Rover Races

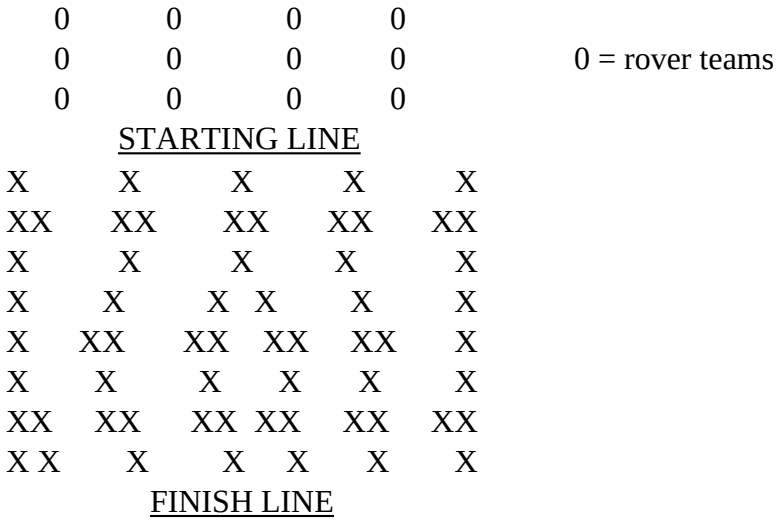
Objective: The girls will learn the challenges of operating a planetary rover and problem solve solutions by using a hands-on simulation.

Supplies:

large playing area (classroom, gym, or outside area)
red construction paper - laminated construction paper works well (**note:** do not use any materials that the blindfolded students will trip or fall over).
3 blindfolds per team
clipboard and pencil for each driver and judge
stopwatch for the timer of each team
masking tape
driver's sheet
judge's sheet
safety cones or empty gallon milk jugs (optional)

Preparation:

1.. Use construction paper tiles (red 9" x 12" work well) to create the obstacle course that the rovers will traverse. Laminated paper tiles work the best and last for many uses. Tape the tiles down or you will have to reset it for each run. Do not use desks or chairs, as girls may trip over them. Make any type of course by arranging the tiles symmetrically. An easy example of this might be:



Set the stage by reading the following introduction.

Many people think that robotic vehicles (like the Mars Pathfinder Sojourner Truth rover) can be driven much like they drive their toy radio controlled cars. They imagine a rover driver watching a computer screen showing the rover on Mars and moving a joystick to make it go. The reality is not so!

The time it takes for a command to reach the surface of another planet (such as Mars) varies with the distance between the planets involved. This prevents any "joy-stick" driving in real time. The commands travel via radio waves at the speed of light (186,000 miles / second) and can take many minutes to reach their destination. Much can happen to an interplanetary robotic vehicle during this time interval. If, for instance, a command were given from the Earth-base for it to go forward on Mars and the Earth-base got a reply (say 12 minutes later) saying that the rover was indeed traveling forward. It

would then take another 12 minutes to send a command from the earth-base to stop the rover. If the rover runs into trouble, crashes, or flips over, there is no one there to fix the situation. The rover mission is over!

Procedure:

1. Choose or draw names of girls to form teams of six. One girl will be designated as "the rover driver", one will be the "team timer", and another will be the "team judge". The remaining three students will become the rover by hooking together in a line (both hands to the shoulders in front of them (O=O=O). The rover will be guided by the driver through an obstacle course (simulated Martian surface)
2. The drivers will proceed through the course first, writing down the instructions that will guide the rover through the course (i.e. 3 steps forward, stop, 1 step left, stop, etc.)
3. Once the drivers have recorded their "upload sequences" on their driver sheets, the rover races can begin. The rover teams line up at the starling line. The three rover members are blindfolded, as to not aid the driver in executing their commands. The rover members link up (to form the 3 sets of wheels like the real rover designs) with their hands on the shoulders of the person in front of them (it is fun to choose different-sized girls to form a rover, as the different sizes of steps taken by each is more evident). The judges will keep a tally of the number of foot faults that their rover team makes by counting each time the front rover person's foot steps on a red tile (Mars rock). The timer of each team will record the time it takes for their rover team to make it through the course. (NOTE: remind the teams that accuracy, not speed is more important when driving a robotic vehicle on another planetary surface.)
4. The teams will all start at the same time, with the timers starting the team stopwatches when the leader indicates. The driver may stand near their team to give the command sequences, but may not physically touch their rover to help guide it (this is, after all, teleoperations!). They must guide their rover by voice only. The rover driver may not deviate from the commands that have been written in their previous trip through the course, even if the rover is going off course.
5. Allow time for all teams to complete the course. Talk about how the driving went - the challenges and what they might change to do a better job the next time.
6. The girls might observe that their steps and those of the rover people might need some type of calibration (i.e. "take baby steps" or "take giant steps"). Turns might be more accurate by saying, "turn 45 or 90 degrees". Running a rover with 3 axles is also different than walking a course singularly.
7. Repeat the activity as time permits, allowing the changes the girls brainstormed to be tested

Race Variations:

1. Safety cones or empty milk jugs can be added to the course as return sample rocks to be collected. Spread cones or milk jugs along the course for each team. When the rover is in the proper position for the last person on in the rover team to bend down (blindfolded) and pick up the "rock", the driver can command "retrieve rock sample". Once the "rock" has been retrieved, the cone can be passed to the middle rover person to be carried.
2. The tiles can be arranged in any design to make the course easier or more difficult.
3. Talk about the time differences the teams took to complete the course. Are there advantages to taking it slower (more careful moves, less crashes) or perhaps the power supply is getting low and more territory needs to be covered (faster).
4. Instead of taping the "tiles" down just mark their place on the floor with tape. Let the girls see how they have "messed up" the Martian landscape. Then the girls can reset the tiles for the next group.

Rover Races

Information Sheet and Course Directions for Driver

Commands:

← Left (L) Right (R) →

Backward (B)
Forward (F)
Stop (S)
Rock Sample Retrieval (RSR)

1) Write down the course directions for the rover to follow, counting your steps as you walk through the Mars course.
2) When the rover is in the correct position for the last person of the rover to collect a rock sample, use the Rock Sample Retrieval command.
3) The rover will only be able to follow your set of written commands. The commands to the rover cannot be any different than the ones you have written down.

Commands:

(Example - 1. F 3 steps. S.
2. Turn L 1 step. S.)

1. 11.
2. 12.
3. 13.
4. 14.
5. 15.
6. 16.
7. 17.
8. 18.
9. 19.
10. 20.

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Judges Sheet

Make a mark (example: IIII) every time the first person on the rover team steps on a tile (rock crashes!). Keep track through the whole course and make a total at the end.

TOTAL ROCK CRASHES =

TOTAL TIME TO COMPLETE THE COURSE =

TOTAL ROCK SAMPLES COLLECTED=