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| **Lesson Title**: Discovering How to Find Surface Area of Right/Rectangular Prisms  **Created by:** Kathleen DeMars | | | **NRS Level of Lesson:** 4 |
| **Intended Modality:** (check all that apply)  **x** In-person **x** Virtual **x** Hybrid | | | |
| **Content Area(s)** | **Targeted** [**IL ABE/ASE Content Standards**](http://www.excellenceinadulted.com/resources/abease-curriculum-project/) | | |
| **Math: 4.G.6 (2021)/4.G.10 (2014) - MWOTL** [The current standard elements are highlighted] | Solve real-world and mathematical problems involving area, volume, and surface area of two and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms. | | |
| **Integrated** [**Essential Employability Skills**](https://www.illinoisworknet.com/DownloadPrint/ILEssentialEmployabilitySkills-Handout.pdf) | | | |
| **x** Personal Ethic *(Integrity, Respect, Perseverance, Positive Attitude)* | | □ Teamwork *(Critical Thinking, Effective & Cooperative Work)* | |
| □ Work Ethic *(Dependability, Professionalism)* | | **x** Communication *(Active Listening, Clear Communication)* | |
| **Lesson Objectives *(Students will be able to)****:*   * Students will be able to answer this essential question:   *How can we solve for the surface area of a rectangular prism?*   * Students will understand the mathematical reason behind the procedure to solve for surface area. * Students will build their own formula to solve for surface area of a right prism (also known as a rectangular prism) and persevere to simplify it to make it more efficient. Simplifying the formula to make it more efficient is a possible extension. We are primarily concerned with conceptual understanding of how to construct surface area for a right prism. * Students will be able to apply the mathematical reasoning to real-world problems and math problems. | | | |
| **Engagement is not “one size fits all.” How are you providing multiple ways to engage all learners? Click on** [**Multiple Means of Engagement**](https://udlguidelines.cast.org/engagement) **to learn more about providing options for learners and explain how you are including this below:**   * **We will minimize threats and distractions** by having an established classroom community that begins on the first day. Students will have a concrete expectation of their routine where they may expect to warm up before diving into new material. This is evidenced on the first slide. The level of support will also vary during this lesson changing from very scaffolded to more independent to drawing conclusions in pairs or independently. * **We will foster collaboration and community** by allowing students to chat with one another either in person or virtually to discuss how to solve the next steps of our problem and to deduce what might come next in terms or synthesizing the formula from the separate parts. * **We will promote expectations and beliefs that optimize motivation** by providing prompts that are chunked to increase the length of on task orientation. The students will solve piece by piece in increasing complexity. Additionally, the application activity requires self-reflection when students are asked what they might do first, next, and last. | | | |
| **Key Vocabulary**:  **Surface area:** the sum of the areas of the faces of a three-dimensional figure. Finding surface area is an extension of finding the area of a complex figure. | | | |
| **Instructional Materials:**  Textbooks or online curriculum:  Google slides for conceptual refresher, lesson sequence, and performance task.  Google document for performance task.  Websites:  None | | | |
| **Lesson Activities:**  **Opening chat – building on prior knowledge:**  **1.Slide 1:**  Ask students 2 **review** questions solving the area of a square and a rectangle. One will show a mathematical problem and the other will provide a real-world scenario. Ask students to use the chat or unmute themselves to remind us how we find the area of a quadrilateral (*area = length x width*). This should be review. Remind students that area is measured in units squared because it measures the entire contents of the two-dimensional shape, not just around the edges, which is perimeter.  **2. Slide 2:** Show students a picture of a birdhouse that is in the shape of a right prism/rectangular prism. Include dimensions of the front face of the birdhouse. Tell students that the dimensions of the back face of the birdhouse are the same. Ask the students to determine the total area of the front and the back faces of the house. Give students a minute to work and instead of asking them for their answer, ask them to share what their brain was doing to find the total area of the two faces?  *Students will likely say that they added the two areas together to come up with a total area. Some students may say that they multiplied either the front or the back area times 2 because the dimensions of the front and back sides of the bird house are the same.*  3. **Slide 3:** Show students a picture of the same birdhouse from slide 2. Now include the dimensions of the left and right sides of the house. Ask students to find the area of the left side and the right side and then the two sides together. Give the students a moment to work. Ask them if they noticed anything similar or different between what they did in slide 2 and slide 3?  *We are guiding students to recognize that the process was the same but that the measurements were different. The face and back of the bird house were larger rectangles than the sides.*  4. **Slide 4:** Now that the students know the dimensions of the front side, back side, left side, and right side of the bird house, ask them if they have enough information to find out the area of the floor of the bird house?  *They DO have enough information: the length of the front of the bird house times the width of the side of the house will provide the area of the floor of the house. If students struggle, ask them guiding questions to create a pathway. For example, ask the students, “what was the length of the bird house in the front?” “How deep does the bird house go back into the yard?” “Is there a measurement that could tell us that?” “What do we know about solving for the area of a quadrilateral?”*  5. **Slide 5:** Finally, ask the students to solve for the area of the roof of the birdhouse. At this point, the students should be able to find the area without much assistance. Give them about 1 minute to figure it out. If they struggle, ask them to think back to how they solved the area of the floor.  *Again, ask students what their brains did instead of what the answer is. We want to build a foundation for how to find total surface area, not just zeroing in on this multiplication problem. Keep the essential question of the lesson in mind as you prompt the learners.*  6. **Slide 6:** This slide has the picture of the bird house along with a list of each of the areas that the students have solved for (front side, back side, left side, right side, floor, and ceiling).  The question on the slide asks students how they might figure out the area for all of the surfaces combined = the surface area of the entire bird house. Ask students to explain what their brains are doing by unmuting themselves or using the chat. (*Students should be totaling the 6 areas they’ve already solved for to come up with a total surface area for the bird house.)*  7. **Slide 7:** Shows the addition of all the areas to make a total. Walk the students through labeling what each side of the house could also be called:   * floor and ceiling: length x width * front and back sides: length x height * left and right sides: width x height   Ask students how many of each of those did we have? (answer: 2 of each)  Ask students if there is a rule that we could write to find the total surface area of a shape like this bird house (rectangular prism) that would work all the time?  Possible likely answers: lw + lw + lh + lh + wh + wh = surface area of right prism/rectangular prism  Simplified/Extended answer: 2lw + 2lh + 2wh = surface area of right prism/rectangular prism  8. **Slide 8:** Show the bird house with all dimensions and the simplified formula, another row with the formula filled in with our specific dimensions, and a final answer that shows the total surface area of the bird house.  9. **Performance task:** Give the students their performance task, which is a document where they are asked to answer 3 questions that are a combination of mathematical and real-world problems. All 3 problems will ask the students to find the surface area of another rectangular prism, a cube (can they make the connection and figure it out?), and a challenge question: a step stool made of two rectangular prisms stacked together. *An answer key is included with the performance task.* | | | |
| **Learners vary in the way that they react to and grasp information that is presented to them. Click on** [**Multiple Means of Representation**](https://udlguidelines.cast.org/representation) **to explore ways that you can provide options for representing content and explain how you are including this below:**   * **We will activate and supply background knowledge** at the start of the lesson by reviewing our previous work with area of a rectangle. * **We will highlight patterns, big ideas, and relationships** by pulling up our prior knowledge of area and applying it to the new learning of surface area. * **We will guide information processing by chunking information** into smaller values slide by slide. * **We will maximize transfer and generalization** by providing specific means of practice through our application activity. | | | |
| **Performance Tasks:**   * “Applying Our Knowledge: Surface Area and Prisms”: * 1. Find the surface area of a similar rectangular prism. * 2. Find the surface area of a cube (can they make the leap?). * 3. Challenge question: find the surface area of a stepstool, which is two rectangular prisms stacked upon one another. (This is an extension question)   *Answer key is included with performance task* | | | |
| **Learners best express what they know in different ways. Click on** [**Multiple Means of Action & Expression**](https://udlguidelines.cast.org/action-expression) **to explore ways to offer options for learners and explain how you are doing this below:**   * **We will vary the methods for response and navigation** by having no time restrictions or requirements on the application activity. Additionally, students may work with a partner and orally exchange ideas about how to solve each step and problem. * **We will use multiple tools for construction and composition** by providing calculators. Additionally, students are welcome to engage with physical right prisms that they may measure by hand using a ruler to find the surface area. | | | |
| **Notes:**  **Math Practice(s) taught and practiced by students:**  **MP1.** Make sense of problems and persevere in solving them  It is valuable to note that not every single method for implementing a Universal Design for Learning is incorporated into this lesson. It is not an especially long lesson. The goal is to provide multiple pathways for our learners to successfully learn and retain new knowledge. Please ensure that you consider YOUR learning population and know you are encouraged to vary your UDL strategies as needed for that population. | | | |