HIGH ROLLER®

THE ART AND DESIGN OF THE HIGH ROLLER OBSERVATION WHEEL

Teacher Guide

Grades 3-5

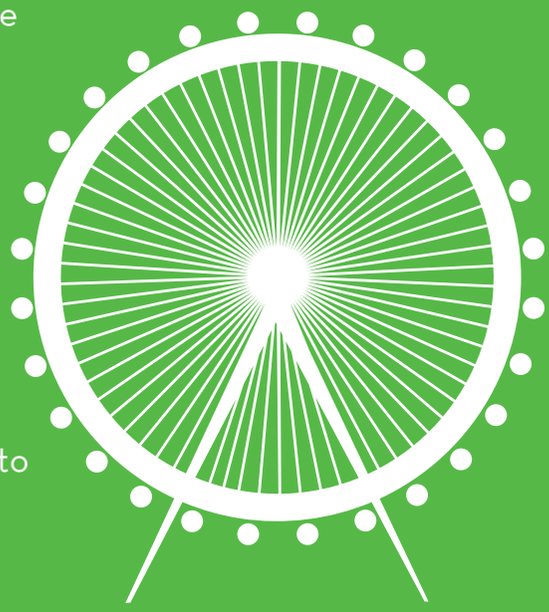
ABOUT THE PROGRAM

This lesson guides students through a design process that will help them create an imaginary structure to add to Las Vegas Blvd that meets the criteria and constraints true to the needs of the High Roller Observation Wheel. Students will work together in groups to participate in a mission to design a feature that would attract and be safe for tourists. Students will undergo the design process where they define, plan, test and improve their design, as well as take a trip to collect data and make observations at the High Roller to propose answers to the question, "How does an engineered design convert energy from one form to another?".

They will express their understanding by asking questions, brainstorming solutions, creating a draft of their solution, critiquing their peers, revising their models and recording their ideas in their design notebooks.

SUMMARY OF ACTIVITIES

A. Ask Questions to Define the Project: Students will use the guidance provided by the teacher and their design notebooks to create a design that can be added to Las Vegas Blvd that would be a safe tourist attraction, while at the same time, cost effective and not pose a threat to natural resources. Students will work in groups of three or four to express and evaluate their initial ideas that address the design problem of replacing the undesirable structure across from Mandalay Bay. Students will creative diagrams to share their ideas with each other. Students will also take this time to evaluate their ideas according to the criteria and constraints they defined in the last section. (60 Minutes)



B. Field Experience: Students will go to the High Roller to see how this feature meets the criteria and constraints of the mission. Staff from the High Roller will be available to explain how the High Roller converts energy from on form to another to power the wheel. Students will also take notes on how the High Roller meets the criteria and constraints of the mission. (3 Hours)

C. Plan Your Design: When students come back to the classroom, they will work in their groups to plan and record the solution they select from the ideas they brainstorm in the last section. (30 Minutes)

D. Create A Draft: Working in their groups students use provided materials to create a model that will make their ideas about a solution to the proposed problem explicit within their group and so that they can communicate their ideas to other groups. (60 Minutes)

E. Improve Your Design: Using the results of the testing phase, as well as the date they collected and observations during the field trip, students will revise their design solution, justifying each change or revision with data from testing or field trip. (20 Minutes)

F. Submit Your Final Design: Students will write a letter describing their engineered design for Las Vegas Blvd. The letter will include what they propose, how it transfers energy and a diagram of the design. (45 Minutes)

NEXT GENERATION SCIENCE STANDARDS:

4-PS3-2• Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat and electric currents.

4-PS3-4• Apply scientific ideas to design, test and refine a device that converts energy from one form to another.

3-5-ETS1-1• Define a simple design problem reflecting a need or want that includes specified criteria success and constraints on materials, time or cost.

3-5-ETS1-2• Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3• Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

GEOGRAPHY STANDARDS:

G6.4.2• Identify regional changes in Nevada over time.

NEVADA ACADEMIC CONTENT STANDAEDS FOR ENGLISH LANGUAGE ARTS:

W.4.7• Conduct short research projects that build knowledge through investigation of different aspects of a topic.

W.4.8• Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information and provide a list of sources.

W.4.2• Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

NEVADA ACADEMIC CONTENT STANDARDS FOR MATHEMATICS:

4.G.A.1• Draw points, lines, line segments, rays, angles (right, acute, obtuse) and perpendicular and parallel lines. Identify these in two-dimensional figures.

4.G.A.3• Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded alon the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

A. ASK QUESTIONS TO DEFINE THE PROJECT/ IMAGINE THE POSSIBILITIES:

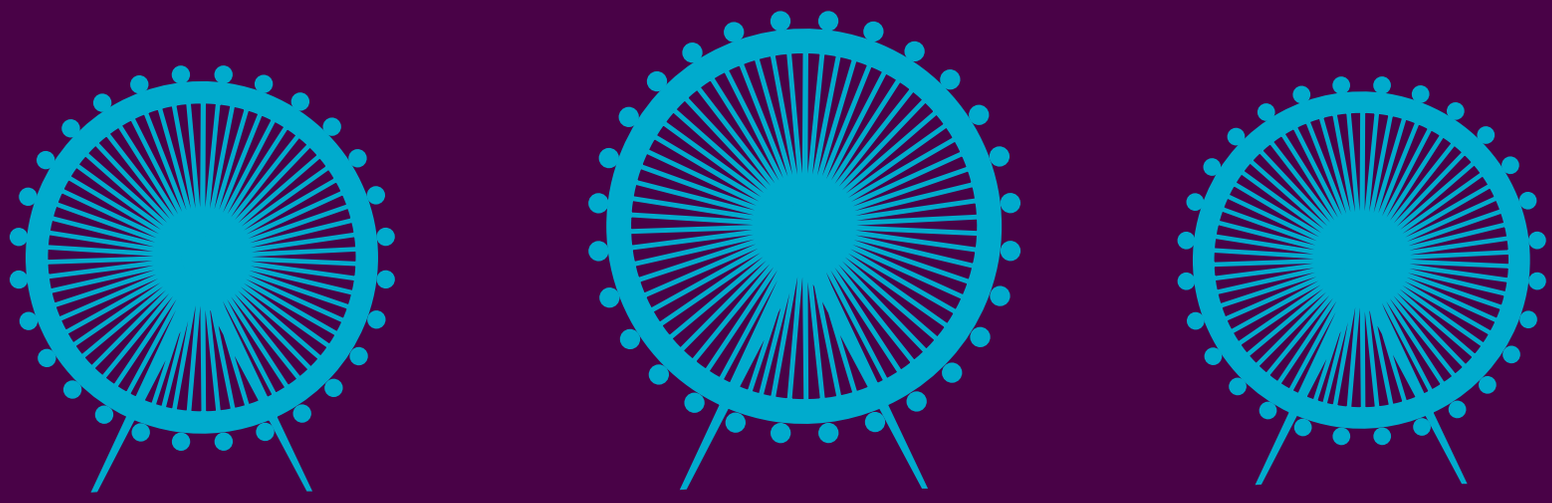
INTRODUCTION: Teacher will introduce the project by reading the faux letter (PART !) from the Las Vegas City Council. Teacher should send paperwork for the field trip home at this thime to get students excited.

Teacher will give students Part 2 of the packet and divide students into groups of 3 or 4. Students will refer to packet and fill out their team's name and names of teammates.

Teacher will show them pictures and videos that show the changes to the Las Vegas Strip over time that will spark their initial thinking about the lesson's BIG QUESTION: How does an engineered design convert energy from one form to another?

POSSIBLE SOURCES:

http://lasvegassun.com/photos/galleries/1905/may/15/strip-aerials/#/0
http://www.unlv.edu/news/slideshows/through-years-las-vegas-city-skyline



ASK QUESTIONS TO DEFINE THE PROJECT:
Teacher will guide students to consider the photos and videos as they think about potential design solutions that address the problem of the "eyesore" of the Las Vegas Strip (show picture of the parking lot across from Mandalay Bay). Your task is to design a "safe and enjoyable" feature to add to the Las Vegas Strip that will attract tourists and converts energy from one form to another. In their small groups, students wil restate the problem posed and write any questions that they may have.

IMAGINE THE POSSIBILITIES:
Teachers will guide students to be creative and communicate all of the ideas that they have what will address the problem of designing a new structure to replace the structure across from Mandalay Bay. Students will work in their small groups to describe three ideas, select the best option and communicate their idea to the whole class.

BRAINSTORM IDEAS:
Teachers should guide students to brainstorm their ideas that are design solutions that answer the Big Question posed in the beginning of the activity. In groups of 3 or 4 students should use the guidance in their design notebooks and pictures of other notable structures on the Las Vegas Strip to help get their ideas on paper. Students should keep their criteria and constraints in mind but for this activity, be creative and get at least three design ideas out in their design notebooks.

EVALUATE IDEAS THROUGH THE CONSTRAINTS AND CRITERIA:
Instruct students to use table to evaluate each of their three design ideas through the lens of their criteria and constraints for the project's result. Students can share the design that they select as their best solution with the whole class.

B. FIELD EXPERIENCE:

(3 Hours)

Teacher should take students on the field trip to the High Roller Observation Wheel. Students should take Part 3 of the students packet and a clipboard with them on field trip. While on field trip students are to note the features that Las Vegas Blvd has to offer and how the High Roller Observation Wheel meets the criteria and constraints of the mission.

Ask the bus driver to drive on Las Vegas Blvd from Russell Road to Spring Mountain Road so that students may see the structure across from Mandalay Bay and other features on Las Vegas Blvd.

Meet staff member of the High Roller to start the guided tour. The tour guide will be able to explain the amount of energy used to power the wheel and how it is transferred from one form to another. Students will have time to ask questions and take notes on how the High Roller meets the criteria and constraints of the mission.

Take restroom breaks and board the High Roller. While on the wheel point out the use of energy to power and move the pods as well as the view it provides. Gather students in the open area just under the wheel again. Provide one last opportunity to discuss the criteria and constraints that were met and write additional notes.

C. PLAN YOUR DESIGN:
(30 Minutes)

Teachers should guide students to use their design notebooks to plan what they need to do and materials they will need to implement their design. Depending on the product that is asked for, this might include a plan for materials, time, money, information resources, expertise, etc. that will be required in order to complete a draft. The second activity is designed for students to make their design plan explicit. The student design notebook includes scaffolding for each of the areas that students might want to consider in their plan. This section can include two parts. First students can consider their material and informational needs. Second, having done that, they can communicate a work plan, based on those needs.

DESCRIBE WHAT YOU WILL NEED:

Prior to articulating their work or design plan, students can be guided to describe the materials, the amount of time, andy additional information they might need to research on their own or ask an expert, etc. Students will use the questions and prompts in their design notebooks to inspire them to consider each of these important needs and communicate them to the other students in their group.

DESCRIBE THE PLAN:

In their design notebooks, they will work as a group to deside upon tasks to be completed and an order of operations so that they can successfully complete a draft/prototype of their idea.

D. CREATE YOUR DRAFT
(60 Minutes)

In this section, students create a prototype or draft that they understand to best satisfy the criteria and constraints laid out in the first section. It is up to the students as to whether they want the prototype to be a blueprint, a physical model, or whatever the design that students can use to make their ideas concrete. This section should contain three parts. First, students will create their draft. Second, they will test their draft and their ideas for how it achieves the goals of the project with the whole class.

CREATE YOUR DRAFT:

Students are given access to materials for the development of their draft. Direct students to use the questions and answer the prompts to journal their development process, including the challenges and the things that work really well. They should have a space for sketching and revising.

TEST YOUR DRAFT:

Students will test their draft based on the criteria for success established in the beginning of the lesson. All students should have the same criteria for success in mind and each idea should undergo the same testing. Design notebooks should include tables for recording testing data and space and prompts for students to record any additional observations or ideas during the testing process. The teacher should also provide a data sheet on the board for students to contribute to, so that they can benefit from the tests and design solution implemented by others.

E. IMPROVE YOUR DRAFT:
(20 Minutes)

In this section, students will incorporate the ideas of their peers and the things that they learned on their trip to the High Roller to improve their draft. This section contains two parts. First students will propose their changes and use a scaffold provided by the lesson design to justify each of those changes, using evidence from class resources (including from peers) and from the field trip. Then, they will make the changes to their draft and complete their design.

TASK #1- PROPOSE CHANGES TO THE PROTOTYPE:

Students should be provided with a mechanism (table, questions, etc.) to record each change they might make to their original design/draft. With each proposed change, they should record a justification, based on information they obtained through testing, observation, the ideas of peers or things they learned on their trip to the High Roller.

TASK #2- MAKE FINAL CHANGES:

Finally, students will make changes to the prototype based on what they learned. A final step might be to present their final design as a whole class and discuss the changes in the forum.

F. SUBMIT YOUR FINAL DESIGN:

(45 Minutes)

In this section, your students will submit an informational letter to the Las Vegas City Council describing the design and explaining how the de4sign transfers energy from one form to another. The letter needs to be several paragraphs lon and must include a diagram of the design.