Challenge #1
Send Sphero to the Office

Introduction

Sphero has a message that the Principal needs to receive by next week. Your mission is to teach Sphero how to get to the office.

In this lesson students will refine and practice their ability to produce procedural writing pieces, give instructions, follow instructions, perform precise measurements, and code. Cross-curricular outcomes will be incorporated including Science, Math, and Literacy.

Prior Knowledge

It is expected that students have been introduced to Sphero and the "Lightning Lab" coding app. It is also expected that students have been introduced to procedural writing in Literacy and Science in prior grades and have knowledge of angles and measuring in centimeters and meters.

Curriculum Outcomes:

Grade 6 Math
- Demonstrate an understanding of percent (N6)
- Demonstrate an understanding on angles (SS1)
    - *In this activity students will mostly be working with 90 degree angles, however Sphero demands that students recognize angles up to 360 degrees (ex: a right turn = 90 degree, a left turn 270 degrees, and driving backwards = 180 degrees)

Grade 6 Science
- Work together to carry out investigations and solve problems (431)
- Communicate procedures using lists and notes in point form (207-2)
- Follow a given set up procedures (205-3)

Grade 6 Language Arts
By the end of grade 6 students will be expected to:
- Use word choice and emphasis, making a conscious attempt to produce a desired effect
- Give and follow instructions to respond to a variety of questions and instructions
- Use audience reaction to help subsequent drafts

Discussion Points

It is important to discuss the important roles that failure and perseverance have in the fields of Science, Technology, Engineering and Math (STEM). An excellent video to highlight this point is "Famous Failures" which will be highlighted in the introduction of Day 2. To access the video click here.

Have fun

Be creative and have fun while you follow the instructions given by students: walk over desks; spin in circles until you get dizzy; walk into walls, etc. This will get a lot of giggles and demonstrate the need for precise language when giving instructions.

Day 1 - Send the Teacher to the Office

Setup

- Have one empty student desk and chair at the back of the classroom (this will be reserved for the teacher once the activity begins). Make sure the chair and desk are positioned in a place that does not have a direct path to the classroom door.
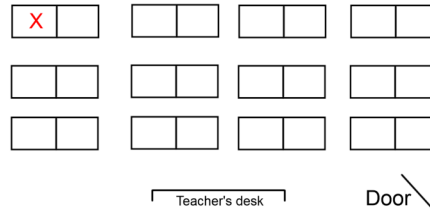
- Display the SMART presentation "Sphero - Challenge 1 Day 1" on the SMART Board. You can access the presentation by clicking here.

Introduction (5 mins.)

- Review the outcomes you will be working on with students. These are provided in student friendly language on the SMART presentation.

- Explain the challenge on slide 3 to students. "This will be an individual challenge. You have 15 minutes to write the instructions necessary to safely and efficiently get your teacher from the desk at the back of the classroom to the office (or any other room of your choosing).

Learning Activity (45– 50 mins)

- The teacher will start the timer and should then sit in the seat at the back of the classroom and pull themselves into the desk. It is important the teacher pull themselves into the desk as students will often write, "Stand up." as step one. If the teacher is pulled into the desk and stands up without being given the instruction "Push your chair back." this will cause the desk to fall over and laughter will ensue.

- After a couple of minutes the teacher should get out of the chair and circulate around the classroom to observe student work. The teacher should instruct students to raise their hands once they have finished. Generally the first student will finish within 2-4 minutes. Often the first student who finishes is a good person to call on to give their instructions once the 15 minutes has elapsed.

- After 15 minutes has elapsed the teacher should call upon selected students to read their instructions. As the student reads their instructions the teacher will perform the actions exactly as stated. Some examples of instructions students often give— but fail to meet the requirements of "safely" and "efficiently" - are:

  * "Stand up." (This will cause the desk to fall over as the teacher is pushed into the desk)

  * "Walk to the door." (Given the position of the desk, telling the teacher to "Walk to the door" would require him/her to climb over desks.)

Day 1 cont…

* "Turn right." (This instruction could be interpreted to mean start spinning in circles as no indication is given about how far to turn right or when to stop turning right. A more precise instruction would be "Turn right 90 degrees.")

* "Take 5 steps." (This instruction is not precise. The teacher can demonstrate this by taking 5 "giant steps" or 5 "baby steps". Students should realize they need precise measurements such as "walk 5 meters".

- After the teacher has selected 3-4 students, performed their instructions and demonstrated the lack of precision in their instructions, give an additional 15 minutes for students to rewrite their procedures using more precise language and measurements.

- Once again, after 15 minutes have elapsed, choose 1-2 students who have demonstrated using more precise language. Even after a second attempt students rarely use language that is precise enough.

Conclusion (5-10 mins)

- Review some of the observations made during the lesson (These can be written on page 4 of the SMART lesson):

    * Procedural writing must be detailed (ex: Saying "stand up" is not an acceptable first step since this will knock the desk over. The first step should be "Push your chair back 30 centimeters.")

    * Measurements must be precise (ex: Saying "Take 5 big steps" might be interpreted differently by different people. More precise language would be "Walk 5 meters.")

    * Learning from your mistakes and the mistakes of others is an important part of the learning process.

Formative Assessment

- Have students create "exit cards" using cue cards. Ask them to briefly respond to the question, "What are 2-3 things to remember when writing procedures for someone to follow?"

Follow-up

- Review the exit cards to ensure students have grasped key aspects of procedural writing. This will be important as they begin getting more precise measurements in the next lesson and start writing the procedures/code for Sphero to get to the office.

Day 2 - Finding Precise Measurements

Setup

- Have plenty of meter sticks / tape measures available for students

- Divide students into groups of 3-4 and assign roles such as: Recorder, Team Captain, Surveyor (aka "measurer"), Tester, Helper, etc.

- It is important that the starting position for the Sphero remain constant. We recommend putting a small mark on the floor where students are to begin their measurements.

- Display the SMART presentation "Sphero - Challenge 1 Day 2" on the SMART Board. You can access the presentation by clicking here.

Introduction (10 mins.)

- Recap key learning from Day 1: Procedural writing requires detail, precise measurements, and numerous edits. (Pg. 2 of SMART lesson)

- Discuss the importance of failure when it comes to learning and show the video "Famous Failures". To view video click here. (Pg. 3 of SMART lesson)

- Assign groups and individual roles to students.

Learning Activity (40 mins.)

- Students are asked to use meter sticks / measuring tape and record measurements and angles in order to give more precise and detailed instructions to get from the desk at the back of the classroom to the office.

- It may be a good idea to start students at different position (ex: Group 1 begins their measurements at the starting point; Group 2 begins their measurements at the classroom door Group 3 beings their measurements at the office and work backwards; etc.). This will ensure the groups are spread out. "Lightning Lab" coding app will allow students to drag and drop in the proper directions in the proper order.

- It is unexpected that students will finish before the 40minutes is up. However, if some groups do finish early, they can move on to the concluding activity

Conclusion (10 mins)

- Students should compare notes with another group. While doing this there are bound to be discrepancies in some of their measurements. Students should make note of these discrepancies and be prepared to re-measure tomorrow.

Discussion Points

While students are measuring it is common for them to carelessly flip the meter stick over or not precisely mark where they left off with the measuring tape. It is important to explain to them that Sphero will roll exactly what they program it to roll therefore every centimeter is important to account for.

Formative Assessment

While students are recording their measurements and having discussions it is important for the teacher to listen in on these conversation and record observations of key words and language being used (ex: angle measures, detailed and precise language, and students' ability to work within group and fulfill their roles within the group.

Day 3 - Rewriting Procedures

<u>Setup</u>

- Have plenty of meter sticks / tape measures available for students.

- Students will be working in the same groups as Day 2.

- Display the SMART Presentation "Sphero—Challenge 1 Day 2" on the SMART Board. You can access the presentation by clicking <u>here.</u>

<u>Introduction (5 mins.)</u>

- At this point it is a good idea to review the concepts that are focused on in this challenge. These are provided on page 2 of the SMART presentation.

- Since teamwork is a pivotal part of these "Sphero Challenges" take some time to reflect upon the challenges and successes of teamwork observed during Day 2. (Page 3 of SMART presentation)

<u>Learning Activity (50mins)</u>

- The learning activity today will be used to finish up anything that has not been completed from Day 2. This might include:

  * Finishing measurements

  * Meeting with another group to compare notes and work with that group to re-measure and refine measurements

- Once groups have finished measuring, comparing and are satisfied with their notes they should then produce a final copy. Each group will only have to produce one final copy but all group members should be involved in the discussion of the final copy.

<u>Conclusion (5 mins.)</u>

- Discussion: Ask students, "What is different about the pieces of procedural writing produced today and the procedural writing produced on Day 1?"

Formative Assessment

- Each group will hand-in their final copy to the teacher to review

- While reading through the final copy make note of some exemplary procedural writing pieces as well as some examples that still need to refining. These will be shared with students during the introduction of Day 4.

Observations

While students are writing and conversing the teacher should be walking around the classroom to listen to the discussions and help students refine their procedural writing pieces by asking leading questions about the precision of words and measurements used.
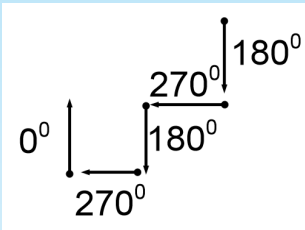
Day 4 - Rolling Out Sphero

Setup

- It is best to have each Sphero dedicated to one particular iPad. This will save time with Bluetooth connections. (Example: Label iPads as 1,2,3,4, etc. and also label Spheros as 1,2,3,4, etc.

- Students will be working in the same groups as in the previous lessons.

- Make sure Spheros and iPads are charged.

- It is assumed students will have had some practice playing with Sphero but this may be their first attempt at coding using the "Lightning Lab" app.

- Place a Sphero in the starting position marked on the floor at the empty desk and chair at the back of the classroom.

- Display SMART presentation "Sphero—Challenge 1 Day 4" on the SMART Board. Click here.

Introduction (10-15 mins.)

- Quickly review some of the samples of the "final copies" of procedural writing pieces that were handed in at the end of last class. Some exemplars of pieces that "meet expectations" as well as examples that are "approaching" should be shared with students. These examples can be written on page 2 of the SMART lesson

- The SMART Presentation "Sphero—Challenge 1 Day 4" features screen captures of various functions students will need in order to use the "Lightning Lab app. Review these features with students before assigning Spheros and iPads.

Learning Activity (35-40 mins.)

- As noted previously, it is expected that this may be the first time students have used the coding app "Lightning Lab". Therefore, it is anticipated that students will require some "playtime" to explore features not covered in the introduction and features they will not even need for this challenge. We recommend giving 10-15 minutes for students to simply get acquainted with the app and try various features.

- Once students have had some time to explore the app and discover its features remind them of their challenge, "Sphero has a message that the Principal needs to receive. Your mission is teach Sphero how to get to the office. You only have 3-4 days left to program Sphero and teach it how to get to the office.

- During the coding phase students will need multiple chances to try out their process. This will be an excellent example of learning by failing. We recommend you make a schedule for groups and every 2-3 minutes give each group a chance to press "start" and see their robot perform the operations they programmed (ex: Group 1 has trials at 10:02, 10:06, 10:10; Group 2 has trials at 10:03, 10:07, 10:11; Group 3 has trails at 10:04, 10:08, 10:12; etc.)

- After groups perform a trial they will spend time in-between trials reprogramming and adding to their code.

Conclusion (10 mins)

- Discussion: "What were some things you discovered about programming Sphero?"; "Do you have any tips that may help other groups?"

Day 5 &6 - Get Sphero to the Office

<u>Setup</u>

- Students will be working in the same groups as in previous lessons.

- Make sure Spheros and iPads are charged.

<u>Introduction (5 mins.)</u>

- Review key learning and "Helpful hints" from Day 4. (There is no SMART lesson created for day 5 & 6 since it is largely an extension of day 4.)

<u>Learning Activity (45 mins.)</u>

- Students will continue programming, testing, and re-programming Sphero.

- Remember to set up some sort of schedule so groups will be able to test their procedures every 3-5 minutes.

- By the end of Day 6 some groups may be having success getting their Sphero to the office (Or whichever room you have chosen). Once they are starting to have success challenge them to continue to refine their programming to increase their success rate. On day 7 each group will be given 5 opportunities to press "start" and allow Sphero to perform the coded procedures. Students will then calculate their success rate as a percent (ex: 3/5 = 60% success rate).

- You may want to set this up as a challenge where students earn points for each Sphero challenge. The winning group scores points in Sphero Challenge #1 and points will be tabulated after all Sphero challenges have been completed.

<u>Conclusion (5 mins.)</u>

- Discussion: "What were some things you discovered about programming Sphero?"; "Do you have any tips that may help other groups?"

Additional Challenge

Groups who finish early can be challenged to program Sphero to do a "touch down dance" at the end to celebrate getting to the office. Sphero could spin in circles while changing colors, flash different colours, shake, etc.

Note

Depending on the number of groups and size of class the "testing phase" may take two classes.

Helpful Hint

Students have noticed that pieces of dirt on the floor can act as a variable and nudge Sphero off course. It may be a good idea to have someone sweep the path after each trial.

Day 7 - Testing

Setup

- Students will be working in the same groups as in previous lessons.
- Make sure Spheros and iPads are charged.
- Display SMART
- Display SMART presentation "Sphero—Challenge 1 Day 7" on the SMART Board. To access the lesson click here.

Introduction (12 mins.)

- Explain the challenge to students: "Each group will have 5 trials to get Sphero to the office. After this you will calculate your rate of success as a percent."
- Give groups 10 minutes for final adjustments and trials.

Learning Activity (40 mins.)

- Each group will have 5 chances to press "start" and have sphero perform the coded operation. While one group goes the other students can observe and follow Sphero (Note: everyone should walk behind to make sure Sphero is not touched while performing the coded operations).
- Once each group has finished their 5 trails members should sit together to calculate their success rates and discuss any improvements to make

Conclusion (8 mins)

Formative Assessment

- In their science journals individual group remembers will write a reflective journal on the coding process and the success and failures encountered while working on Sphero. Some guiding questions could be:
  * "What would you change about your code to improve the success rate of Sphero?"
  * "What were some important discoveries you made while working with Sphero that helped contribute to your success?"
  * "What were some obstacles you encountered or problems you had while working with Sphero or within your group? How did you overcome these obstacles/problems?"

Day 8 - Get Your Teacher to the Office

<u>Setup</u>

- Students will need their science journals and a pencil.

- Display SMART presentation "Sphero—Challenge 1 Day 8" on the SMART Board. To access the lesson click <u>here.</u>

<u>Introduction (5 mins.)</u>

- Perform a quick review of key aspects of procedural writing: precision, detail, word choice, etc.

<u>Learning Activity (35 mins.)</u>

- Students will be given 35 minutes to write a procedural writing piece to get the teacher from the desk at the back of the classroom to the office. This should be neatly done as it will be submitted to be graded as a summative assessment piece.

<u>Conclusion (20 mins.)</u>

- The teacher will choose 2-3 students and perform the procedural writing pieces.

Observations

Remind students that procedural writing will take time due to the importance of precise language, measurements, and detail. Reflect back upon the lesson on Day 1 when some students were finished in 2-4 minutes. At this point students should realize that even 35 minutes may not be enough time to write all the necessary steps in explicit detail.