

Problem-Based Learning Park Design Unit

5th Grade Math

Title of Unit or Topic	Problem-Based Learning Park Design Unit	
Content Area	Math/ELA/Science	Grade Level: 5
Developed By	Marti Sullivan	

NC State Standards	
<p><u>Math</u></p> <ul style="list-style-type: none"> • 5.NBT.5 Fluently multiply multi-digit whole numbers using the standard algorithm. • 5.NBT.7 Add, subtract, multiply, and divide using concrete models. • 5.G.3 Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. • 5.G.4 Classify two-dimensional figures in a hierarchy based on properties. • 5.NF.2 Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. • 5.NF.5 Interpret multiplication as scaling. • 5.NF.6 Solve real world math problems involving multiplication of fractions and mixed numbers. <p><u>Standards for Mathematical Practice</u></p> <ul style="list-style-type: none"> • Make sense of problems and persevere in solving them. • Reason abstractly and quantitatively. • Construct viable arguments and critique the reasoning of others. • Model with mathematics. • Use appropriate tools strategically. • Attend to precision. • Look for and make use of structure. • Look for and express regularity in repeated reasoning. • Solve problems in novel ways and pose new mathematical questions of interest to investigate. <p><u>Science</u></p> <ul style="list-style-type: none"> • 5.L.2 Understand interdependence of plants and animals with their ecosystem. <p><u>ELA</u></p> <ul style="list-style-type: none"> • L.5.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. • L.5.2 Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. • L.5.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening. • L.5.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 5 reading and content, choosing flexibly from a range of strategies. • L.5.6 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal contrast, addition, and other logical relationships (e.g., however, although, nevertheless, similarly, moreover, in addition). • RF.5.4 Read with sufficient accuracy and fluency to support comprehension. • RI.5.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topic or subject area. • RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. • RI.5.8 Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s). • RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the 	

subject knowledgeably.

- RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text.
- RI.5.2 Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.
- SL.5.3 Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.
- SL.5.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
- SL.5.2 Summarize written a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- SL.5.3 Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence.
- SL.5.4 Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.
- SL.5.5 Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.
- W.5.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
- W.5.5 With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
- W.5.6 With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of two pages in a single sitting.
- W.5.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
- W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.
- W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
- W.5.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

ACS Instructional Framework Connections

Engage Students in Relevant and Rigorous Learning
Provide a Student Centered Learning Environment
Implement Digital Learning
Ensure Instructional Innovation

Know	Understand (that)	Do
Students will know the properties of various lines, shapes, and angles.	Students will understand how engineers use math to design.	Students will apply critical thinking and problem solving skills to a real-life scenario.
Students will know how to apply knowledge of geometric principles to a real-world situation.	Students will understand the engineering process.	Students will work collaboratively with a group.
Students will know how to solve problems, to communicate, to collaborate, and to use higher order thinking to complete a	Students will understand that including survey data and research results will make a stronger presentation.	Students will share their opinions and respectfully listen and respond to others' opinions.
	Students will understand that persistence is required when	Students will design a park maximizing the use of the land.

<p>challenge.</p> <p>Students will know how to share their thinking process with others.</p> <p>Students will know how to use a note-taking strategy to organize research.</p> <p>Students will know how to develop a product to share that meets the requirements specified in the challenge.</p> <p>Students will know the geometric principles necessary to help them make the best use of the land.</p> <p>Students will know the measurement concepts necessary to design a space.</p> <p>Students will know how to research in order to make an informed decision.</p> <p>Students will know how to make a budget that includes materials, labor, and maintenance.</p>	<p>faced with an open-ended challenge.</p>	<p>Students will design at least four components to attract a variety of age groups to the park.</p> <p>Students will justify the four components of their park design.</p> <p>Students will create a birds-eye view sketch of the park including a layout of the four elements chosen.</p> <p>Students will build a model of at least one of the features of the park.</p> <p>Students will create an oral presentation explaining the features of the design and utilizing available technology.</p> <p>Students will evaluate their work as well as receiving teacher feedback on their work.</p>
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Essential Questions
<ul style="list-style-type: none"> • How is math used in the real world? • How does math connect with engineering and design? • How can technology be utilized in design?

Assessments - Evidence of Student Learning
<p>Pre Assessment: Students will demonstrate prior knowledge of problem-based learning, the engineering process, and math concepts they will encounter in this unit.</p> <p>Post-assessment: Students create a presentation to share the park designs that were developed through research and collaboration.</p>

I, We, You

The learning environment will encourage a spirit of inquiry. The environment will foster respect for each other and each other's ideas. The teacher sets the stage for respectful and engaging mathematical discussions by setting the following expectations for all members of the group: ask questions; make a contribution to an attentive, responsive audience; be treated respectfully; discuss ideas presented not the people presenting them; listen to others in order to understand; agree or disagree with a speaker's comments and explain why.

List of Instructional Activities and Experiences (Lessons)

Day 1:

Review problem-based learning. Discuss engineer design process. Read [letter](#) regarding the project. Develop design teams.

Day 2:

Use Chromebooks to begin research. Determine which elements will be included in the park based on research. Research may include survey data.

Day 3:

Narrow down research to four chosen elements that will best meet community needs. Determine how these elements will be incorporated into the land and amenities provided.

Days 4-6:

Develop a detailed budget for each element including all costs associated with that element.

Day 7:

Develop a birds-eye view of the park design.

Days 8-9:

Create a model of one element included in the park design.

Days 10-12:

Create an oral presentation using available technology that shares the elements chosen, cost analysis, and research sharing justification for why these elements best fit community needs.

Days 13-15:

Share oral presentations including park design sketches and models. Teams receive feedback from peers and teacher. They also participate in a self-evaluation.

Intervention and Enrichment

Students who "need more support"

- Collaboration with peers
- Teacher support

Students who are "already there"

This unit offers opportunity for critical thinking, problem solving, and collaboration. Students have opportunities to clarify and share their own thoughts, deepen their own reasoning, and engage with the reasoning of others.

Integration with Other Content Areas
<p>This unit integrates math, science, and ELA. It focuses on creative and critical thinking while reasoning and problem-solving. Students explore concepts through a real life scenario that allows them to see how math connects to the work of everyday people. They develop the ability to think and speak like mathematicians by learning to communicate with precise mathematical language both verbally and in writing. The unit allows them to think at high levels regardless of prior knowledge. They explore the engineering process.</p>

Teacher Reflection
<p>At the end of your unit, write a brief reflection about how your plans worked as you carried them out. What worked well? What did not work well? How did your students engage with the content?</p>