WAMC Lab Template

Math Concept(s): Create equations that describe numbers or relationships
Source / Text: Explorations and Projects Book
Developed by: Rachelle Ridout E-Mail: rridout@eagles.edu Date: Summer Conference 2022

Attach the following documents:

- Lab Instructions: Highlighted on student handout
- Student Handout(s)
- Rubric and/or Assessment Tool: included in students handout

Short Description (Be sure to include where in your instruction this lab takes place):

Students will collect data related to the number of baskets they can make from different distances from the basketball hoop. This is the very beginning of a series of three lessons. From the lab, students will create a scatter plot for the data. From that scatter plot, students will create a model to help predict their accuracy from the basketball hoop. Students then complete a data analysis. This instruction takes place after the quadratics unit assuming students have been taught about scatter plots and lines/curves of best fit.

Lab Plan

Lab Title: Basketball Shooting

Prerequisite skills: Linear Functions, Quadratic functions, scatter plot, lines/curves of best fit.

Lab objective: The objective of the lab is for students shoot baskets various distances from a basket and record the number of baskets made from each location. From the data collected from this lab, students will create a model to predict your ability to make a basket based on your distance from the basket. Students will gain a better understanding of using technology to help analyze data and create a data write up. They will also demonstrate their skills with a tape measure as a tool.

Standards: *(Note SPECIFIC relationship to Science, Technology, and/or Engineering)*

Mathematics K–12 Learning Standards:

- HS.N-Q.2, HS.N-Q.3, HS.A-CED.3

Standards for Mathematical Practice:

- Lab: 5. Use appropriate tools strategically.
- Overall project: 4. Model with mathematics

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- Writing Standards W.2

K-12 Science Standards

- N/A

Technology

- Lab: 1.b. Students build networks and customize their learning environments in ways that support the learning process.
- Overall Project: 5.a. Students formulate problem definitions for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.

Engineering

- N/A

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

☐ Global Awareness ☐ Financial/Economic/Business/Entrepreneurial Literacy ☐ Civic Literacy
☐ Health/Safety Literacy ☐ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION

Creativity and Innovation
☐ Think Creatively
☐ Work Creatively with Others
☐ Implement Innovations

Critical Thinking and Problem Solving
☒ Reason Effectively
☐ Use Systems Thinking
☐ Make Judgments and Decisions
☐ Solve Problems

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☒ Communicate Clearly
☒ Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy
☒ Access and Evaluate Information
☐ Use and manage Information

Media Literacy
☐ Analyze Media
☐ Create Media Products

Information, Communications and Technology (ICT Literacy)
☒ Apply Technology Effectively

LIFE & CAREER SKILLS

Flexibility and Adaptability
☐ Adapt to Change
☒ Be Flexible

Initiative and Self-Direction
☒ Manage Goals and Time
☐ Work Independently
☐ Be Self-Directed Learners

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☐ Interact Effectively with Others
☒ Work Effectively in Diverse Teams

Productivity and Accountability
☐ Manage Projects
☐ Produce Results

Leadership and Responsibility
☐ Guide and Lead Others
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Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- Basketballs and basketball hoops (Alternatively: paper and a waste basket)

Set-Up Required:

- Gym or open space to set up waste baskets

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

Cooperative Learning:

- Students will work in groups of 3 or 4 to shoot baskets and collect data. They will need to make decisions like what does it mean to be "zero" feet from the basket.

Expectations:

- Students will collaborate to complete the task and collect data. They will work in diverse groups that could range from students that are skilled at basketball to students that have never shot a basketball. They will need to collect individual data and organize group data in a table. If using real basketballs in a gym, one partner should be shooting, one should be recording, and one should be rebounding the ball for the shooter.

Timeline:

- The lab is expected to take 50 minutes to shoot the baskets. If a group is making a lot of baskets, it could take longer.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- In this lab students improve their ability to collect data, organize data, communicate findings and predict future outcomes.

Career Applications

- Data collection industries

Optional or Extension Activities

- This lab can be done by using paper and a wastebasket instead of a ball and hoop. Students can discuss repeated trials.

BASKETBALL SHOOTING PROJECT (Algebra 2)

*This project can be turned in as a group or individually

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2]	GATHERING DATA	(2)_____
2]	MAKE A SCATTER PLOT OF DATA	(2)_____
3]	LINEAR MODELING OF GRAPH AND DATA	(3)_____
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4]	DATA ANALYSIS	
	A] STATING GOAL FOR PROJECT	(1)_____
	B] EVALUATION OF BOTH MODELS	(1)_____
	C] COMARISON OF RESULTS TO PREDICTION	(1)_____
	D] COMPARISON OF OTHER SPORTS	(1)_____
5]	EXTRA POINTS: INVESTIGATION	(+3)_____

MAXIMUM REGULAR SCORE FOR PROJECT (15 PTS.) TOTAL:_____

DUE: FRIDAY 3/4/22

DATA GATHERING MEMBERS OF YOUR GROUP:

1] _____

2] _____

3] _____

4] _____

5] _____

BASKETBALL SHOOTING PROJECT (Algebra 2)

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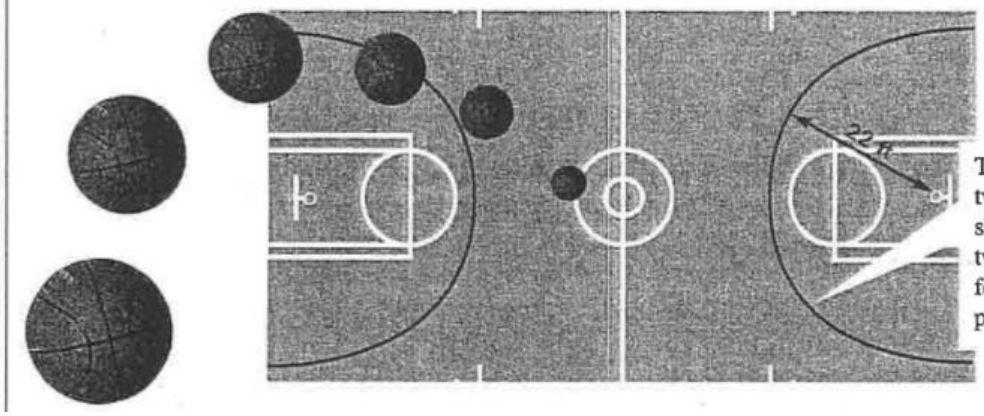
Project Goal: Create a model to predict your ability to make a basket based on your distance from the basket.

Introduction:

Predicting Basketball Accuracy

In 1979 the National Basketball Association instituted a *three-point rule*. According to this rule, a basket shot from a point outside the three-point "line" is worth three points, while a basket shot from a closer distance is worth two points. Why do you think the rules were changed?



The **three-point line** is two inches wide. A shot counts for only two points if a player's foot touches the three-point line.

Procedures/Report Categories:

1. Collect Data: Stand 0 feet from the basket. Shoot the ball 10 times and record the number of shots that go into the basket for each person in your group. Repeat the process from 3ft, 6ft, etc. Continue stepping back 3 feet until you reach a distance where none of the shots goes into the basket for your group. Organize your data in a table.

2. Graph the Results: Create a scatterplot of the data by hand.

3. Make a Model:
    1. Describe your graph. Do you think the data decreases linearly? At what distance did the number of shots that went into the basket decrease the most? *Include the answers in your data analysis*.
    2. Model your data with a linear function and data points in the same coordinate plane by hand. Make sure to include your process to find the linear model.
    3. Model your data with a quadratic function and data points in the same coordinate plane by hand. Make sure to include your process to find the quadratic model. You may use your graphing calculator to help you with this.

4. Data Analysis: Analyze your data using complete sentences and paragraph(s). This must be typed. Reference the Monopoly Project Analysis if you need ideas or guidance. You are not limited to answering the following questions, but make sure your analysis includes the following:
    - Restate project goal
    - Compare data to the model's predictions. Which model do you think most accurately represents your data? Why? Make sure to include the questions you answered during "Make a Model". How do you think your results would change if you repeated the experiment 5 times? 10 times? 50 times? Explain your reasoning.
    - Compare your findings to other sports. Why do you think the 3-point rule was created? What other sports have rules that take the likelihood of scoring points into account? Describe the method for scoring for each sport you discuss.
    - Self-asses your ability to reach the project goal. Discuss your successes and challenges. Include a description of any difficulties you had in finding a linear model and quadratic model to fit your data. How did you resolve those difficulties?

WAMC Lesson Plan

Name(s): Rachelle Ridout
Email Address: rridout@eagles.edu
Lesson Title: Basketball Shooting
Date: 6/21/22
Text: N/A STEM Correlation: Technology Lesson Length: 50 minutes

Big Idea (Cluster): Create equations that describe numbers or relationships.	
Mathematics K–12 Learning Standards: CCSS: HS.N-Q.2, HS.N-Q.3, HS.A-CED.3	
Mathematical Practice(s): 4. Model with mathematics	
Content Objectives: Students will be able to create a model to predict a shooter's ability to make a basket based on that shooter's distance from the basket.	**Language Objectives (ELL):** Students will be able to use the vocabulary to communicate with each other verbally during the creation of the model.
Vocabulary: • Data • Model • Scatter Plot • Line of Best Fit • Slope • Y-intercept • Slope-intercept form • quadratic	**Connections to Prior Learning:** • Plotting Points • Creating Scatterplot • Draw line/curve of best fit • Create linear equation between two points • Create quadratic equation from a graph
Questions to Develop Mathematical Thinking: • Is your data increasing or decreasing? Why do you think that is? • Does your y-intercept make sense in context of the situation? • Do you think you would end up with the same results if you repeated your data collection process? • What does the x-intercept represent? • Do you think the data decreases linearly? • At what distance did the number of shots that went into the basket decrease the most?	**Common Misconceptions:** • For quadratic model: students try to fit the entire parabola in the first quadrant. • Dependent vs. independent variables • Connecting points vs. creating lines of best fit • Writing an equation between two scatter plot points, not two points on the line of best fit.

Assessment (Formative and Summative):

- Formative Assessment: The formative assessment during this lesson is mostly verbal and observational. Students will be working in their groups to create their models. I will be listening and watching the groups work, collecting formative information. I will be available to offer support or help address misconceptions. I will take note of groups that still have misconceptions at the end of the lesson and make a note to check in with them at the beginning of the next lesson.

- Summative Assessment: The rubric and requirements for the summative assessment has been included. A project write up that includes the original scatter plot, a scatter plot with the linear model including the mathematical calculations, a scatter plot with a quadratic model, and the data analysis with create the summative assessment.

Materials:

- Graph Paper, calculators, access to Desmos.com or graphing calculator.

Instruction Plan:

Introduction: The learning target will be projected on a PowerPoint slide. Students should enter the classroom and sit with their data collection groups. We will verbally recap the activity from the day before and discuss the target for the day.

Explore: Students will spend the remainder of the lesson completing the scatterplots and mathematical data for their models while thinking about the questions asked on the project hand out. Students will collaborate to delegate tasks and make decisions together.

When I observe students: Students should be working collaboratively with their groups. I will be monitoring work, listening to discussion and asking guiding questions to students/groups that appear to be need assistance.

Questions to Develop Mathematical Thinking as you observe:

- Is your data increasing or decreasing? Why do you think that is?
- Does your y-intercept make sense in context of the situation?
- Do you think you would end up with the same results if you repeated your data collection process?
- What does the x-intercept represent?
- Do you think the data decreases linearly?
- At what distance did the number of shots that went into the basket decrease the most?

Answers:

- Sample Answer: Our data is decreasing. This makes sense because the farther you are away from the basket, the more difficult it will be to a make a basket.
- The y-intercept should make sense since the group collected data “0” feet from the basket.
- No, each time should be different. We do predict that the results would be similar.
- The distance from the basket in which zero baskets would be made.
- Sample Answer: Yes, out data decreases linearly.
- Sample Answer: 21 ft.

Summarize:

- Help students wrap up their models in preparation for completing that data analysis during the next lesson.
- In summary, students can create a linear model for a scatter plot by drawing a line of best fit and writing an equation between two points on the line.

Career Application(s):

- Data collection fields

Leadership/21st Century Skills:

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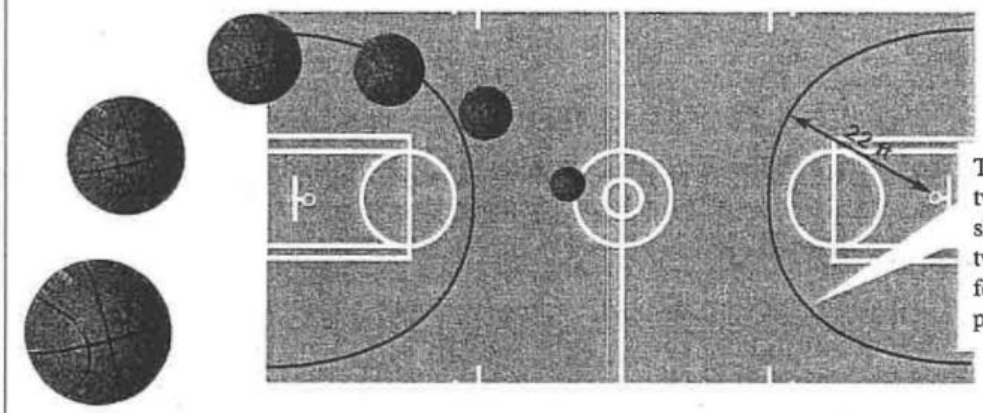

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