

SPIRIT 2.0 Lesson: **Remote Possibilities**

Lesson Header

Lesson Title: Remote Possibilities

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1st Author (Writer): Lynn Spady

2nd Author (Editor/Resource Finder):

Algebra Topic: Combinations and Theoretical and Experimental Probability

Grade Level: 4-6th Grade

Cartoon Illustration Idea: A kid holding a remote control pointing at a robot with the caption, “Mom, where’s the button on this remote to get “Robot’s Name” to do my homework?”

Content (what is taught):

- Combinations and Probability

Context (how it is taught):

- A remote control robot is needed to show the different combinations of pressing buttons and the direction(s) it causes the robot to move
- In groups, students will record the different combinations of buttons for their remote and then use the remote to decide which ones cause the robot to move.
- Students will answer theoretical probability questions based on their remote.

Standards:

Math: E4, C4

Science: A1, A2

Technology: C1, C4

Materials List:

Robot(s) w/ Remote(s)

Different Game System Remotes (X-Box, Nintendo, Wii, etc)

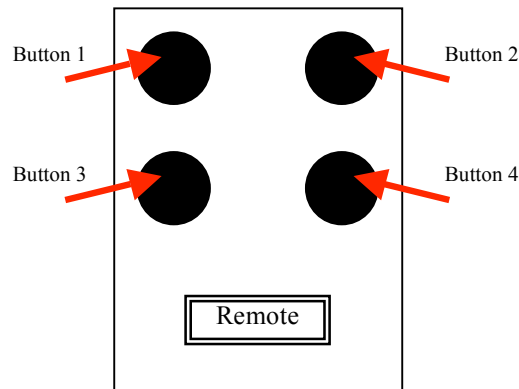
Notebook

ASKING Questions (Remote Possibilities)

Summary: Students can bring in different remotes from their gaming systems (Nintendo, Wii, X-Box, etc.) and explain how to use them in a particular game. A remote for a robot will be shown and students will be asked to come up with the different ways the button(s) can be pressed to move the robot.

Outline:

- Have students bring in different remotes for their gaming systems and explain how to use them in a particular game (e.g. press the forward button while pressing the “A” button will make the player jump).
- Show a remote for a robot and have students think about the different ways to push the buttons to make the robot move. For example:



Questions					Possible Answers
1. What are some of the combinations of buttons you could push on this robot remote and what do you think the robot will do if you press that combination?					<ul style="list-style-type: none">• You could press button 1 and 2 and the robot would go forward.• Press button 3 and 4 and the button would go backwards.• Pressing button 2 might make the robot turn right.• Pressing button 1 by itself would make the robot turn left.• Press button 4 and the robot would back up to the left.• Press button 3 and the robot would back up.• You could press all 4 buttons at once and the robot might jump.
2. If you can only press 2 buttons at once, the table below shows all the combinations. Which ones can you cross off and why? How many combinations are left?					<ul style="list-style-type: none">• You can't press button 1 and button 1 at the same time so the 4 doubles could be crossed off.• Pressing 1 and 2 at the same time is just the same as pressing 2 and 1 at the same time so you can cross off duplicates.• There are only 6 combinations left (1,2-1,3-1,4-2,3-2,4-4,3)
	Button 1	Button 2	Button 3	Button 4	
Button 1	1,1	1,2	1,3	1,4	
Button 2	2,1	2,2	2,3	2,4	
Button 3	3,1	3,2	3,3	3,4	
Button 4	4,1	4,2	4,3	4,4	

EXPLORING Concepts (Remote Possibilities)

Summary: Students will practice using the remote(s) for the robot(s). Students will record the combinations of button(s) pressed and the movement of the robot.

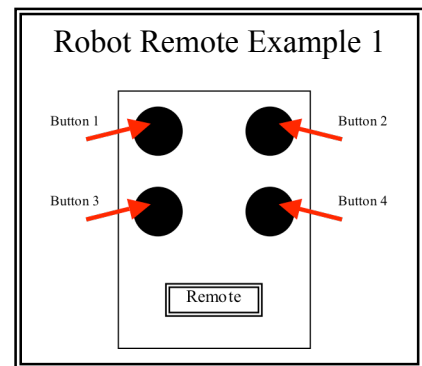
Outline:

- Students take turns using the remote. If more than one robot with remote is available, set up different stations for students to go to in groups.
- Each student will use the remote. Together as a group, students will decide all the combinations of button(s) that can be pressed and the outcome (movement of the robot).

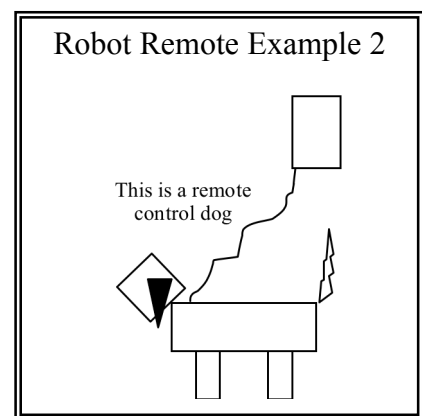
Activity:

Ideally, more than one robot with a remote will be available. (Note: Remote control toys can be used.) Students will record how they will identify the buttons (e.g. button 1, button 2, etc.). Next students will record the combinations of buttons pressed and the movement it caused. This can be done in a table format.

Button(s) Pressed	Robot's Movement
1 and 2	The robot moved forward
1 and 3	The robot did nothing
1 and 4	The robot did nothing
1 by itself	The robot turned left and went in circles



Button(s) Pressed	Robot's Movement
1	The dog barked
2	The dog wagged its tail
1 and 2	The dog walked forward



INSTRUCTING Concepts (Remote Possibilities)

Putting “Probability” in *Recognizable* terms: **Probability:** a strong likelihood or chance of something (dictionary.com)

Putting “Probability” in *Conceptual* terms: **Theoretical Probability** the ratio of the number of ways the event can occur to the total number of possibilities in the sample space (<http://regentsprep.org/Regents/math/probab/PracThoe.htm>). **Experimental Probability** of an event is the ratio of the number of times the event occurs to the total number of trials (<http://www.icoachmath.com/sitemap/ExperimentalProbability.html>).

Need more “I” information! ☺

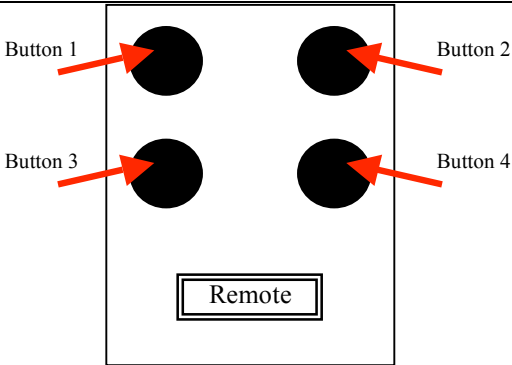
ORGANIZING Learning (Remote Possibilities)

Summary: Students will make a list of the possible button(s) to push on their robot remote and record the movement. Students will then calculate different theoretical probabilities. Students will compare the theoretical probability with the experimental probability by actually doing a simulation.

Outline:

- Draw the robot remote and label the buttons
- Record the button(s) combinations
- Use the remote to press the button(s) combinations and record the movement
- Cross off any combination(s) that do not make the robot move
- Record the number of button(s) combinations that make the robot move
- Answer theoretical probability questions

Worksheet Idea: Record sheet

Remote Drawing	
	
Button(s) Pressed	Movement
1	Robot turns left in a counter-clockwise circle
2	Robot turns right in a clockwise circle
3	Robot turns backwards in a counter-clockwise circle
4	Robot turns backwards in a clockwise circle
1, 2	Robot moves forward
1, 3	Robot does not move
1, 4	Robot does not move
2, 3	Robot does not move
2, 4	Robot does not move
3, 4	Robot moves backwards

There are 6 combinations (1 and 2 button) that make the robot move

Sample probability questions:

- If only one button or two buttons could be pressed at a time on the remote, how many combinations are possible? (10)
- If all those combinations were placed in a hat, what's the probability that you would pick a combination for the robot to move? (6/10 or 3/5)
- If all the movement combinations were placed in a hat, what's the probability that you would pick a combination for the robot to turn? (4/6 or 2/3)
- What's the probability you could get the robot to travel this path?
Forward (1/6), Turn Right (1/6), Backwards (1/6), Turn Left (1/6)
1/1296
- What if after drawing the combination I didn't put it back in the hat? What would that do to the probability?
Forward (1/6), Turn Right (1/5), Backwards (1/4), Turn Left (1/3)
1/360
- What if there were more pieces of paper added that had the forward combination on it. What does that do to the probability? Actually do this and have students compare the theoretical and experimental probability.

UNDERSTANDING Learning (Remote Possibilities)

Summary: Students will find combinations and theoretical and experimental probability

Outline:

- Formative assessment of finding combinations and theoretical and experimental probability
- Summative assessment of finding combinations and theoretical and experimental probability

Activity:

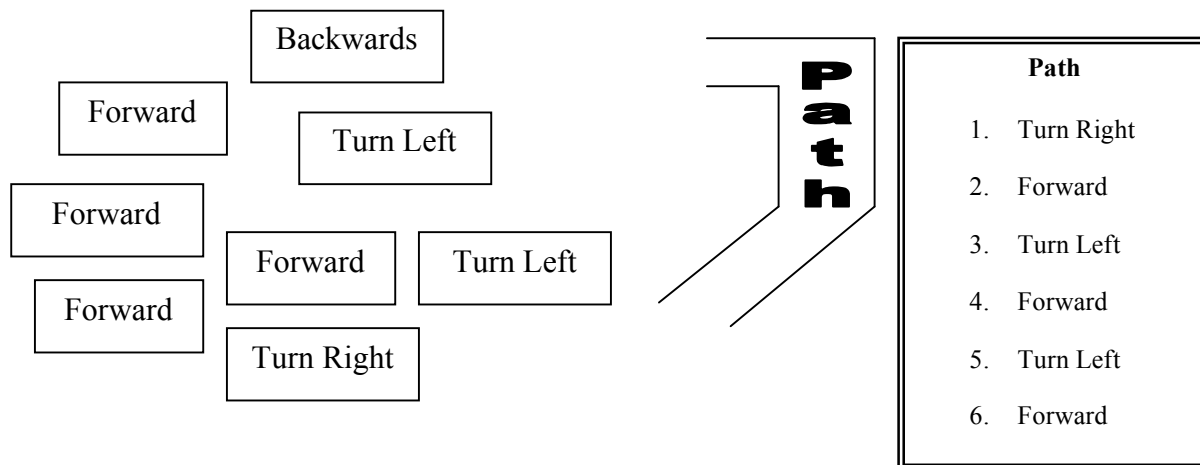
Formative Assessment

As students are engaged in learning activities, ask yourself or your students these types of questions:

1. Given a remote control for a robot, can students identify the combinations of buttons that can be pressed?
2. When listing combinations, do students start making a random list of buttons to press or do they form an organized list making sure to list all the possible combinations?
3. Are students able to tell the difference between theoretical and experimental probability?

Summative Assessment

Situation 1: The following pieces of paper are placed in a hat. You pick one piece of paper at a time and do not put it back in the hat. What is the theoretical probability that you will get the robot to follow the path below? After calculating the theoretical probability, actually perform the situation and record the pieces of paper drawn and the path the robot actually took.



Situation 2: Look at the remote below and make a list of the different ways you can press the buttons. Assume that you can press one arrow by itself or two arrows at a time-one from each side. Note: It might be useful to label the arrows.

