Problem Solving: Strengthening Critical Thinking in Measurement

Francisca Eunice G. Rebullida
Tinsley Elementary School

INTRODUCTION

The language of mathematics is global. When one travels to a non-English speaking country, shoppers negotiate using numbers and the calculator to price their items. In return, the merchants show their agreement to the negotiation writing numbers down until the items are sold or left unsold. The 21st century puts emphasis on applying mathematics to "daily" or real world situations. Word problem solving is related to real life. However, students with reading levels below grade level have difficulty understanding the word problems. Computations and basic facts are easy for them to do, but when word problems or math stories are presented to them, math becomes difficult and uninteresting. Teaching mathematics to the upper grades is very challenging. Both students in the mainstreamed classes and language learners find reflecting and sense-making, generating ideas, asking questions and making educated guesses challenging.

I teach science to fifth grade students who are language learners and native speakers of English as well. The student population is approximately 75 percent Hispanic, 24.98 percent African Americans, and .02 percent Asian. The school population is diverse in terms of socio-economic level and educational background. It is considered as a Title 1 school because 86 percent of the students receive free breakfast and lunch. The rate of student mobility is high. The jobs of their parents often require working in different areas, so the children move with them. Students leave the school, and there are newcomers at any time during the school year. Although there are some students that started first grade and are still in the school, many others are transferees.

Most of the students are English Second Language Learners. They have difficulty in the areas of listening, speaking, reading, and writing in the academic areas. When their proficiency level is at an advanced high in speaking, some of them have the notion that they will be successful in the academic content areas. However, speaking in a native-like manner is not the same as the cognitive academic language proficiency area. The students' language proficiency must reach an advanced high level.

Therefore, second language learners need to understand that an advanced high proficiency level in the upper elementary grade is required to succeed in the academic areas of oral and written language in the areas of reading, writing, and math/science.

OBJECTIVES

The curriculum unit is designed for English as a Second Language (ESL) teachers and for mainstream teachers in fifth grade. It is a teaching tool to help students think critically in the academic areas of math/science and reading. Houston Independent School District requires the teachers to plan their lessons using the curriculum that is vertically and horizontally aligned. It is designed to meet the academic needs of all students.

The learning focus of my unit for fifth graders will be on nonstandard and standard measurement. The first part of my unit will be the introduction to nonstandard measurement and the other part will be standard measurement. Texas Assessment of Knowledge and Skills

objective 4 states that the students will demonstrate an understanding of the concepts and uses of measurement.

This curriculum unit will be taught during the third nine weeks. Modified, the nonstandard unit of measure could be taught in the first nine weeks based on a 45-60 minute language arts block or math/science for 10 days. The standard unit of measure could be taught in the third nine weeks based on a 45-60 minute block for ten days. Math/Science and language arts will be integrated. In math, Learning Focus 3.1, students will measure volume and perform conversions for both customary and SI (metric) systems. The math standards are stated below: The students will be able to…

- Math 5.10A Perform simple conversions with the same measurement system [SI (metric) or customary systems].

- Math 5.10B Connect models with perimeter, area, and volume with their respective formulas.

- Math 5.10C Select and use appropriate units and formulas to measure length, length, perimeter, area and volume in customary system and SI (metric system).

- Math 5.5A Describe the relationship between the sets of data in graphic organizers, such as lists, tables, charts and diagrams, extend the pattern, and state the rule for non-consecutive related pairs.

- Math 5.16B Restate informal language to mathematical language and symbols.

- Science 5.2B Collect and analyze information by observing, measuring, and using numerical operations, such as addition, subtraction, and scaling.

- Science 5.2D Communicate and evaluate valid conclusions using oral presentations or written statements that include pictorial and numerical representations.

- ELA 5 (1.13A) Listen to variety of genres being read aloud.

- ELA 5.10A Activate his/her own knowledge and experience to comprehend.

- ELA 3.2. This learning focus emphasizes the following core reading skills informational text. namely listening, speaking, reading and writing skills. Students will engage in discussions. They will compare and contrast text. Students will collaborate with other writers and will write to inform. Students will interpret graphic organizers. When the students have completed their lessons. they will celebrate math and science through reading and writing

RATIONALE

The second language learners at my school have different language proficiency levels. They are in the bilingual program from first to third grade and then move on to the English as a Second Language Program in the fourth and fifth grade. Since our school is high in mobility, there are students who enroll towards the end of the third quarter and the beginning of the last quarter. Their language and academic skills are inept so that they encounter difficulty in the academic areas of math and science. Some are also reading below their grade level; for this reason, thinking in terms of measurement is abstract to them.

Second language learners go through two phases to acquire English. Oral language is not enough to be successful in the classroom. The students have to acquire proficiency in the cognitive academic areas. Science and math are two of the most crucial subjects. In order to help the fifth graders learn the language of math and science, this unit has been designed for them.

To understand second language acquisition, the students have to go through generally two phases, namely the BICS and the CALP. "The acronyms BICS and CALP refer to a distinction introduced by Cummins between basic interpersonal communicative skills and cognitive academic language proficiency ("Cognitive/academic"). The distinction was intended to draw attention to the very different time periods, typically required by immigrant children to acquire conversational fluency in their second language as compared to grade-appropriate academic proficiency in that language. Conversational fluency is often acquired to a functional level within about two years of initial exposure to the second language whereas at least five years is usually required to catch up to native speakers in academic aspects of the second language" (Cummins, "Age on Arrival").

This curriculum unit will help second language learners acquire academic proficiency in the areas of math/science in measurement. This curriculum unit will help the students not only read meaningfully to make sense of the word problem but also include language acquisition strategies that will help them learn effectively.

In this unit, I will use children's books that will make the math/science measurement concepts easier for the second language learners to understand. When reading to them or reading with them, these books will keep them engaged in learning. Their interest level will increase the abstract concept in linear measure, volume, weight, and capacity. It will be a great way to learn English through the math and science connection.

Since my students are challenged with measurement, I intend to give more hands-on activities so that they will experience measuring area, perimeter, volume, and mass. In doing so, the abstract concept becomes concrete. Students will measure objects or items that they can relate to, such as their growth development and measuring ingredients when they are baking or cooking.

This unit will help students understand not only the measurement concept but also the ability to compare and use the language of comparison, such as tall/taller or greater than/less than. They will improve their organization skills in sorting and classifying objects. Students will learn how to read with good comprehension skills, how to solve real world problem (understanding the given information), use problem solving strategies, and communicate in oral and written language how they solve measurement problems.

UNIT BACKGROUND

Measurement is defined as the estimation of physical quantity, such as length, temperature, or time. Measurements find the ratio of some physical quantity to a standard quantity of the same type. Thus, a measurement of length is the ratio of a physical length to a standard length such as a standard meter. The concept of measurement is one of the most complex areas in the mathematics curriculum. Students find measurement abstract. They are challenged to compare things with a unit having the same attribute.

Measurement is taught from the primary to the upper grades. In spite of the textbooks provided to the students, there are gaps that occur when students learn the concept without depth. There are several reasons for the gaps. Perhaps students are rushed through the topic because there are more topics to teach. Teachers have to complete the curriculum and prepare the students for promotion standards assessment. The teachers have to comply with the state mandated curriculum.

When it comes to real world problems application, the students are confused with measuring; for example, the perimeter or area of a football field. Sometimes when given objects to measure like a pencil, using the metric ruler, which unit is applicable to the pencil's measurement? This unit will be using literature books to introduce standard measurement, and the lesson plans will

have hands-on activities in order for the students to experience matching or covering or filling with the objects attributes using different tools.

Teachers know that measurement is one of the important parts of a math/science elementary school curriculum. The students should learn nonstandard/standard measurements and the English US customary units of measurement. They should be able to use measuring tools, such as metric rulers, meter sticks, yardsticks, and tape measures. In the science lab, students in the upper grades should be familiar with the other measuring tools, such as graduated cylinders, beakers, and triple beam balances. These mathematical skills are assessed in the Texas Assessment of Knowledge and Skills for fifth grade math and science. Passing these tests is part of Houston Independent School District's standard promotion to the next grade level.

Nowadays, students have limited opportunity to use measuring in the classrooms. For this reason, measurement becomes an abstract concept. There are very few students who can relate to measuring liquids and solids. They have had no actual experience of using measuring cups or measuring spoons in their daily lives. In the classrooms, students are challenged to measure the length of objects like a string in centimeters. When given a ruler, the students have difficulty differentiating the millimeters from the inches.

English language learners have to learn the English language and the language of math and science. When solving word problems that involve estimation and measuring weight using ounces and pounds, they have a hard time understanding the problems. For this reason, the curriculum unit will cover nonstandard/standard measurement, customary units (US), and the metric system. To cover these topics effectively, there will be two parts. Part one of the unit will be a review of using nonstandard units, and the other part will be standard units of measurement which will include the customary units (US), such as inches, feet, yards, and miles and the Metric System.

Therefore, to start the measurement unit, I will establish a "discover and try out" approach in my classroom. I will begin the unit with an activity to engage them by brainstorming a list of all areas where they see numbers. I will record their responses on a chart paper and post it in front of the class. The title of my list will be "Numbers from Everywhere." From this list, the students will create another list with the title, "The Different Ways We Measure." I will put my math resources together by sharing with the students the collection of children's books in math and pointing out the five books based on the mathematical concept of measurement; I will also send home a letter asking parental support by helping them locate games and toys designed to teach the measurement concept. I will display these things on a table, then ask the students to explain what they have learned from their games or play things. I will also invite specialists who rely on measurement to do their work. One part of their evaluation is to ask the students to create a collage of people showing how they use measurement in their everyday lives.

Part I. Nonstandard Units of Measurement

For the nonstandard measurement, students will review how they first learned measuring different objects. When the objects are flat and straight, they should find the length. One of the activities in the classroom is for the students to find the length of the teacher's table. They can line up M&Ms or jelly beans to find the length from end to end and figure out how many M&Ms or jelly beans they used in all. Then they could measure the student's desk and use the numbers to compare which desk is longer or shorter.

Research shows that there are several ways to teach math effectively like teaching students how to use manipulatives. Literature is also another tool to teach them successfully. Using mathematics children's books gives children a way to make learning fun and more personal. Children can relate to the characters which make the book meaningful to them. Also, the books

will provide them with easy yet meaningful stories about problem solving in the real world. They will increase their vocabulary, improve their fluency and understand the concept of measurement.

In mathematics, teaching children how to solve problems is one of the major elements of instruction. One of the literature books that I would like to use to introduce the unit is *How Big Is a Foot?* written by Rolf Myller. The students will learn how objects are measured with nonstandard and standard units. They will compare measureable characteristics of different objects on the same dimensions. The teacher will keep the students engaged, exploring, explaining, elaborating and evaluated throughout the lesson. This is called the 5 E model of instruction.

How Big Is a Foot?

In this unit the students must be kept engaged. The students should be allowed to predict what the story is about. Their responses must be recorded on the board or on a separate chart. Read aloud the story and check for comprehension. Discuss the vocabulary words: measurement, nonstandard measurement, and estimation.

The following activities are suggested in order to maintain the students' interest. For instance, ask the students to act out the story so they can show how different sizes of feet would result in different measurements of the Queen's bed. Ask them to make simple props for the creative play. Students can make different kinds of hats for the characters in the story, such as the king, queen, and the prime minister. They can use different kinds of baseball caps for the other characters, like the head carpenter and the carpenter's assistant.

The students will create a display of Math Tools, such as a tape measure or a ruler to measure the physical dimensions, a thermometer to measure temperature, a wrist watch to measure time, and other measuring tools like measuring cups, measuring spoons, scales, medicine droppers, pedometer, and many others.

For art, the students will trace their own feet and hands on construction paper. They will cut traced feet and hands and punch a hole on the top part of each shape. Tie their traced shaped with a yarn, and they will have created their own set of measurement tools to use with activities like measuring how many hands tall is his/her desk, how tall is a friend, and how tall is the teacher's desk.

Part II Standard Units of Measurement

According to Van de Walle and Lovin, measurement is a difficult area of the curriculum. The state mandates that students should learn measurement at every grade level. Mathematics textbooks are designed to meet the needs of the students and present all the information. I mentioned earlier that teachers have to cover many topics and prepare for standardized testing. So the students who are below average in their grade level get confused and develop gaps in their learning.

The curriculum unit will have four concepts of standard measurement and four math books. Lesson one will be on linear measurement for length, width and height. The math literature for this lesson is *Actual Size,* written by Steve Jenkins. *Sir Circumference and the Sword in the Cone,* written by Cindy Neuschwander, relates to volume and capacity which will be discussed in the second lesson. *Millions to Measure* written by David M. Schwartz and illustrated by Steven Kellogg will deal with length, weight, and volume measurement. The last lesson will be on time measurement and will be explored using *Time Math,* written by Kieran Walsh. To better understand the literature and math connection the description of the books will be discussed in the paragraphs that follow.

Actual Size

Steve Jenkins book, *Actual Size* is about large and small animals. The animals are pictures of their actual size. Readers can see the real size of these creatures. Some of these creatures are the atlas moth, the dwarf goby, and the giant squid. The atlas moth has a wingspan of 12 inches. It is so large that the moth is mistaken for a bird. The fish, dwarf goby is the smallest fish because its length is only ½ inch. The giant squid body and tentacles has a measurement of 59 feet long and its eyes are12 inches across. This amazing book will motivate the students' interest in science as well as in math. The vocabulary words in this book are : creatures, large, larger, largest, small, smaller, smallest, dwarf, giant, moth, ostrich, anteater, termites, tarantula, reptile, and pygmy. At the end of the book, each animal is given a scientific description and its habitat.

Estimating and measuring weight using customary units will be taught next for guided instruction. A mini lesson for measuring weight will be on ounce (oz.) and pounds (lb.). The students will work with the teacher on a sample problem. There will be 3 steps to solve this problem. Step 1 is to know how heavy each object. Step 2 is to change the weights into ounces. Step 3 is to compare the weights. The solution will be knowing which object is the heaviest and the lightest. The vocabulary words will be ounces, pounds, heaviest and lightest. TEKS' application will be knowing what would be the reasonable unit for measuring weight of objects or items, such as a baby's weight, a piece of paper, a bag of oranges, a can of juice, and many others. Students will convert ounces to pounds or pounds to ounces and a combination of pounds and ounces. The final activity will be to complete the chart and use it to solve each real world problem.

Sir Circumference and the Sword in the Cone: A Math Adventure

This story will motivate the students to learn about shapes, dimensions, and the revised version of the Knights of the Round Table. Show the book to the students and ask them to give their ideas on what the story is all about. Record their responses on a chart and put it up on the board. Introduce the major characters in the story namely King Arthur, Vertex, Radius, Sir Circumference, and Lady Di of Ameter. Define the meaning of the following words: Edgecalibur, knight, parchment, heir, measure, face, points, shapes, cube, pyramid, rectangular prism, triangular prism, cylinders, and cones.

King Arthur wants to choose an heir to the throne. So he asks all of his knights to find the sword Edgecalibur that he has hidden. The competing knights will have to solve the puzzle and the clues that King Arthur has given them on the parchment. There are strange drawings of two dimensional shapes, such as parallelograms, polygons, triangles, and circles. Vertex, one of the knights, goes to the courtyard with his best friend named Radius. They see other knights trying to find Edgecalibur. One knight is carving solid shapes. Another knight is counting the edges of each stone in the castle. The third knight is inspecting the points of several swords. Vertex and Radius go to a secret tunnel and with the help of the carpenters explained to them the strange drawings on the parchment. Their adventures begin. Vertex and Radius start identifying the different shapes and make models of each shape. They use the clues of measurement and go around the castle, on the tower, and everywhere. The story ends with Vertex discovering the cone with Edgecalibur in it. He explains his measurement strategies to the king. So King Arthur gets Edgecalibur and knights Vertex. Prince Vertex becomes his successor.

After reading the story to the students, ask questions and allow time to reflect what they have learned in the story. Then build up a discussion of what happened in the story. Define solid shapes and explain what happens when they are flattened out. Tell them that Vertex used the solid shapes to make shapes with height, length and width. Show students how to cut and fold shapes to make a cube. A cube has 6 square sides/faces, 8 corner points, and 12 edges from where the

faces come together. Explain that shapes are cubes, pyramids, rectangular prisms, and triangular prisms. They have flat faces, corner points, and straight edges.

To meet the standards, the students will learn shapes and solids in terms of vertices, edges, and faces. The mini lesson on vertices, edges, and faces will teach the students that they can describe plane shapes by the number of vertices and sides. Explain polygons and vertex. Show students some common polygons, such as the triangle, quadrilateral, pentagon, hexagon, and octagon. Quadrilaterals have special names and features. These are the rectangle, square, trapezoid, parallelogram, and rhombus. Solve a real world problem with the students for guided instruction.

Give the students another problem for a solid shape with 3 dimensional figures. Explain face, edge, and vertex. Give examples of the solids that have polygon faces, namely a cube, a rectangular prism, a triangular prism, a square pyramid, and a triangular pyramid. Solve the problem with them. Also, explain to the students that cylinders, cones, and spheres have curved surfaces. For independent work and TEKS application, ask the students to do the following activity: Choose the plane shape from a given table that matches the written description and circle the face that is similar to the side of the solid figure.

Millions to Measure

Marvelosissimo, the Mathematical Magician, explains in this book by David Schwarz that there are millions of things to measure and almost as many ways to measure them. He explores the invention of length, weight, and volume measurements. A group of children travels through prehistoric time. They see prehistoric children who were thinking about distance when they were racing. There is this little boy who asks his dad how tall he is. So Marvelosissimo waves his wand and a bright idea of measurement came up. The prehistoric children think about feet. Then he waves his wand, the wizard introduces the world of metrics, and makes it easy to understand the basic pattern of meters, liters, and grams. Marvelosissimo shows the children that rulers were made a long time ago. At first it was hard to know which ruler would measure best. But gradually the people learn how to use the same standard ruler in any part of the world. Steven Kellogg's illustration makes math delightful!

Start the lesson with brainstorming what the book is all about. Record the students' responses on a chart and display it on the board. Introduce the vocabulary words in the story: distance, size, weight, accurate, heavyweight, tons, volume, pint, quart, gallon, solid, liquid, and kilo. Read aloud the story to the students and ask comprehension questions as you read each page. After reading the story explain to the students why measurement is important.

There are three countries in the world using the English or the customary system of measurement. Two of them are Liberia and Myanmar (formerly named Burma) and the United States of America. That means units of measure in length and distance use are inches, feet, yards, and miles. Weight is use to measure in ounces, cups, pints, quarts, gallons and barrels. The other countries of the world are now using the Metric System. David Schwartz explains that a spacecraft was designed to orbit Mars on September 23, 1999. However, it was lost in space because the scientists/people who built the Mars Climate Observer used English units. The operators used metric units.

Schwartz also explains in his book that during the French Revolution in 1700s, the king and queen were overthrown. The new government was democratic. Some of the influential French did not like the idea of using units of measurement that reminded them of the former royal government. They also wanted their units of measure scientifically based so they recognized the metric system. The French officially called this term *Systeme International* (SI), meaning "International System." Furthermore, this book explains in simple language: understanding

metric units, the use of the metric system, the all important metric number, the most amazing thing of all about the metric system, and think metric.

The mini lesson that will meet the standards is for the students to estimate and measure capacity using standard units using cups, pints, quarts, and gallons. They will also identify the mathematics in everyday situations. Explain to them capacity and the customary units for measuring capacity. Solve a problem with guided instruction. Explain how to change from one unit of capacity to another. For independent practice ask the students to choose a reasonable unit for measuring the capacity of each container like a glass of milk (fluid ounce, cup, pint, quart, or gallon). The students will also estimate how much a container would hold; for instance, would a sink hold 5 gallons or 5 quarts? The last activity is word problem solving.

Time Math

This is one of the most interesting books for children on time. The attractive front cover shows pictures different kinds of wrist watches. The book has a variety of information on time, such as clocks, military time, time zones, calendars, and A.D. and B.C. time. There are also time word problems. Included in this book are science and social studies information. In science, it shows how much time it takes the Earth to revolve around the Sun. The book also shows how different people use different calendars. This book presents time math facts in a fun way!

Present the book to the students and brainstorm different ideas of what the book is all about. Record their responses on a chart paper and display it on the board. Go back to this chart after reading the book to the students and discuss their different predictions. Define the following words and ask the students to use them in sentences: time, seconds, minutes, hours, days, months, year, decade, century, and millennium. Ask the students to check their comprehension skills.

To meet the standards the students should be able to measure and solve problems involving time and temperature; identify the mathematics in everyday situations; and the use of tools, such as real objects or manipulatives, to solve problems. Students can use what they have learned about time and temperature to solve problems. For example, define elapsed time. It is the amount of time that passes from one time to another. Temperature is the measurement of how hot or cold an object is. Fahrenheit (F) is the customary unit for temperature. Celsius (C) is the metric unit for temperature. Use guided instruction to help the students solve problems on elapsed time. Independent practice will be solving word problems involving time and temperature.

Conclusion

Mathematics is an integral part of our everyday lives. At home children learn how to measure a glass of milk, a glass of water, a spoonful of sugar, a small bowl of cereal, a large bowl of cereal, and how many chicken nuggets they should eat for lunch or dinner. All these activities relate to numbers. Measuring concrete objects is easy for them. However, students encounter difficulty when asked to measure length, width, height, capacity, volume, and time. The abstract part of measurement is hard for them. The curriculum unit integrates math/science and reading language arts to enable the students to learn effectively the language of math and the English language as a whole. The math related books are powerful tools to help the learners understand abstract mathematical concepts. As each page is read the students will see colorful illustrations, vivid language, and mathematical information which are the concentration of the lessons.

Teachers must have the "whatever it takes attitude" to provide instruction and assessment that will bridge achievement gaps. The 5 Es- Model of Instruction needs to be incorporated in teaching this unit. Authentic examples need to be used to keep mathematics real and relevant to the students. Teachers should also give ample hands on activities integrating math and other content areas. They must plan activities that will help the learners with actual measurement as well as solving real world problems. The activities in this curriculum unit will help students

become critical thinkers who are ready to take on problems that involve higher order thinking skills like analyzing, synthesizing and evaluating. As a result the students become productive members of the society.

LESSON PLANS

Lesson 1: Nonstandard Measurement: *How Big Is a Foot?*

This is an introduction to math measurement comparing students' feet size and their height.

Objectives: The students will understand the importance of accuracy in measurement.

- TEKS Math 5.10C Select and use appropriate units and formulas to measure length, height, perimeter, area and volume in customary system and SI (metric system)

- ELA 5.10A Activate his/her own knowledge and experience to comprehend

Materials: Copies of *How Big is a Foot?* by Rolf Myller, paper crowns, baseball caps, cardboard, tape, construction paper

Procedures

Present the book to the class. Ask the students to make their own predictions about the book. Write the students' responses on a chart and display it on the board. Introduce the vocabulary words: measure, nonstandard, foot, and estimation. To check for understanding, ask comprehension questions. Allow the students to work with their partners and write a summary of the story. Each pair will read aloud its work. Show students a sample of the teacher's cut out foot. Distribute the cardboard or construction paper and instruct each student to trace an outline of his or her shoes on the construction paper. Students will predict how many shoes it takes for to equal their height. Record their predictions on another chart. Work with their partner again and measure each other's height using their traced shoes. Ask the students to record their actual measurement. They will compare and contrast their estimated and actual values.

Assessment: This is a pair activity and each pair will get grades from the estimated and actual measurement of students' height. The formal assessment will be the TAKS/TEKS correlation word problems.

Lesson 2: Linear Measurement: *Actual Size*

TAKS Objective 3: The students will be able to demonstrate an understanding of geometry and spatial reasoning. TEKS ELA ELA 5 (1.13A) Listen to variety of genres being read aloud. The students will visualize measurements and mathematical proportions, which, in turn, teaches ratio.

Materials: Copies of *Actual Size* written by Steve Jenkins, journal, pencil, Venn diagram, Compare/ contrast charts

Procedures

Present the book to the students. Ask them to describe the front and back cover of the book. Guess which animal has that huge hand and name the tiny animal that is on the huge hand. Can they name the spider? Ask the students to name small and large animals. Write their responses on a chart paper. Define the words actual size and measurement. Read aloud and discuss the story. As each page is read encourage the students to comment on what they may find interesting. Record student's ideas or responses on chart paper. Ask the students to complete a chart with the animal's name, physical attributes, and actual measurement. Encourage them to use figurative language in describing the animals in the story. For example, the flea is as tiny as a dot.

Assessment: Ask the student to work in pairs. Each pair will research on two animals and describe its related attributes. Compare and contrast the two animals. Use a Venn diagram to

illustrate their comparison. Find a measurement tool that will show their actual size. Illustrate and write about their animals. Solve word problems that show TEKS/TAKS correlation.

Lesson 3: Capacity and Volume: *Sir Circumference and the Sword in the Cone*

Objectives: Math 5.10C Select and use appropriate units and formulas to measure length, length, perimeter, area and volume in customary system and SI (metric system). Sci.5.2B Collect and analyze information by observing, measuring and using numerical operations such as addition, subtraction and scaling. ELA 5 (1.13A) Listen to variety of genres being read aloud.

Materials: Copies of *Sir Circumference and the Sword in the Cone* written by Cindy Neuschwander, journal notebook, models of three-dimensional figures, polygons and quadrilaterals.

Procedures

Show the book to the students and ask them to predict. Encourage a discussion on riddles. Record their responses on chart paper and display it on the board or the resource center. Explain the vocabulary words: riddle, knight, parchment, shapes, height, length, width, and three-dimensional figures. Read and discuss the story. Allow the students to ask questions or comment on their ideas. Students work in pairs to summarize the story orally and then write their summary. Before moving on to the literature-math connections, ask questions to check their understanding. Divide the students in groups of three or four and ask them to act out the story.

Describe plane shapes and the number of vertices and sides. Explain a polygon and a vertex. With the teacher's guided instruction, solve one problem. Ask them questions about the physical attributes of a Bus Stop sign. Discuss the plane shape, the number of sides, and the number of vertices. Guide the students again to solve another problem on solid shapes with three-dimensional figures. Explain to the students the features of the figure to solve the problem and also include solids that have curved surfaces. Give individual students unfolded or flattened cereal, cookie, tissue, or pencil boxes. Ask them to reconstruct the box of their choice and write a description of the 3-dimensional figure.

Assessment: Grade the students with their reconstructed boxes and written work individual. Also give them independent work that will apply the TEKS objectives. Students will solve problems on vertices, edges, and faces.

Lesson 4 Length, Weight & Volume: *Millions to Measure*

Objectives: Math 5.10A students will perform simple conversions within the same measurement system. ELA.5.1B Interpret, compare and represent text ideas through a variety of response options such as journal writing, discussion, enactment, timelines, outlines, and media production.

Materials: Copies of *Millions to Measure* by David Schwartz and illustrated by Steven Kellogg, construction paper to make the wizard's hat, pencil and journal notebook.

Procedures

Read the title aloud and show the book to the students. Encourage them to look at the cover closely and predict what the story is all about. Record their responses on a chart paper and display it on the board or resource center. Define the following words: wizard, millions, prehistoric, volume, distance, container, standards, heavy weight, fraction, metric system, pronghorn, mass, kilo, and massive. Allow the students to make their own sentences using the vocabulary words. Read aloud and discuss the story. Encourage the students to ask questions or comment as you read along. Check their understanding by asking comprehension questions. After the reading and discussing the story, divide the students in groups of three and ask them to summarize the story.

Explain to the students some math ideas, and tell them to add more to your list of math ideas in the story.

For guided instruction, teach the students how to estimate and measure weight using standard units and identify the mathematics in everyday situations. Show them how to solve word problems using ounces and pounds. For critical thinking skills, ask them to think of a reasonable unit for measuring given objects, such as a basket ball, a teaspoon, and a bag of grapefruit. Use estimation to find the weight of certain objects, such as the weight of a sandwich, a rubber band, or an eraser. Give students a chart that shows one pound equals sixteen ounces, two pounds equals *blank* ounces, etc. Next, teach them how to estimate and measure using standard units, including grams and kilograms. Guide them on problem solving in comparing the mass of objects like a watermelon. For example, James picked a watermelon that has a mass of 3,000 grams. Andrew picked a watermelon that has a mass of 4 kilograms. Whose pumpkin will cost more? The cost of the watermelon is $3.00 per kilogram.

The students will continue to estimate and measure capacity using standard units, including cups, pints, quarts, and gallons and identify the mathematics in everyday situations. With guided instruction, explain how to change from one unit of capacity to another. For example, to change smaller units to larger units, divide. To change larger units to smaller units, multiply. They will also work on problems to demonstrate their understanding of the concepts and the uses of measurement.

In addition to the lessons above, students will measure to solve problems involving length, perimeter, and area. Explain to the students that the perimeter of a figure is the distance around it. The area of a figure is the number of squares needed to cover it. Guide them to solve a problem on finding the perimeter of a fence. Also, explain that rectangles will help them find the perimeter. Give another example using the metric ruler to measure the distance on the map.

Assessment: Group work will be graded according to their summary presentation. For math connection, students will be asked to work independently to solve word problems that are TAKS/TEKS correlated.

Lesson 5: Time: *Time Math*

Objectives: Math 5.10A Students will perform simple conversions within the same measurement system. The students will measure to solve problems involving time and temperature, identify the mathematics in everyday situations, and use tools such as real objects or manipulatives to solve problems. ELA 5 (1.13A) Listen to variety of genres being read aloud. ELA 5.10A Activate his/her own knowledge and experience to comprehend

Materials: Copies of *Time Math* by Kieran Walsh, clocks, watches, thermometer, journal notebook

Procedures

Generate curiosity and ask the students to predict what the story is all about. The front cover illustration shows different kinds of watches. Generate curiosity by asking them what those watches are for. Record students' responses on chart paper and display it on the board or resource center. Define the following words: time, elapsed time, time difference, Greenwich Mean Time (GMT), seconds, minutes, hours, days, and months. Read aloud and discuss the story. To check for understanding, allow the students to answer comprehension questions. Pair them up and ask them to explain orally what the story is all about. After their explanation, give the students time to write their journal responses.

Try this activity for fun. Students work in pairs. Have them get a sense of activities they can complete in a minute. These are as follows: How many words can you read per minute? How

many odd numbers can you write in a minute? How many times can you sing a familiar song like "Twinkle, Twinkle Little Star"? How many times tables can you write in a minute? How many names of your friends and classmates can you write in a minute?

Another fun activity is to figure out how long does it takes to do something. Brainstorm a list of everyday school activities. How long does it take to sharpen a pencil? How long does it take to erase the board? How long does it take to go to the science lab? How long does it take to go to the cafeteria? Divide the students in groups to do the estimates. Then do the same activities and find the actual elapsed time.

Explain to the students how to solve elapsed time word problems. Give them one example and explain clearly the strategies used to solve the problem. Another problem to explain will be finding the date of someone's birthday by using a calendar. Next mini lesson will be on temperature. Provide the students another example, such as a cup of hot milk, and put in the thermometer to find out how hot it is.

Assessment: Students write their ideas about *Time Math* in their journal. For independent practice use the TAKS/TEKS correlation problems. Use and activity sheet and give individual grades.

ANNOTATED BIBLIOGRAPHY

Works Cited

Cummings, J. "Age on Arrival and Immigrant Second Language Learning in Canada: A Reassessment." *Applied Linguistics* 2 (1981a): l32-l49.

---. "Cognitive/academic Language Proficiency, Linguistic Interdependence, the Optimum Age Question and Some Other Matters." 2007-2008. *Revised Mathematics Chart Working Papers on Bilingualism* 19 (1979): 121-129.

Jenkins, Steve. *Actual Size.* Boston, MA: Houghton Mifflin Company, 2004.
  This book illustrates visually stunning facts and figures of both large and small animals.

Myller, Rolf. *How Big Is a Foot.* New York: Yearling, 1991.

Neuschwander, Cindy. *Sir Circumference and the Sword in the Cone:A Math Adventure.* Watertown, MA: Charlesbridge, 2003. King Arthur hides "Edgecalibur" in a geometric solid. Sir Circumference, Radius, and Sir Vertex search for the sword.

Schwarz, David. *Millions to Measure.* New York: Harper Collins Publishers, 2003.
  This book explores the invention of length, weight and volume measurements. Marvelosissimo, the Mathematician wizard, introduces the Metric System.

Van de Walle, John A., and LouAnn Lovin. *Teaching Student Centered Mathematics Grades 3-5.* Boston, MA: Pearson Education Inc., 2006.
  The book provides great informational resources in math for teachers use.

Walsh, Kieran. *Time Math.* New York: Rourke Publishing LLC, 2006.
  This book of time shows that math is around through a variety of time pieces, time zones, years, and calendars.

Supplemental Resources

Bennet, William J., Chester E. Finn, and John T. E. Crib. *The Educated Child: A Parent's Guide from Pre School Through Eighth Grade*. New York: The Free Press, 1999.
  This is a comprehensive and easy book for parents to use to understand the curriculum from Pre-K to Eighth grade.

Billstein, Rick, S. Libeskind, and J. Lott. *A Problem Solving Approach to Mathematics for Elementary School Teachers 8th Edition.* Boston, MA: Pearson Education, Inc., 2004.
This book is designed to meet the educational needs of prospective elementary teachers who will be the future's high quality teachers.

Cooper, Terry. *Math Around You: Integrated Theme Units.* New York: Scholastic Inc., 1994.
This is a teacher's resource kit of integrated theme units for children.

Cummins, J. *"Bilingualism and Special Education: Issues in Assessment and Pedagogy."* *Multilingual Matters.* Clevedon, GB, 1984.

---. "Empowering Minority Students: A Framework for Intervention." *Harvard Educational Review* 56 (1986): 18-36.

---. "Negotiating Identities: Education for Empowerment in a Diverse Society." Los Angeles: California Association for Bilingual Education, 1996.

---. "Putting Language Proficiency in Its Place: Responding to Critiques of the Conversational/academic Language Distinction," in J. Cenoz and U. Jessner (eds.) *English in Europe: The Acquisition of a Third Language.* Clevedon, GB: Multilingual Matters.

---. "The Role of Primary Language Development in Promoting Educational success for Language Minority Students." In *California State Department of Education (Ed.), Schooling and Language Minority Students: A Theoretical Framework.* Evaluation, Dissemination and Assessment Center, Los Angeles, California State University, 1981b.

Cummins, J., and M. Swain. "Analysis-by Rhetoric: Reading the Text or the Reader's Own Projections? A reply to Edelsky, et al." *Applied Linguistics* 4 (1983): 22-41.

DuFour Richard, Rebecca DuFour, R. Eaker, and J. Karhanek. *Whatever It Takes. How Professional Learning Communities Respond When Kids Don't Learn*. Bloomington, IN: Solution Tree (formerly Education Service), 2004.
The book suggests school wide interventions when a student does not learn or experiences difficulty in his/her learning.

Harcourt Brace. *Math Advantage.* Chapter 14.4 Grade 5 Student Book Math Resource adopted for Houston Independent School District.

Harris-Stewart, Charmaine, et al. *Measuring Up to the Texas Essential Knowledge and Skills and Success Strategies for the TAKS Mathematics*. Saddle Brook, NJ: The Peoples Publishing Group Inc, 2005.
This book is one of the math resources for students use in Houston Independent School District and the lessons cover all TEKS.

Region IV Math Benchmarks. Teachers resource that provides performance assessments to check students' mastery as a result to TEKS based instruction.

Spano, Marie, et al. *Measuring Up to the Texas Essential Knowledge and Skills and Success Strategies for the TAKS Science*. Saddle Brook, NJ: The Peoples Publishing Group Inc, 2005.
This book is one of the science resources for students use in Houston Independent School District and the lessons cover all TEKS.

Zemelman, Steven, Daniels Harvey, and Arthur Hyde. *Best Practice. Today's Standards for Teaching and Learning in America's Schools*. New York: Heinemann, 2005.
This book explains how American schools have changed dramatically. It gives teachers information and strategies that will help teachers become effective in the classroom.

Websites

<http://falcon.jmu.edu/~ramseyil/mathpict.htm>.
The website states the usefulness of Children's Literature in Mathematics Instruction by Meghan Eddy.

<http://www.mathbenchmarks.org>.This website provides math benchmark assessments designed to assess students' mastery as a result of TEKS based instructions.

<http://www.utdanacenter.org/mathtoolkit/>. The website provides resources for implementing the mathematics TEKS and strengthening mathematics education in Texas.

<http://dept.houstonisd.org/curriculum/math/HAPGResources.html>. (Episode algebraic reasoning pattern) Houston Independent School District Curriculum Planning Guide for Mathematics 5th Grade.

<http://dept.houstonisd.org/curriculum/math/HAPGResources.html>. 2007-2008 Revised Mathematics Chart Houston Independent School District Curriculum Planning Guide for Mathematics 5th Grade.

<http://www.intel.com/corporate/education/emea/eng/za/elem_sec/tools_resources/plans/measure/measure. html>.This website brings technology and resources in the classroom.

<http://www.brainpopjr.com/math/measurement/inchesandfeet/grownups.weml>. The teacher resource website provides educational movies and homework for elementary students.

<http://www.eduref.org/Virtual/Lessons/Mathematics/Measurement/MEA0212.html>.

<http://www.readwritethink.org/lessons/lesson_view_printer_friendly.asp?id=822>.