# Unit Plan: 3-D’ville

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| **Unit Author** | | | | | | |
| First and Last Name | | | | | Catherine Nosky | |
| School District | | | | | Scottsdale Unified School District | |
| School Name | | | | | Kiva Elementary | |
| School City, State | | | | | Scottsdale, AZ | |
| **Unit Overview** | | | | | | |
| **Unit Title** | | | | | | |
| 3-D’ville | | | | | | |
| **Unit Summary** | | | | | | |
| Students will create a model scale town made of three-dimensional shapes (polyhedra, cylinders, and cones.) Students will have to be able to determine which buildings are necessary in their town, determine the shape of each building, and construct each building using paper templates. Students will need to adhere to a budget. Costs will be determined by one rate for all visible surface area and a different rate for all bases. Students will use estimation skills for initial planning purposes. Students will assign roles within their groups, such as city manager, mayor, CFO, etc. Each group will need to present their model to the class; including a cost-analysis. | | | | | | |
| **Subject Area** | | | | | | |
| Math | | | | | | |
| **Grade Level** | | | | | | |
| Sixth Grade | | | | | | |
| **Approximate Time Needed** | | | | | | |
| 15 50-minute class periods – three to four weeks. | | | | | | |
| **Unit Foundation** | | | | | | |
| **Targeted Content Standards and Benchmarks** | | | | | | |
| **Strand 4: Geometry and Measurement**  Geometry is a natural place for the development of students' reasoning, higher thinking, and justification skills culminating in work with proofs. Geometric modeling and spatial reasoning offer ways to interpret and describe physical environments and can be important tools in problem solving. A major emphasis in this strand is becoming familiar with the units and processes that are used in measuring attributes.  **Concept 1: Geometric Properties**  Analyze the attributes and properties of 2- and 3- dimensional figures and develop mathematical arguments about their relationships.  PO 1. Define (pi) as the ratio between the circumference and diameter of a circle and explain the relationship among the diameter, radius, and circumference.  **Concept 4: Measurement**  Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.  PO 3. Estimate the measure of objects using a scale drawing or map.  PO 4. Solve problems involving the area of simple polygons using formulas for rectangles and triangles.  **Strand 1: Number and Operations**  Number sense is the understanding of numbers and how they relate to each other and how they are used in specific context or real-world application. Students develop a sense of what numbers are, i.e., to use numbers and number relationships to acquire basic facts, to solve a wide variety of real-world problems, and to estimate to determine the reasonableness of results.  **Concept 2: Numerical Operations**  Understand and apply numerical operations and their relationship to one another.  PO 2. Multiply multi-digit decimals through thousandths. | | | | | | |
| **Student Objectives/Learning Outcomes** | | | | | |
| * Decide each group participants role * Review 3-D shape attributes * Plan a 3-D city model * Estimate costs for each building * Design buildings * Construct buildings * Calculate actual size based on scale relationship * Compute actual costs (multiplying with decimals to the hundredths place) * Revise plan if needed to stay in budget * Assemble final city * Produce a PowerPoint presentation to the city council for final vote | | | | | |
| **Curriculum-Framing Questions** | | | | | |
|  | | **Essential Question** | | Does cost matter? | |
|  | | **Unit Questions** | | How does cost affect design decisions? | |
|  | | **Content Questions** | | What is the formula for the area of a rectangle?  What is the formula for the area of a triangle?  What is the formula for the area of a square?  What is the formula for the area of a pentagon?  What is the formula for the area of a hexagon?  What is the formula for the area of an octagon?  What is the formula for the area of a circle?  What is the value of having a scale model?  What is the algorithm for multiplying decimals? | |
| **Assessment Plan** | | | | | |
| **Assessment Timeline** | | | | | |
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| **Assessment Summary** | | | | | |
| Throughout the unit there will be assessment activities before, during, and after the project.  **Before:**  I will discuss with studentss what it means to work collaboratively: What are the benefits? What are the challenges?  Students will be given a pre assement that evaluates their understanding of the following concepts: area, surface area, scale, multiplying decmials to the hundredths place.  **Ongoing:**  Students will be asked to create charts that show their understanding of 3-D shapes and their attributes, scale conversions, and building cost forms to show understanding of area, surface area, and multiplying with decimals to the hundredths place. Students will work in teams to create mystery shape cards with clues on one side and the name and diagram of the shape on the other side.  Students will be observed periodically by the teacher to evaulate their understanding of the mathematical and 21st century skills being explored during the unit. A teacher observation form will be used to record student progress using the following scale: 3=Consistently, 2=Sometimes, 1=Rarely, I=Incomplete.  **After:**  Groups will create a PowerPoint presentation to share their understanding and reflect on the concepts learned.  The pre assessment will be administered as a post assessment to show groth – the assessment will be tailored to meet the needs of the particular class.  Students will assess themselves and their group roles as leaders and collaborators, as well as how well they understood the concepts and could communicate about the concepts being taught. | | | | | |
| **Unit Details** | | | | | |
| **Prerequisite Skills** | | | | | |
| Students need to know how to multiply multi-digit numbers and have an understanding of what area represents. Students should also be familiar with two-dimensional shapes and their attributes. | | | | | |
| **Instructional Procedures** | | | | | |
| **Day 1:** Pre assessment.  **Day 2:** Introduction to unit; class discussion on collaboration, create teams, discuss team member roles and responsibilities.  **Day 3:** Teams determine city name, assign team roles – title and responsibilities, brainstorm building needs for their city, begin visualization and/or sketch of city.  **Day 4:** Review 2-dimensional and 3-dimensional shapes and their attributes, discuss faces, edges, and verticies; have students cut out polygons and circles and create their own 3-d shapes.  **Day 5:** Go to the computer lab and have groups create a formula chart to find the area of a rectangle, square, triangle, and a circle using Excel. Have students work in their group to figure out how they can find the area of a pentagon, hexagon, and an octagon using problem solving strategies. Have groups share their findings on a blog and add those shapes to their formula chart. Every student should save their group chart to their personal school fusion page.  **Day 6:** Allow students more time to create and explore with 3-d shapes and continue planning their city. Groups need to start creating their 3-D chart rough draft. Chart should include some of the following: name of shape; diagram; number of faces, edges, verticies; names of 2-d shapes included (base and sides), etc.  **Day 7:** Introduce mystery 3-D shape cards. Groups will create cards with the name and diagram of the shape on one side. Using their 3-D chart they will add two to three cluse on the other side of the card. Complete cards in the computer lab.  **Day 8:** Have students finish their mystery 3-D shape cards and/or coninue working on the buildings for their city. Review scale and multiplying decimals in small groups with students who did not show a mastery level in either topic on the pre assessment. Have groups share their mystery 3-D shpae cards with other groups in a pair-share activity.  **Day 9:** Introduce the building cost form and review budget constraints for the project. Model how to complete the form. Remind students that the base of the building has a higher rate per square meter than the visible surface areas. Have each group collaboratively fill out at least one form for one of their buildings.  **Days 10 - 13:** Students continue to construct buildings for their cities and complete the building cost forms. Meet with individuals and/or small groups who are not able to independently complete a building cost form correctly. Remind groups to continually determine their current cost so they can remain within their budget. Using blogs have students discuss how design choices are affecting their budget and vice versa.  **Day 14:** Introduce PowerPoint presentations. Have students work in the computer lab on their presentations.  **Day 15:** Students need to complete all finishing touches on their city and all building cost forms.  **Day 16:** In the computer lab students will complete their PowerPoint presentations.  **Day 17:** Post assessment.  **Day 18:** Group PowerPoint Presentations.  **Wrapping Up:** Hold a class discussion around the Essential Question, *Does cost matter?* Have students conduct a pair-share to discuss their answers and opinions to the Essential Question using examples from their research and project work. Do a partner swap and give students time to share with another peer. Take anecdotal notes as discussions take place, documenting students’ understanding of the concepts learned throughout the unit. Have students record their ideas and opinions on a blog. | | | | | |
| **Accommodations for Differentiated Instruction** | | | | | |
|  | **Special Needs Students** | | * Provide additional templates, manipulatives, and scaffolds. * Provide additional support in small group or one-on-one * Peer partner with a gifted/high-level student | | |
|  | **Nonnative Speakers** | | * Write simplified explanations of the project * Add math pictures and explanations to the student’s card file of vocabulary words. * Work with the EIS instructor for additional support. | | |
|  | **Gifted/Talented Students** | | * Have the student create a test or quiz for the class that is related to geometry or scale. * Have the student create a step-by-step example of how to multiply by decimals to the hundredths place. * Have students research and present information about occupations relevant to the unit of study – architects, city planners, city council members, chief financial officer, etc. | | |
| **Materials and Resources Required For Unit** | | | | | |
| **Technology – Hardware** (Click boxes of all equipment needed) | | | | | |

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| Camera  Computer(s)  Digital Camera  DVD Player  Internet Connection | Laser Disk  Printer  Projection System  Scanner  Television | VCR  Video Camera  Video Conferencing Equip.  Other |
| **Technology – Software** (Click boxes of all software needed.) | | |
| Database/Spreadsheet  Desktop Publishing  E-mail Software  Encyclopedia on CD-ROM | Image Processing  Internet Web Browser  Multimedia | Web Page Development  Word Processing  Other |

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| **Printed Materials** | Math Connections Course 2 – Glencoe math textbook |
| **Supplies** | Polygon and circle templates, display boards for city, construction paper, scissors, tape |
| **Internet Resources** | Interactives: Geometry 3D Shapes (<http://www.learner.org/interactives/geometry/>)  Information website on attributes of 3-D shapes.  Primary Resources (<http://www.primaryresources.co.uk/maths/mathsE3.htm>)  Shows various 3-D images that can be saved for project work.  Matching Game (<http://www.interactivestuff.org/match/maker.phtml?featured=1&id=15>)  Reinforcement acitvity to help students understand attributes of 3-D shapes.  Illuminations: Geometric Solids (<http://illuminations.nctm.org/ActivityDetail.aspx?id=70>)  Students can turn 3-D images to see the shape from multiple angles.  Design Resources and Training  (<http://www.design-skills.org/scale.html>)  Support site to help students understand the purpose and uses of scale models. |
| **Other Resources** | Guest speakers that represent the following jobs: architect, city planner, mayor/city council member, and/or chief financial officer. |

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