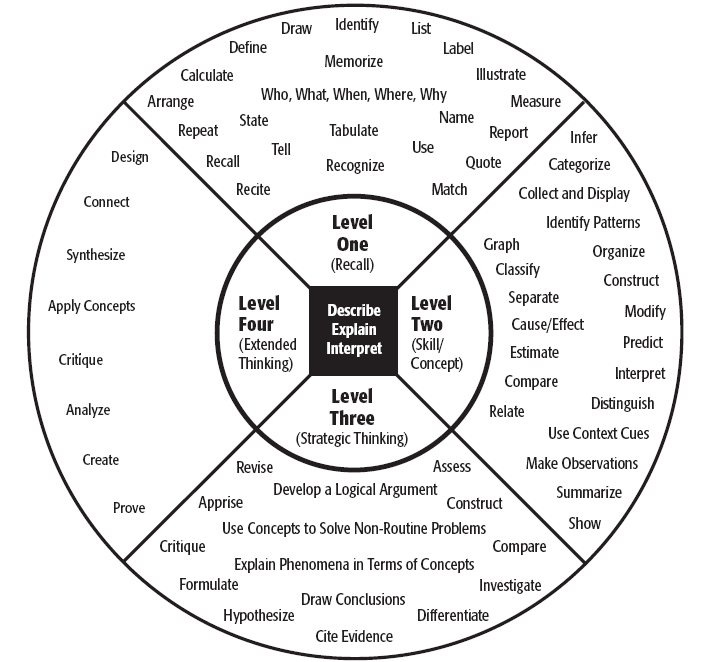
**Distinguishing Between Linear and Area Measurements and Finding Surface Area**

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| Standard(s): Lead Standard 6.G.4  Solve real-world and mathematical problems involving area, surface area, and volume  Supporting Standards  3.MD.5 Recognize area as an attribute of plane figures and understand the concepts of area measurement  a. A square with side length 1 unit, called “ a unit square”, is said to have “one square unit” of area, and can be used to measure area b. A plane figure which can be covered without gaps and overlaps by *n* unit squares is said to have an area of *n* square units  3.MD.6 Measure areas by counting unit squares (square cm, square m, square in, square ft and improvised units  3.MD.7a Find the area of a rectangle with whole number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths  4 MD.3 Apply the area and perimeter formulas for rectangles in real world and mathematical problems  6.EE.1 Write and evaluate numerical expressions involving whole number exponents  6.G.4 Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems | Instructional Shift(s) and Explanation:  Shift One-Focus: Students must focus on the concept of area and surface area of rectangles and squares in this lesson. The students will use hands-on activites to deepen their understanding of these foundational formulas.  Shift Two-Coherence: Students will start with the simpler concept of area and move into the ideas of surface area and how exponents and variables are used in the actual formulas  Shift Three-Rigor:Students will be required to apply the concepts learned to real-life situations. |
| Length of Lesson: 3-3 ½ hours | **EFL’s Targeted: B, C /grade levels 3-6** |
| Materials and Resources Needed:For students: Worksheets1-6, nets, calculators, , boxes, ¼ inch graph paper, scissors, tape, string, centimeter rulers , cut-out centimeter squares, colored pencils or markers, rulers/measuring tapes, ribbon, Common Core Basics Mathematics book (one site where lesson is being taught does not have access to the internet or computers)  For teacher: answer keys to handouts, net for Box A, box to take apart, string to show linear measurement vs surface measurement, and all those supplies that the students have | |

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| Objective  Students will be able to understand what a squared number represents and recognize that area in a plane figure is a combination of square units and how length times width results in square units | DOK Level(s)  2 | Activity(ies)  Fill in the rectangular and square shapes with tiles on handout #1 | Assessment(s)/Check(s) for Understanding  Observation of student work |
| Students will be able to calculate the perimeter and area of a rectangle and recognize that we label area in square measurements vs linear measurements for perimeter | 2 | Activity #1, 2,  (continuation of activity with handout #2) | same |
| Students will use the nets to create a create a rectangular prism and calculate its surface area | 2 | Design a cubed stool. Figure surface area (net of a cube) Handout # 3 | Observation of student work |
| Students will then use what they have learned about surface area in real-world problems | 3 | Figure amount of gift wrapping needed for Box A and Box B  Handout #4 | Collection of student work  and Handouts #5 & 6 |
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*\*Objectives should be tied directly to DOK Levels, an activity, and a form of assessment.*

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| Lesson Flow |
| Warm Up/Introduction: Ask students what they remember from previous lessons about exponents. Ask them to give examples of exponents in action and discuss how problems like 3x3 can be written as 32 . Then ask about what other words they know that are related to this specific exponents(squared) Then explain how the idea of squaring can apply to measuring using rectangles and squares. Asks“if you were buying a piece of carpet for a space that was 3 feet by 3 feet, what does that mean.” Ask “how is carpet bought “ and explain that if they don’t know it that carpet is always bought in square feet, yards, and other measurements. Show how the 3x3 shape makes a perfect square. Discuss other perfect squares and what is necessary to make it a perfect square. Then ask “if you were to carpet a small room that measured 6 feet by 7 feet. Would you still buy your carpet in square measurements?” |
| Direct Instruction/Classroom Activities1. Using the centimeter graph paper, have the students draw rectangular shapes that are 3x5, 2x4, and 3x3. Then have them cut-out a length of string that goes around the edge of the first shape (3x5). Once the string is cut, have them measure the string using the centimeter rulers. Once they have found their measurement, explain how they just found the perimeter of the shape and how that is a linear measurement –hence the string lays out in a straight line. Then ask the students what might be an easier way of finding the perimeter of the next shape. Hve them stretch the edge of the string over the width and write that measurement down, then over the length and write that down. How could they use those 2 measurements to find the perimeter for the next shape and then the 3rd one.  2.. Pass out Handout # 1, centimeter rulers and cut-out centimeter squares. Ask the students to measure the widths and lengths of all the shapes in centimeters. Stress how the outline represents a linear measurement only and how that makes the perimeter of the shape. Have them record it on their sheets (use the string here if necessary to outline a shape on the board)  Explain that several of the shapes have been rotated and how that does not affect what the area or perimeter are. Ask students if there are alternative ways to find the perimeter rather than just adding up all the sides. (square =4xside/rectangle=2xlength + 2x width). After completing the perimeter questions, have them fill in one square shape and one rectangular shape with the centimeter squares. Discuss how the perfect squares (like the 3x3) are filled with squares, but so are the rectangles which are not perfect squares . Discuss how the inside of the shape is called area because it has a length and width filling up a 2-dimensional space. Ask “what did we use to cover this space? (Squares) All area is measured in square units. In this case it is square centimeters because the measurement of the lengths and widths are in centimeters. Ask the class how we could figure out how many squares it would take to cover an area that is 22cm by 10cm? (we could multiply length times width to get an area of 220 square centimeters) Have them finish the area problems on this worksheet. Remind students that perimeter is a linear measurement, but area is ALWAYS IN SQUARE UNITS, so they will have to label the area measurements as squared measurements, not squared numbers  2a. Individual practice using handout #2  3. Pass out Handout #3. Ask students what they think it is? Discuss. Explain that it is a 2-dimensional drawing of a 3-dimensional figure. We call these types of drawings “nets”. Discuss how this net will make a cube. Tell the students that they are going to design this cube. It is the blueprint for a bean-bag stool. Explain that the colored tabs are not part of the net, they are just there to help us tape our final design together. Have the students figure the surface area of this cube and discuss that this measurement represents how much material is needed to make the cube-shaped stool, Ask if there is an easier way to figure the area? Dis cuss (Formula= 6s2) Allow students a few minutes to design and color their cubes and tape together. You could mention that if we were going to fill the cube with Styrofoam, we would be doing a measurement called “volume”, but that is for another time. Today we are only concerned with how much material we need to make the cube.  4. Review with students what they have learned from this part of the lesson. Have them verbalize the steps they went through to get their answers to check on whether they have gotten the concept.  Day 2 of lesson:  1. Take a box (called rectangular prism because it is 3-D and its sides are rectangles) measure and record the length, width and height. Cut the box so that it lays flat. Talk about its surface area. Using the graph paper, model how to make a net of the box. (Tell them that the scale is 1/4 “ is equal to 1 so drawing something 10” long would go across 10 squares on the paper. ) Discuss how there are 6 sides, but only 3 different shapes. Write the measurements of the box on the sketched net. How would we figure the surface area of the entire box? (Calculate all 6 areas and add together or calculate the 3 different areas, add them together and then multiply by 2. Think about a formula that would make this process simpler. (Surface area = 2x length + 2xwidth+ 2x height) ( An adaption would be to give each student group a box-but all boxes would need to be the same size so that everyone would be getting the same measurements)  5. Students can also figure surface area of rectangular prisms around the classroom such as filing cabinets, books, etc. (*Measuring tapes or rulers would be needed here so a review of how to read measuring devices would be necessary before doing this. It also would probably be best to round off to the nearest inch too.)*  2. Ask students if they have ever had a gift, gift-wrapped, or if they do it themselves. Discuss how easy it is to over-estimate or under-estimate how much paper that you need-making do with a bow over bare spots, etc. Pass out Hand-out #4. Explain that it is Christmas time and we are working in the gift department of store where we have to gift-wrap people’s purchases. We will do Box A together as a class and then students will work in pairs to do Box B.  1) on ¼” graph paper, make a net of BoxA (tell students to draw on graph paper in the landscape position for more room) You should have a net that is 24” by 19”. Add the 1 ½ “ overlap and the final dimension will be 27” by 22”  2) Convert yards to inches and you can see that 26 boxes across with 2 boxes deep will equal 52 wrapped boxes  3) Discuss exactly how a ribbon would look if you drew it on the net- One direction would be 2+15+2+15=34, and the other direction would be 2+10+2+10=24 (don’t forget the overlap=1 and the bow=48) so 34+24+1+48=107 ”  4) Change 100 yards to 3600 inches and divide by 107. You get 33 wrapped boxes with 69” left over..  5) Have students do BoxB with a partner. When they have completed the questions, go through and discuss the answers. |
| Recommended Strategies:Students will have the opportunity to use hands-on type activities before translating what they have learned to the worksheets |
| Differentiation options:Calculators will be given to those who need them Measuring tools, boxes and ribbon will be on each table for students to experiment with if necessary, Students will be assigned a partner (lower level math student will be paired with a higher level partner) |
| Assessments: Teacher observation while students are working independently and in pairs, worksheets will be collected at the end of class, Hand-outs 5 & 6, students verbalizing the steps they went through to get the numbers for their answers |
| Independent/Distance/Homework Options:  1) Students can go to [www.khanacademy.org/math/cc-sixth -grade-math/cc-6th-geometry-topic/](http://www.khanacademy.org/math/cc-sixth -grade-math/cc-6th-geometry-topic/), then click on “Geometry” on the right side; scroll to “Volume and Surface Are” then click on “Calculating surface area using net”. There is a video to watch. The next item is an interactive exercise figuring surface area from nets.  2) Students can go to [www.learner.org/interactives/geometry/area\_surface.html](http://www.learner.org/interactives/geometry/area_surface.html) (When typing in the address, there is an underline between the words “area” and “surface”)  3) Students can pick a box from the teacher’s supply or bring one of their own and without tearing the box apart, they can figure how much wrapping paper would be needed to wrap the box given a 2” overlap on each side. Then they could figure the amount of ribbon if the ribbon is wrapped around the middle of the box in both directions with a 1” overlap and another 45” for a bow.  4) Common Core Basics math book Ch12-sections 12.1-12.4, |

[](http://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=images&cd=&cad=rja&uact=8&docid=p30Z6fLBnETREM&tbnid=3BiBjse4ExeIOM:&ved=0CAUQjRw&url=http://theteachablemoments.wordpress.com/2012/03/08/dok-is-not-a-verb-and-it-is-not-blooms-taxonomy-in-a-circle/&ei=2VOYU-r5CtLNsQSpn4LgCA&bvm=bv.68693194,d.cWc&psig=AFQjCNEhpUPWlItP8Z9C6ZJLXC_1E7v7uA&ust=1402578252955798)**Lesson Planning Resources**

**Webb’s DOK Levels:**

DOK Level 1: Recall and Reproduction

DOK Level 2: Skills/Concepts

DOK Level 3: Strategic Thinking

DOK Level 4: Extended Thinking

*Every lesson delivered should hit more than one DOK level. For a more detailed explanation of DOK and a comparison to Bloom’s Taxonomy click* [*here*](http://blogs.mtlakes.org/curriculum/files/2012/10/Screen-Shot-2012-10-21-at-4.57.09-PM.png)*.*

**Standards & Instructional Shifts:**

Indiana Adult Education is using the College and Career Readiness Standards for Adults developed by OCTAE. You can access a copy of the standards [here](http://lincs.ed.gov/publications/pdf/CCRStandardsAdultEd.pdf) to assist you in identifying the standards aligned to and the instructional shifts targeted in your lesson plan

**A note about this lesson plan template:**

This lesson plan template was created in 2012 and revised in 2014 to better reflect standards based education and assessment changes. The original was designed by Indiana Adult Education Teachers during a statewide teacher meeting. In addition to identifying the required “components” of a lesson plan, teachers also contributed a list of “characteristics” of good lesson plans: *engaging, fun, visual examples, accommodates for learning styles, clear and concise, flexible within structure, allows for student ownership, includes modifications and adaptations, evokes passion, builds on previous knowledge, and appropriately reflects its audience.*