Student name: The Teacher **ID:** 490686798

Title of problem 1: Freddie and Sammy

NZC strand: Geometry and Measurement **NZC level**: 3

Mathematical justification of strand/level: This problem is a good introduction to coordinates, as it uses simplified language (e.g. "Leaf 1" and "Row 1") to identify rows and columns for positioning and describing paths. Therefore, Geometry and Measurement (sub-strand: position and orientation)at level 3 is appropriate as this strand states that students areusing a co-ordinate system to specify locations and describe paths (Ministry of Education, 2007).

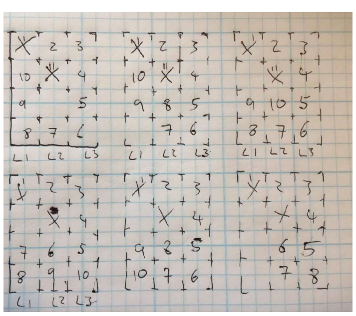
1. Understand Problem

Data:12 lily leaves, 6 lily flowers, Freddie is on leaf 1, row 4, andSammy is on leaf 2 row 3.
Conditions: Freddie moved to Sammy's leaf, visiting as many leaves along the way. Lily flowers prevent diagonal jumps. Can only visit a leaf once.
Restate problem: (1) What was the best path for Freddie to take? (2) What leaf could Sammy live on for Freddie to visit every leaf?

2. Devise Plan

Pattern: There are 2 available starting moves: (1) move to Leaf 1, Row 3, or (2) move to Leaf 2, Row 4. The first option requires Freddie to move to Leaf 1, Row 2. The second option requires Freddie to move to Leaf 3, Row 2. Both these positions are symmetrical, and therefore the choice is redundant.
Strategy: "proof by exhaustion" method via Leaf 3, Row 2.Redraw the lily pond for each attempt. Mark each leaf visited with an incremental count.

3. Carry Out Plan



there are 3 optimal paths with Freddie visiting 11 leaves (inclusive of first) for each.

Freddie could jump on all the leaves if Sammy was located on Row 1, Leaf 3, or Row 2, Leaf 2 or Row 3, Leaf 3, or Row 1, Leaf 1.

4. Look Back

Proof by exhaustion has mathematically proven 3 optimal paths of 11 visited leaves (inclusive of first) for each. This strategy appears to have worked.

Different Solution: The A* algorithm is widely used in computer science for path finding and can be modified to solve this problem.

Solution Pathway (Polya's problem Solving Model)

Name and source of parallel problem: Treasure Island(University of Cambridge, 2015) is a parallel problem retrieved from: http://nrich.maths.org/1112/index.

Student name: The Teacher

Title of problem 2: The Giant Kauri Tree

NZC strand: Numbers and Algebra **NZC level:** 4

Mathematical justification of strand/level: Level 4 of the New Zealand Curriculum mathematicachievement objectives states that students can solve simple linear equations (Ministry of Education, 2007). In order to solve "The Giant Kauri Tree" problem, students must understand that the height of the standing piece (SP) is 5 times smaller than the broken piece (BP). In other words, SP = PB/5. This is a linear equation.

1. Understand Problem

Data: Broken piece is close to base, 5 times longer than standing piece, tip of broken piece is 25 meters from the base of the tree. Two pieces in total.

Conditions: The broken piece is 5 times longer.

Restate problem: (1) What is the height of the piece left standing? (2) What is the sum of the height of the broken piece and the piece left standing?

2. Devise Plan

Pattern: The transitive property of equality lets us determine the solution to both problem (1) and (2).Let the broken piece = A and the standing piece = B.

Strategy (1): Given A*5 = B and B = 25. Then 25/5 = A.

Strategy (2): Total height = A+B

Perform strategy (1) and then (2). Write down the solution for both and compare results with peers for correct answer.

3. Carry Out Plan

Solution (1): 25 / 5 = 5 meters

Solution (2): 25 + 5 = 30 meters

Therefore, the height of the piece left standing is 5 meters and the height of the tree before breaking was 30 meters.

Answer:(1) The scientists would have to climb 5 meters to get to the place where the tree broke off.

(2) The tree was 30 meters before breaking.

4. Look Back

It appears that the strategies have worked. It can be verified by multiplying 5 meters (the height of the standing piece) by 5, which meets the condition that the broken piece is 5 times longer and therefore the standing piece is 5 times shorter.

Check Result: Comparing with peers revealed the same result.

Solution Pathway (Polya's problem Solving Model)

Name and source of parallel problem:Piccini's (2014) penny balancing activity is aparallel problem. It can be retrieved from: http://mrpiccmath.weebly.com/uploads/6/5/0/9/6509522/penny_equations_-_student_work.zip (refer to: *One Step Equations* –Addition.pdf).

Student name: The Teacher **Page 3**

Reflection (Smyth, 1989)

Describe: An incident that occurred during the maths workshops was that I worked independently during the group activities. After I had developed a working strategy and solved the problem, I would start to work with the group. At this stage, I would be eager to share my own strategy and solution, but sometimes fail to realise and acknowledge my peer's alternative methods.

Inform: The reason this incident occurs is because I like to think about problems in my head. I also want to know that my solution works before attempting to teach it to someone else. The effect of this is that I do not collaborate during the problem-solvingprocess. My strategy may also derive from a fear of being wrong and taking the group down a path that ultimately leads to an incorrect solution.

Confront: This means that I value correctness and do not like being wrong. It is important to overcome this, so that I can model failure as well. Otherwise students develop misconceptions toward their own abilities.

My previous work also required problems to be solved independently. Tasks were assigned to individuals, as collaboration increased overhead. Only as a last resort would colleges be approached and this act would confess an inadequacy in one's own ability.

In contrast, identifying how other people solve a problem is important as a teacher. Just knowing the answer yourself does not help students to learn. You have to build from what the student already knows. This is achieved through observation and collaboration.

Whilst I may have been modelling a correct solution there was no collaboration and, therefore, I had failed to realise my peers approach to the problem. If they had required help I would not have known their current understanding or previousmethod, two importantfactors when teaching.

Reconstruct: An alternative view is that by solving the problem first, it ensures that I have a working strategy and can confidently teach it to my students(knowing that it works). However, in order to exercise effective teaching practice, I need to work with my students in solving maths problems, rather than complete them alone. By observing their strategy, I may discover an alternative solution or I could steer them toward an efficient strategy, if they require assistance. Furthermore, by verbalising my thought process throughout the exercise I am modelling the mathematical process for my students,which also allows for their input and feedback.

References

Ministry of Education. (2007). *The New Zealand curriculum*. Wellington, New Zealand: Learning Media Ltd.

Piccini, T. (2014). *Notes - One Step Equations* - Addition. Retrieved from: http://mrpiccmath.weebly.com/uploads/6/5/0/9/6509522/penny_equations_-_student_work.zip

University of Cambridge. (2015). *Treasure Island*. Retrieved from: http://nrich.maths.org/1112/index