Title: Speedy Dash

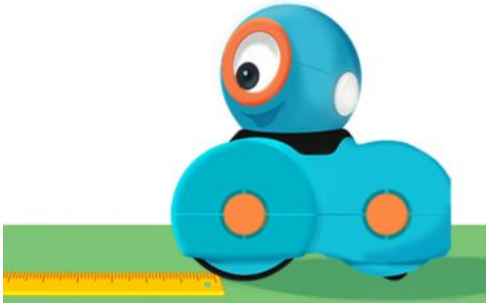
Year level band: Years 1-2

Description: In this learning activity students will develop simple sequences (algorithms) using the Blockly app to move dash at different speeds and distances. They move Dash for different periods of time and measure the distance travelled. Students measure the distance of Dash's movements and collect and represent data about the way different speeds impact on the robot's movements. This lesson links with Mathematics relating to measurement.

Resources:

- Dash Robot
- One iPad or tablet per group with the MakeWonder Blockly App Downloaded
- Metre ruler
- Timer (if unavailable, use the dash distance (Forward count) as unit of measure)
- Recording sheet (end of lesson plan. Alternatively, use Math book)
- Pencil

Prior Student Learning: Students will have already been introduced to the Dash Robot and have had an opportunity to Play. They will had some experience exploring simple drag and drop features of the Blockly app to give commands to the robot. Students will have had some exposure to measurement, and this lesson provides an opportunity to apply skills and knowledge in measurement using a ruler and number sense.



Australian Curriculum alignment summary

Digital Technologies: Students design solutions to simple problems using a sequence of steps and decisions.

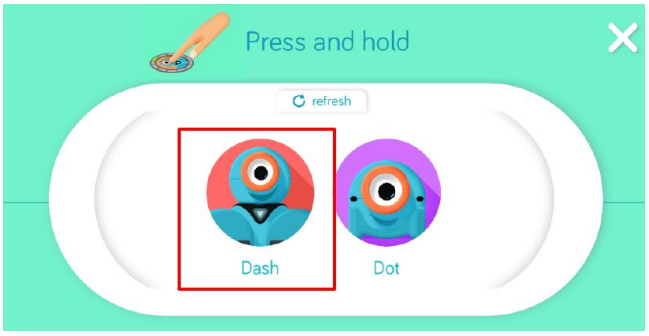
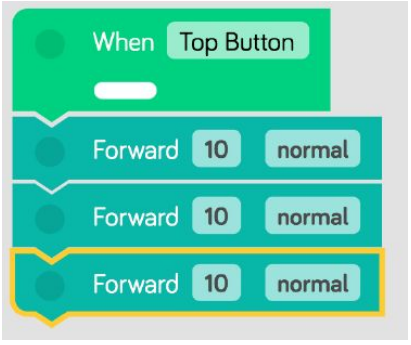
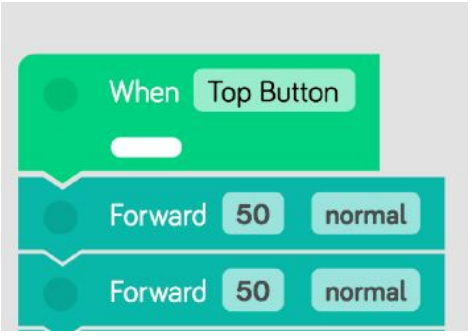
Students begin to learn about … patterns that exist within data they collect. Students organise, manipulate and present this data, including numerical, categorical, text, image, audio and video data, in creative ways to create meaning.

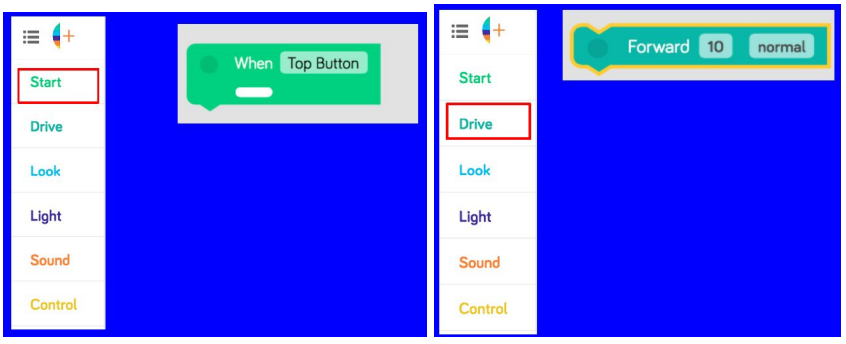
Mathematics: (Year 1) Students count to and from 100 and locate numbers on a number line. They carry out simple additions and subtractions using counting strategies. (Year 2) They perform simple addition and subtraction calculations using a range of strategies.

Year	Content Descriptors
F-2	**Digital Technologies** • Follow, describe and represent a sequence of steps and decisions (algorithms) needed to solve simple problems (ACTDIP004)

CC BY NC

	• Collect, explore and sort data, and use digital systems to present the data creatively (ACTDIP003) • Recognise and explore patterns in data and represent data as pictures, symbols and diagrams (ACTDIK002)
	Mathematics • Year 1: Measure and compare the lengths and capacities of pairs of objects using uniform informal units (ACMMG019) • Year 2: Compare and order several shapes and objects based on length, area, volume and capacity using appropriate uniform informal units (ACMMG037)

Element	**Summary of tasks**
Learning hook	The teacher demonstrates how to connect the Dash Robot to the iPad.  In this introduction, we are building students' code comprehension (ability to read code and predict output). Display the blocks on a board and ask the question "What will this algorithm do?"   Students read the code and predict what Dash will do. The teacher asks: *If this code was given to a human, would Dash and the Human move the same distance? Why/why not?* Looking at the two pieces of code, ask students to think about: *What is different between the two parts of code? What is the same?* Note: we are looking for students to identify changes in the number of forward moves

	(the variable). This could also be repeated with the change in speed (from the normal setting). After predictions, the teacher runs the code on Dash and students can watch to see what happens. Reflect: *Was our prediction correct? If not, where did we go wrong?*
Achievement Standards Learning Map (Sequence)	**Digital Technologies:** Students design solutions to simple problems using a sequence of steps and decisions. They collect familiar data and display them to convey meaning. **Mathematics:** (Year 1) Students order objects based on lengths and capacities using informal units. (Year 2): Students count to and from 100 and locate numbers on a number line. They carry out simple additions and subtractions using counting strategies.
	Students conduct two experiments in which they: ● write a sequence of commands (algorithm) to make Dash move forward for different time periods ● measure the distance Dash travels in each time period ● create a line plot of the distance for each time period ● write a sequence of commands (algorithm) to make Dash move at different speeds for different time periods ● measure the distance Dash travels in each time period ● create a line plot of the distance for each time period
Learning input	Today we will be writing algorithms in Blockly to have Dash move forward for different amounts of time and speed! *Teacher note: Review steps on how to write an algorithm using Start, Drive Commands and setting options.*  The teacher adds blocks of code to instruct Dash to move forward, with help eliciting responses from the class. Together, as a whole class, they implement the algorithm on Dash, observing how Dash moves. The teacher demonstrates how to change the distance and the speed of Dash. Students reflect on how it changed the way Dash moved.

CC BY NC

Learning construction	**Activity One: Exploring distance** Before beginning the activity experiment, provide time for the students to explore moving Dash different distances and timing their movements. ● The first experiment will be to measure how far Dash travels in 1 second at normal speed. Test and measure this 3 times in each group. ● Then test how far Dash travels in 2 seconds at normal speed. Test and measure 3 times. ● Then test how far Dash travels in 3 seconds at normal speed. Test and measure 3 times. Remind students that in an experiment, they must only change one thing at a time. They will do several different experiments but each test only change one **variable.** * (have students work in groups of 3 and run the experiment 3 times so that each person has a chance to write an algorithm, measure the distance, record the distance on the data sheet and line plot) ● Have line plots hanging on chart paper around the room. Have students plot their data on the line plots so that you have class line plots for 1, 2, and 3 seconds. **Class discussion:** Have students look at the class data. What observations can they make? Do they notice any patterns? **Activity Two: Exploring speed** Before beginning the second activity experiment, provide time for the students to explore moving Dash different speeds. Working in the same small group have students repeat the inquiry above having Dash move at a different speed (assign each group a different speed to investigate). Have students use different colored markers to show the distance in 1, 2, 3 seconds at the different speeds. Students should answer these questions in their math journals or on the worksheet provided. ● How much farther did Dash travel between 1 second and 2 seconds? (each student should answer the question based on the measurement they took). ● Did the speed that Dash traveled change how far he went? What observation can you make about this? What data are you using as evidence for your observation? ● Describe any patterns that you notice in this activity. ● What questions do you have that you would like to investigate next time? **Extension:** If finished early, invite students to explore other “variables” available in the Dash app that impact on the robot’s movement in terms of distance or speed. What are they? Students choose one new variable to change for a third experiment and record data on a new sheet, as well as display their results.

	Assessment for this experiment is to assess the suitability of this third experiment - have they identified an appropriate variable? Have they designed a suitable experiment?
Learning demo	Each group can video the process to show how they built the equation and algorithm to demonstrate how Dash moves along. Students present their graph and a summary of their findings.
Learning reflection	Students video record (or write) what they have learned about: ● What they have learned about how the robot moves. ● How they can change the way that Dash moves. ● What their graph shows about how the robot moves based on their different inputs.

Assessment:

- Collection of photos of algorithms or design documents for algorithms for Dash to move forward for different time periods.
- Artefacts that demonstrate the students' ability to collect data about the distance Dash travels in each time period and presentation of a line plot of the distance for each time period.

Sample student self-assessment (that can be adapted)

My Checklist
❑ I can add and subtract multiples of 10.
❑ I can use a ruler to measure the distance Dash travels.
❑ I can write an algorithm for Dash to move forward in a straight line.
❑ I can make Dash move faster or slower than normal.
❑ I can make Dash move at different distances.
❑ I can debug if my program doesn't work right.
❑ I can work as a team member with my partner/classmates.
❑ I can …..
❑ I can….
Next time, I would like to learn how to…..

	Quantity of knowledge			Quality of understanding	
Criteria	**Pre-structural**	**Uni-structural**	**Multi-structural**	**Relational**	**Extended abstract**
Students design solutions to simple problems using a sequence of steps and decisions. (* students design their algorithm using the templates provided by teacher or writing the text for what they intend to do).	Unable to design an algorithm that moves Dash in a straight line.	Can present a design using a sequence of steps that makes Dash move in a straight line with assistance.	Can present a design using a sequence of steps that makes Dash move in a straight line without assistance. With support can identify and solve mistakes in their algorithm. Can explain some parts of their algorithm design with teacher prompts.	Can present more than one algorithm design using a sequence of steps that makes Dash move in a straight line at different speeds or distances. Can explain and justify their algorithm design.	Can present multiple algorithm designs using a sequence of steps that makes Dash move in a straight line at different speeds and distances. The algorithm includes loops in place of repeated code. Can explain and justify when and where they use loops and how they can extend their algorithm.
Counting in multiples of 10	Unable to count in multiples of 10.	Can count in multiples of 10 with assistance.	Can count in multiples of 10 without assistance. With support can identify and solve mistakes when counting. Can explain how they count in multiples of 10.	Can count in multiples of 10 as well as other multiples (2, 5, 20, 100, etc). Without support can identify and solve mistakes when counting. Can explain how they count in multiples but does not yet understand how the method of counting in different multiples are connected.	Can count in multiples of 10 as well as other multiples (2, 5, 20, 100, etc). Can explain how they count in multiples. Can identifying patterns in counting and can count in multiples when required without prompts.

CC BY NC

CSER Professional Learning:

This lesson plan corresponds to professional learning in the following CSER Digital Technologies MOOCs:

F-6 Digital Technologies: Foundations

- Unit 7: Algorithms and Programming
- Unit 8: Visual Programming

F-6 Digital Technologies: Extended

- Unit 2: Algorithms & Programming

See: http://csermoocs.adelaide.edu.au/moocs

Further Resources:

This lesson was inspired by Michelle Eckstein, Peak to Peak Charter School. CO: https://education.makewonder.com/curriculum/dashing-off-at-different-speeds

More ideas in the Dash and dot Magazines of 2015

https://www.makewonder.com/magazine/

Appendix 1: worksheet

Seconds	Speed	Distance (centimetres)
Experiment _____		
1	normal	
1	normal	
1	normal	
2	normal	
2	normal	
2	normal	
3	normal	
3	normal	
3	normal	
Experiment _____		
1		
1		
1		
2		
2		
2		
3		
3		
3		

This work is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License. Computer Science Education Research (CSER) Group, The University of Adelaide.