Lesson Plan Session 1

Problem Solving Practical Session

General Aspects:

1. Learning Goals:

To develop an understanding of mathematical problem solving strategies

To develop problem solving skills

2. General Strategy:

Working on 3 main problems, alongside discussion of key concepts

3. Structure:

8 lesson segments: an introduction (including a warm up activity), an opening challenge, 3 main problem solving activities (including, reflection time, small group work and whole group discussion of strategies), two demonstration and discussion segments (including exposition and discussion of key ideas) and a conclusion.
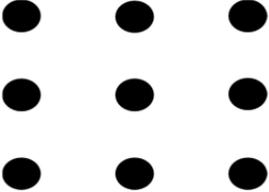
4. Resources:

Worksheet, PowerPoint presentation
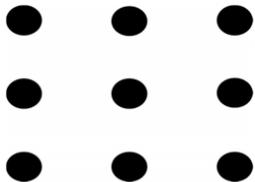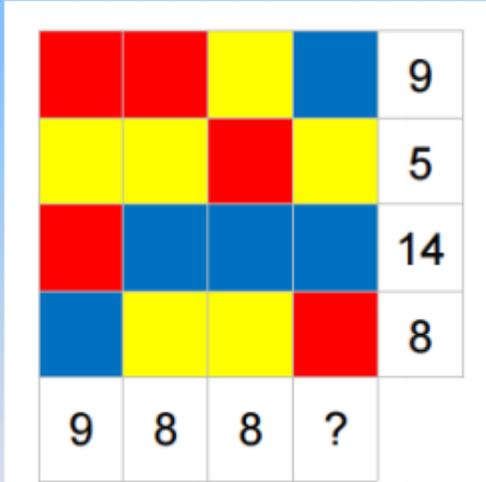
Development of the Lesson:

Task and Learning Activities	Expected Duration	Class Activity (potential difficulties)	Instructor Support	Goal and Assessment
Introduction Warm Up https://www.youtube.com/watch?v=VLf76wRTDzI Discussion: What words to you associate with problem solving in mathematics?	10 mins	Reflect individually, discuss ideas with partner before sharing solution with class (as this is a pop culture reference some people may be familiar – encourage them to think of hints or prompts, challenge: not to obvious!) Brainstorm individually, then in groups of 2/3. Each group shares key words and ideas	Allow reflection time before discussion of solution Add ideas to presentation, discuss similarities/differences in perspective	*Goal* To develop idea of what problem solving is To understand preconceptions of problem solving *Assessment* Group discussion
Opening Challenge Connect these nine dots with only four straight lines without lifting your pencil from the paper. 	20 mins	Small groups work on solving problem Potential questions: Do the lines have to be of equal length? Can you go through the same dot twice? Same approach for extension challenge...	Explain that the only restrictions are those in the question, allow ample reflection time After 5/10 minutes, if hints necessary "you have to think outside the box" Direct anyone who has finished towards	*Goal* To improve problem solving skills, and enhance idea of problem -solving as thinking outside the box *Assessment* Peer assessment, group discussion

Extension Divide these dots using three squares so that each dot is in its own section (the lines of the squares do not go through / touch the dots) 		To finish – discuss approaches of each group	extension challenge (same approach) Enable whole group discussion before and after showing solution	

Demonstration and Discussion
  - Why is problem solving important?
  - Problems with Problem Solving
  - Problem Solving Models
  - What Constitutes a Problem?
  - Stages of Problem Solving
	10 mins	Take notes on models, stages, and characteristics – possibility for discussion/questions from own practice/experiences	Explanation and facilitation of group discussion	*Goal*
				To enhance understanding of problem solving and strategies for problem solving
				
				Assessment
				Group discussion

Problem 1 John has 18 ten-cent coins in his wallet and Owen has 22 five-cent coins in his wallet. Each day, they decide to take one coin from their wallets and put it in a money box, until one of them has no more coins in their wallet. When does Owen have more money than John in his wallet?	20 mins	First few minutes reflection time before splitting into groups of 2/3 Group work/discussion to solve If found a solution, try to solve it a different way	Allow for group interactions After 15 minutes, show various possible strategies on slides – facilitate group discussion. Discuss any new/different methods found by group	*Goal* To improve problem solving skills, and enhance understanding of problem solving strategies *Assessment*

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				Peer assessment, group discussion
Problem 2 **What is the missing number?** 	20 mins	As before: First few minutes reflection time before splitting into groups of 2/3 Group work/discussion to solve If found a solution, try to solve it a different way (possible hint to push boundaries – you don't necessarily need formal algebra)	Allow for group interactions After 15 minutes, show various possible strategies on slides – facilitate group discussion. Discuss any new/different methods found by group	*Goal* To improve problem solving skills, and enhance understanding of problem solving strategies *Assessment* Peer assessment, group discussion
Demonstration and Discussion Do we stifle creativity in school maths? Factors contributing to successful problem solving Beliefs and problem solving Challenging student beliefs....	10 mins	Take notes on research provided and discuss ideas from own experience	Explanation and facilitation of group discussion	*Goal* To enhance understanding of barriers and supports to problem solving in school mathematics *Assessment* Group discussion

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Problem 3 Two friends, John and Angela, meet after having not seen each other in many years. They have the following conversation...... John: Are you married? Do you have any children? How many? How old are they? Angela: Yes, I am married? I have three children and the product of their ages is 36. John: (After doing some thinking). I cannot figure out their ages. I don't have enough clues. Angela: Right! What if I told you that the sum of their ages is the number of your address? John: (After doing some thinking again). I still can't figure out their ages, but I should be able to if I have I get one more hint. Angela: I can also tell you that the oldest has blond hair. John: Aha! Now, I know the ages of your three children. What are the ages of the children (ages can only be natural numbers)?	25 mins	As before: First few minutes reflection time before splitting into groups of 2/3 Group work/discussion to solve If found a solution – try to work out a hint which is not too obvious	Allow for group interactions If necessary (after at least 10 minutes reflection time from groups), give hint – it is not about what we know, but what John knows After 15 minutes, show various possible strategies on slides – facilitate group discussion. Discuss any new/different approaches taken by group	*Goal* To improve problem solving skills, and enhance understanding of problem solving strategies *Assessment* Peer assessment, group discussion
Conclusion Final points and allow for questions	5 mins	Group discussion/questions on problems and strategies	Facilitate discussion	

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