Coding, Creating and Problem Solving

TLC Project Highlights – 2016/2017

Project Objectives

- Our goal was to use our student's inherent interest and motivation when using technology to develop and transfer problem solving skills to the math classroom. By teaching a problem solving model while integrating Dot and Dash robots in math centres, as well as a series of lessons covering learning objectives in Motion Geometry, we were hoping to see a transfer of problem solving skills to other areas of math and social situations.

Project Scope

- The project was to be carried out in 3 classrooms – 1/2, 2/3 , and 3/4
- At the time of writing this report, 2 classes had completed the lessons as planned, with the third class hoping to finish by the 2nd week of June
- Teachers would meet to collaborate on creating a pre- and post-activity survey to analyze Attitude toward Problem-Solving and any changes that might have occurred as a result of the project. Teachers also collaborated on creating the lessons that would be used to introduce Dot and Dash to the classroom, as well as to do some learning ourselves about coding and how to use Blockly (a visual java programming language similar to Scratch)

Problem Solving Attitude Survey

1. When I face a problem I?
   a) Quit
   b) Ask for help
   c) Get emotional
   d) Keep trying

2. When I have a problem I think of a plan to solve it…
   a) Always
   b) Sometimes
   c) Never
   d) Don't know

3. I look for different solutions to a problem…
   a) Always
   b) Sometimes
   c) Never
   d) Don't know

4. When I make a plan to solve a problem I stick to it even if it is hard…
   a) Always
   b) Sometimes
   c) Never
   d) I don't normally make a plan

5. When a problem starts small but then gets bigger and bigger I….
   a) Quit
   b) Ask for help
   c) Get emotional
   d) Keep trying

6. After I solve a problem I…
   a) Can easily move on to my next task
   b) Sometimes need to time before I can move on
   c) Usually need time before I can move on
   d) Don't know

7. When I start a math problem I…
   a) Read it and write the answer
   b) Look for information from the problem
   c) Think about similar problems and pick a strategy
   d) Ask for help

8. I finish what I begin…
   a) Usually
   b) Sometimes
   c) Never
   d) Don't know

9. I am a hard worker…
   a) Usually
   b) Sometimes
   c) Never
   d) Don't know

10. What is your favourite activity?
    a) Lego
    b) Watching TV
    c) Playing a game with a friend
    d) Prodigy on the computer

11. When I learn a new game…
    a) I want to make up the rules
    b) I get frustrated if I don't get it right away
    c) I quit if I don't get it
    d) I listen when people are trying to help me

12. When I am being taught a new game I…
    a) Follow the instructions carefully
    b) Ignore the instructions and figure it out myself
    c) Listen to some of the instructions, but get distracted
    d) Ask questions if I don't understand

13. If I make a mistake I feel…
    a) Embarrassed
    b) Upset and frustrated
    c) Okay
    d) Like I want to quit

Curriculum Links

- **Grade 1 – Geometry and Spatial Sense**

• describe the relative locations of objects using positional language.

Specific Expectations addressed:

-describe the relative locations of objects or people using positional language (e.g. over, under, above, below, in front of, behind, inside, outside, beside, between, along)

– describe the relative locations of objects on concrete maps created in the classroom

- **Grade 2 – Geometry and Spatial Sense**

• describe and represent the relative locations of objects, and represent objects on a map

– describe the relative locations (e.g., beside, two steps to the right of) and the movements of objects on a map

-draw simple maps of familiar settings, and describe the relative locations of objects on the maps

- **Grade 3 – Geometry and Spatial Sense**

• identify and describe the locations and movements of shapes and objects

-describe movement from one location to another using a grid map

- **Grade 4 – Geometry and Spatial Sense**

• identify and describe the location of an object, using a grid map

-identify and describe the general location of an object using a grid system

Gr. 1/2 Lesson Planning – C. Bode

Learning Goal #1 : We can use position words to describe where something is

Learning Goal #2 : We can describe where something is by comparing its position to something else.

Learning Goal #3: We can make a simple map

This lesson scope and sequence isn't complete yet…will be by June!

Gr. 2/3 Lesson Planning – R. Lamour

- Learning Goal #1: We can draw simple maps.
- Learning Goal #2: We can describe the location of an object based on comparisons to other objects.
- Learning Goal # 3: We can describe the movement of objects using directions.

- We created a grid on our reading carpet - using string- and labelled the y axis A B C D E F G H I J and the x axis 1 2 3 4 5 6 7 8 9 10. Next I had small groups take turn moving Dash to the coordinates I called out. They also took turns calling out coordinates to each other. Later I placed objects in various coordinates and had students tell me where there were, and where they were located in correspondence to the other objects (i.e. the red ball is 2 squares to the left and 4 squares down from the yellow cube). After these warm ups I would give students directions, such as "move Dash 2 squares to the right and 5 squares up," and then students would tell me what the coordinates were to the square they ended up in. We continued to extend this activity to where the students would tell me how they would move Dash to get from one location to another, using the proper mathematical language

Gr. 2/3 Lesson Planning (cont'd)

- . Once they were comfortable with this, I also had them apply some problem solving skills to this activity. I had students work together to come up with the shortest, and easiest path to get from one location to another - moving around other obstacles that were on the grid. They then would try to move Dash through various paths that they thought were the shortest, and find out which one actually was.

Gr. 3/4 Lesson Planning – A. Edwards

- Learning Goal #1 : We can describe the movement of objects on a grid
- Learning Goal #2 : We identify and describe the location of objects on a grid
- Learning Goal #3 : We can solve problems independently, troubleshooting when necessary

- Step 1: Introducing Dot and Dash (www.makewonder.com)

Students were introduced to the robots and the Blockly program as one of our math centres. This gave students time to get used to using the app and block programming language and just experiment with what it could do. Various activities were assigned and discussions around angles for rotations/turns, measurement of distances and positional language were all developed as a result

Gr. 3/4 Lesson Planning (cont'd)

- Step 2. - Growth Mindset

-as part of the pre-teaching, I felt it important to highlight growth mindset. I chose to use an integrated literacy/science activity that involved a Reader's theatre script of a fractured fairy tale and a matching STEM challenge

https://www.teacherspayteachers.com/Product/Growth-Mindset-STEM-BUNDLE-2-8-Fairy-Tales-2844647

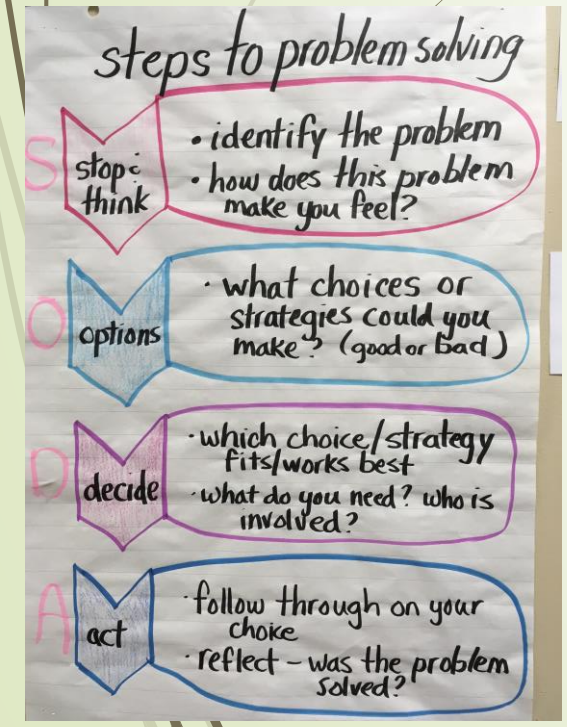
This activity allowed me to introduce growth mindset and set the stage for introducing the problem solving model.

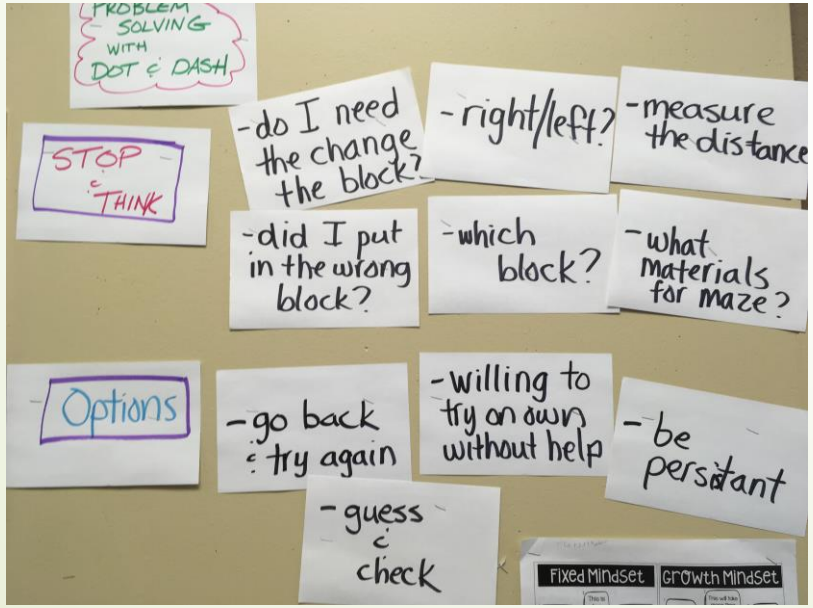
Gr. 3/4 Lesson Planning (cont'd)

- Step 3 – Introducing the 4 step Problem Solving Model

-based on the problem solving model found in the Ontario Curriculum students were introduced to a general problem solving model.

-we used this to frame discussions around decision making in health and problem solving social situations and then thought about how we could make the connection to using the model in math class and specifically when troubleshooting problem solving with Dot and Dash





Grade 3/4 Lesson Planning (cont'd)

- Step 5 – Introducing the Problem

After introductory lessons to activate prior knowledge and pre-teach vocabulary, students were challenged to create a maze using our class learning carpet (carpet with grid). They were then asked to describe the path through the maze and then presented with the challenge of programming Dash through the maze.

A link to a sample student video is included below:

https://www.youtube.com/watch?v=m73Qm21O0U4

Gr. 3/4 Lesson Planning (cont'd)

- After students had a chance to master a given maze, the problem was opened up and they had to create their own maze and code Dash to go through the maze. Again, a focus on using the grid, creating and communicating the path through the grid, and problem solving was highlighted
- Students often encountered problems when programming and while some experienced frustration, all continued to work through the challenge until their maze was mastered.

- Video examples:
- https://www.youtube.com/watch?v=rQIbkKZcn-A

  https://www.youtube.com/watch?v=5Q3gyN3qHCo

Our Results

Observations

Gr. 2/3

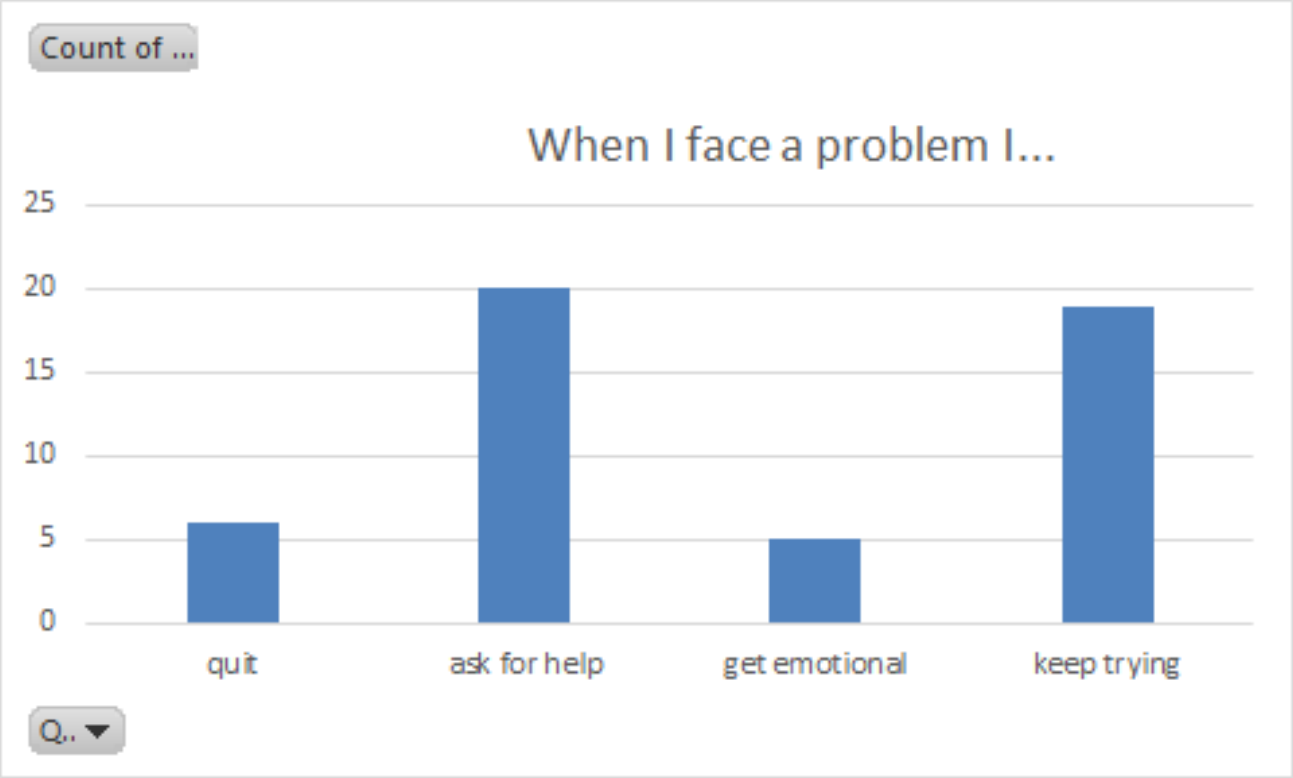
- Students greatly enjoyed using the robot to help use mathematical terms to describe locations on the grid. They also were more eager to problem solve with the use of technology that was engaging. Students often struggled to get Dash to move in a straight line, and often ran over objects on the grid, but with a few tries, they felt more confident in their driving abilities. No one became frustrated when Dash would not go where they were intending for him to end up. They persevered through these problems and kept on trying, with a smile on their face.

Gr. 3/4

-students motivation to solve the problem of the maze kept them engaged through the entire learning sequence. Even when faced with a challenge, students rarely asked for adult assistance (which happens often in regular problem solving activities) and were more independent in solving their own problems.

Survey Results

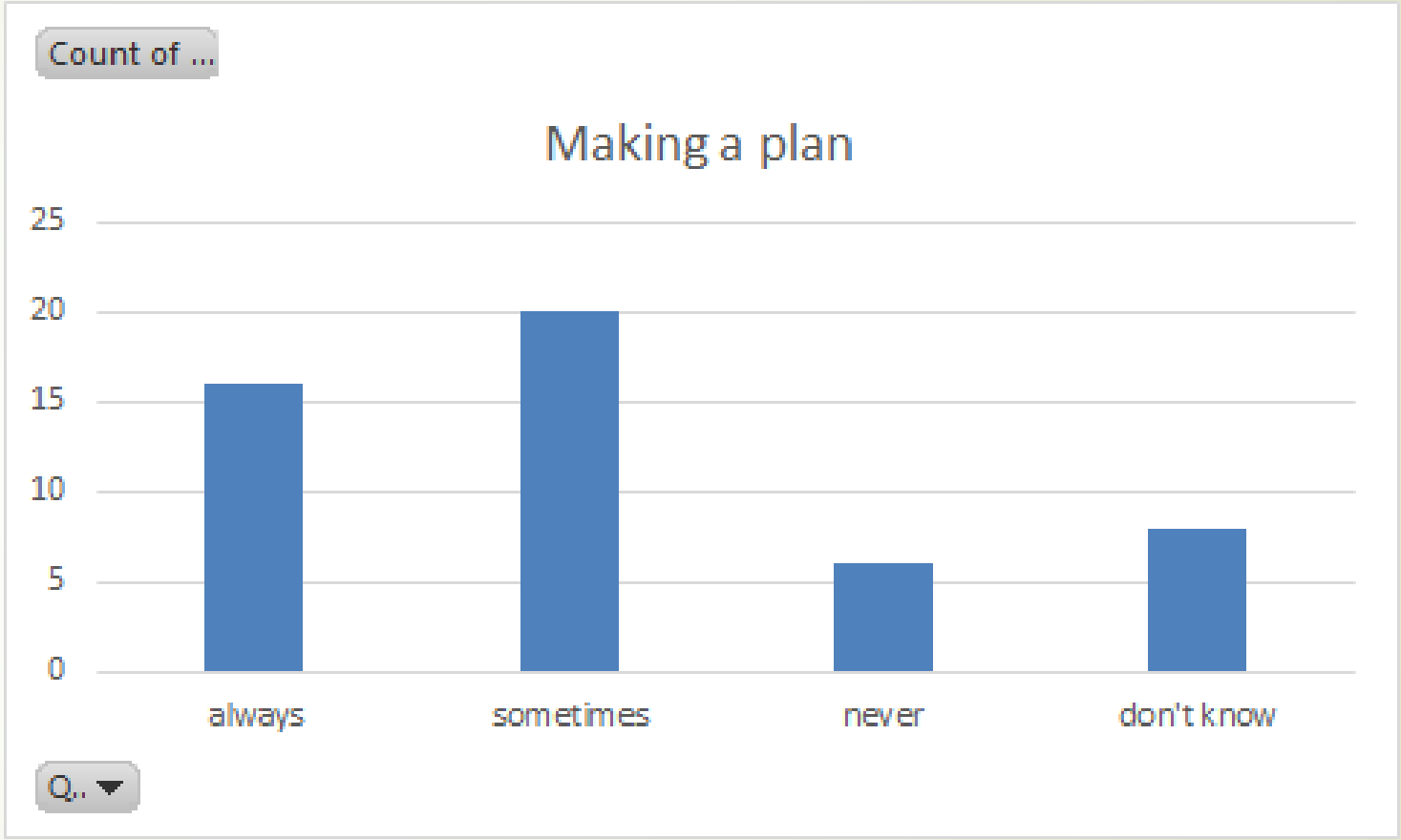
- 25 % of students who initially chose ask for help switched their response to keep trying.



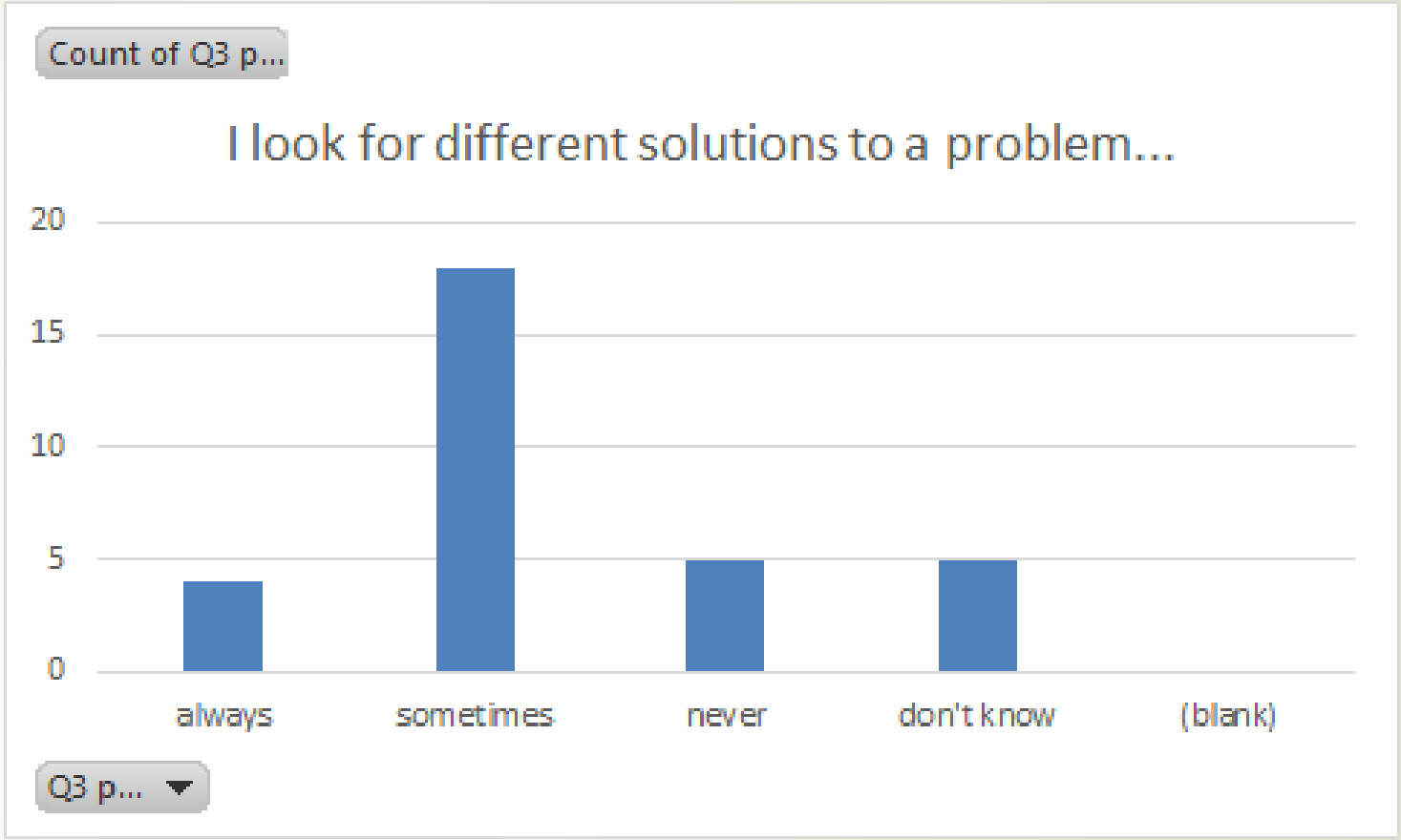
50% of the students who chose quit or get emotional switched their response to ask for help or keep trying

4% increase in making a plan

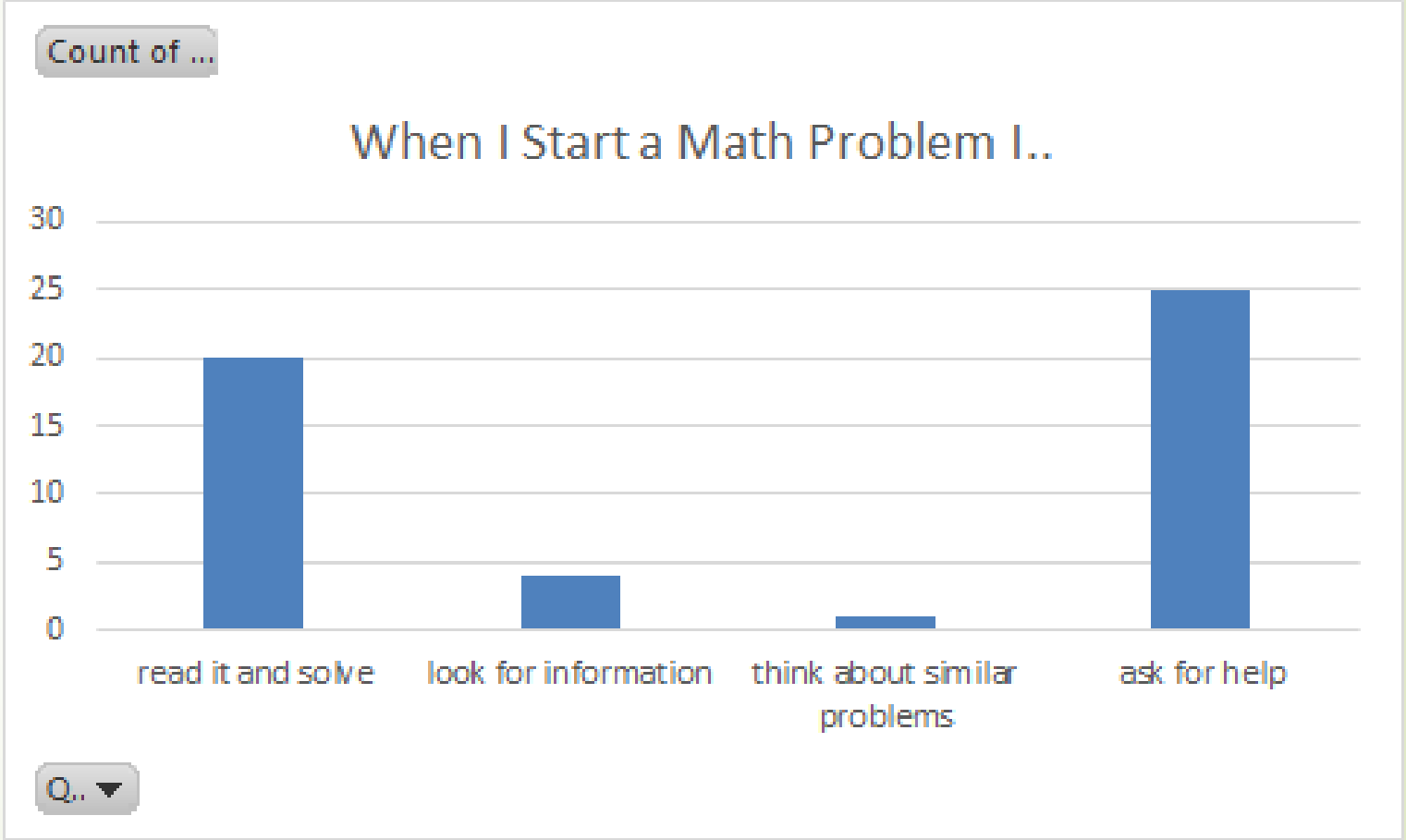
- Interesting to note that there were 4% of responses that switched from always or sometimes to never.



5% increase in students who always or sometimes look for different solutions to a problem.



50% of students would just ask for help to start a problem prior to working with Dot and Dash. This statistic did not change even though our anecdotal observations noted a significant change.



Conclusions

- Teachers learned a lot about how to integrate technology in a meaningful way in our classrooms. Students were truly motivated to work through the problem solving method independently and persevered even in the face of significant challenges
- When asked how they felt using Dot and Dash in the maze - "I was getting frustrated because I kept hitting and failing the maze"…(after) "I feel great that I solved the maze challenge because it was a real hard challenge to do."

"Really, really frustrated and I liked it!"

- When asked what most common reaction when faced with a challenge using Dot or Dash – "I would say, "I am going to do this, I just need to tweak this."

"I can do it, come on. I said that because I believed in myself."

"I just kept on trying, again and again and again."

Future Plans

- Finish learning sequence in all classes
- Develop lessons in other strands…i.e. measurement for sure (as we found very easy to integrate while coding) and in other subject areas. Student engagement is high when using the robots.