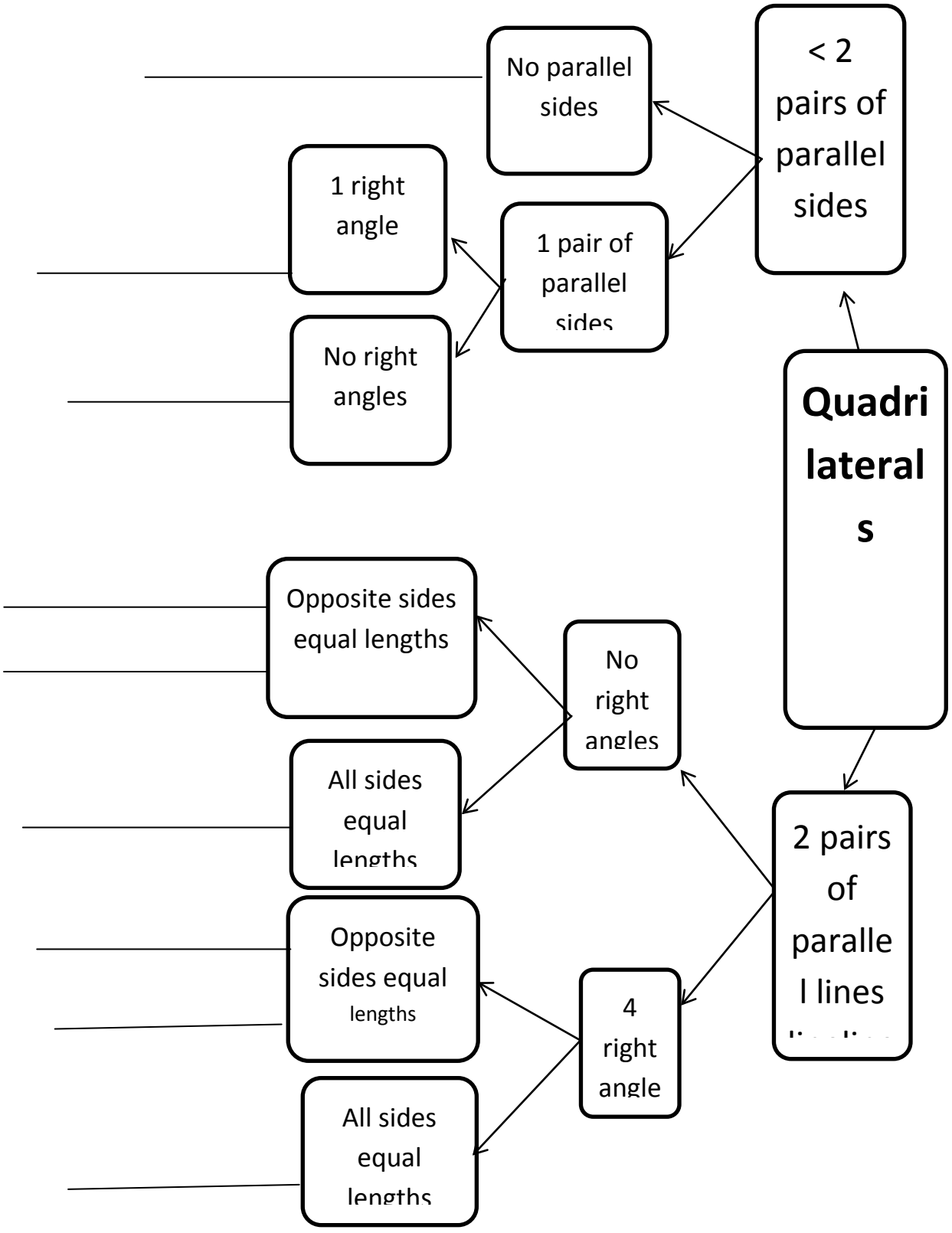
equilateral triangle: http://www.mathopenref.com/equilateral.html

right triangle: http://www.mathopenref.com/righttriangle.html

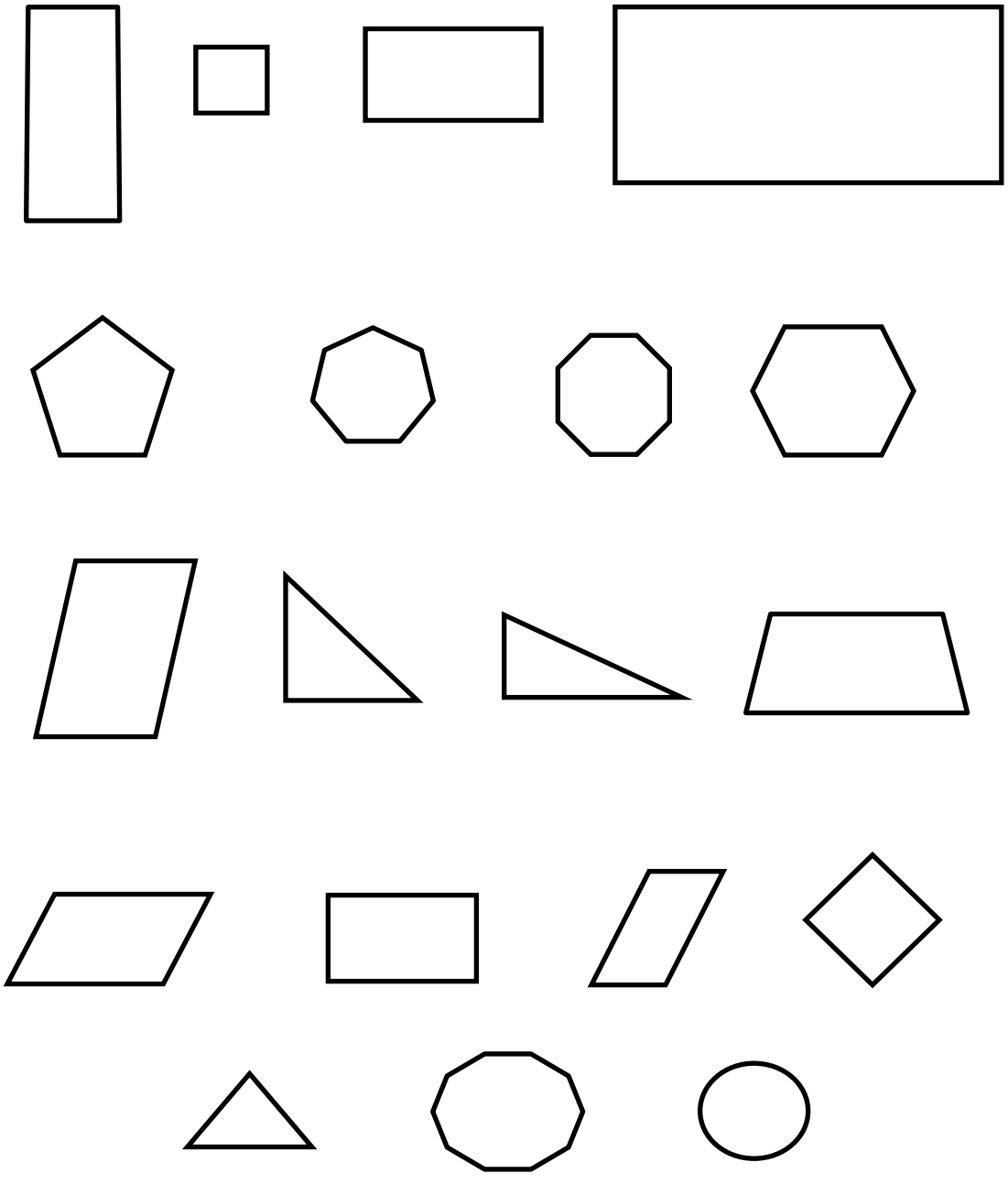
Appendix E: Pretest



Appendix F: Dichotomous Key for Quadrilaterals



Appendix G: Figures for student project



Shapes may be used more than once. Shapes may not overlap.
Use centimeter square paper. (Each cm = 1 foot.)
Dimensions are 8 X 8 cm.
Students must include:

- 1 bed, 6 X 3 cm
- Desk, chair
- Dresser
- Closet
- 2 cm. walkway

Optional:

- Shelf
- Other chairs
- Table for TV, lamp, etc.
- Closet
- Portable refrigerator (1 cm X 1 cm)

This can be extended by adding a living space between 2 dorm rooms. Including: sofa, table, chairs, etc.

Curriculum Unit Title	2-D Shapes: Do We Have an Identity Crisis?	**Author**	Ellen Shackelford

KEY LEARNING, ENDURING UNDERSTANDING, ETC.

Geometric figures have unique combinations of attributes that define them. These figures can be classified in ways that show their similarities and differences.

ESSENTIAL QUESTION(S) for the UNIT

What would be a good way to classify geometric figures? How can this classification help me learn more about the figures?

CONCEPT A	**CONCEPT B**	**CONCEPT C**
Geometric figures have certain attributes.	Attributes define geometric figures.	Geometric figures can be classified.
ESSENTIAL QUESTIONS A	**ESSENTIAL QUESTIONS B**	**ESSENTIAL QUESTIONS C**
What are geometric attributes?	How do I identify geometric figures?	What is the best way to classify geometric figures? What comparisons can I make from the classification?
VOCABULARY A	**VOCABULARY A**	**VOCABULARY A**
Parallel lines, right, acute, and obtuse angles, equal length sides, symmetry, congruency	rectangle, square, rhombus, parallelogram, trapezoid, equilateral, obtuse, equilateral triangle, pentagon, hexagon, heptagon, octagon	Polygon, quadrilateral

ADDITIONAL INFORMATION/MATERIAL/TEXT/FILM/RESOURCES