Lesson Plan Session 2

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 10 main problems, discuss methods taken to find solutions

3. *Structure*:

12 lesson segments: an introduction (including a refresher of previously discussed strategies, 10 main problem solving activities (including, reflection time, small group work and whole group discussion of strategies and lessons learned), and a concluding discussion.

4. Resources:

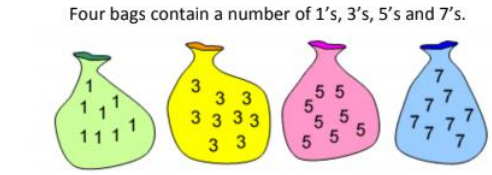
Worksheet, inquiry cubes, PowerPoint presentation

Development of the Lesson:

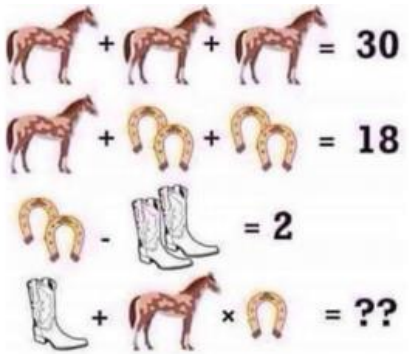
With the support of the Erasmus+
programme of the European Union

Task and Learning Activities	Expected Duration	Class Activity (potential difficulties)	Instructor Support	Goal and Assessment
Introduction Stages and Strategies of Problem Solving Teachers as Problem Solvers	5 mins	Brief discussion as reminder of Polya's stages of problem solving, and some key problem solving strategies which can be implemented generally Discuss importance of teachers as problem solvers	Explanation and facilitation of group discussion	*Goal* To revise key problem solving strategies *Assessment* Group discussion
Problem 1 Inquiry Cubes – Draw the side of the covered cube face...	20 mins	Small groups work on solving problem (completing the pattern of the cube) Extension – groups design their own inquiry cube – swap with nearby groups To finish – discuss approaches of each group	Direct anyone who has finished towards extension challenge (same approach) Enable whole group discussion before and after showing solution	*Goal* To improve problem solving skills *Assessment* Peer assessment, group discussion

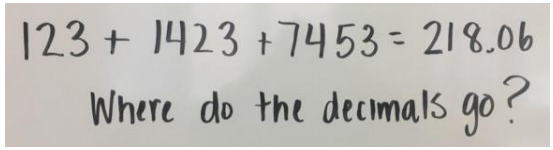
With the support of the Erasmus+ programme of the European Union

Problem 2  Pick any ten numbers from the bags above so that their total is 37.	10 mins	Small groups work on solving problem If necessary take hint Discuss various approaches to proving this	Allow reflection time If hint needed: Has anybody managed to find 10 numbers? Is it possible at all? Prove it. Group discussion after	*Goal* To improve problem solving skills *Assessment* Group discussion
Problem 3 You are a prisoner sentenced to death. Your captor offers you a chance to live by playing a simple game. He gives you 20 yellow cubes, 20 red cubes and 2 empty bowls. He then says 'Divide these 40 cubes into these 2 bowls. You can divide them any way you like as long as you use all the cubes. Then I will blindfold you and mix the bowls around. You can then choose one bowl and remove one cube. If the cube is YELLOW, you will live but if the cube is RED, you will die'. How do you divide the cubes up so that you have the greatest probability of choosing a YELLOW cube?	10 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 7/8 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
Problem 4 The island of Aruba is well known for its beaches and predictable warm, sunny weather. In fact, Aruba's weather is so predictable that the daily newspapers don't even bother printing a forecast. Strangely enough, however, on New Year's Eve 2012, as the islanders were counting down the last 10 seconds of 2012, it began to rain. What is the probability, from 0	5 mins	As before: First few minutes reflection time before splitting into groups of 2/3 Group work/discussion to solve	Allow for group interactions After 7/8 minutes, show various possible strategies on slides – facilitate group discussion.	*Goal* To improve problem solving skills, and enhance understanding of problem solving strategies *Assessment*

With the support of the Erasmus+ programme of the European Union

to 1, that 72 hours later the sun will be shining?				Peer assessment, group discussion
Problem 5 	5 mins	As before: reflection time before splitting into groups of 2/3 Group work/discussion to solve	Allow for group interactions After 7/8 minutes, show solution on slides – facilitate group discussion.	*Goal* To improve problem solving skills *Assessment* Group discussion
Discussion	5 mins	Discussion of what the last two problems had in common – what is to be learned from this	Not always a "mathematical" solution – importance of logic and common sense	*Goal* To understand the importance of logic in problem solving *Assessment* Group discussion
Problem 6 	5 mins	As before: First few minutes reflection time before splitting into groups of 2/3 Group work/discussion to solve If found a solution – check with other groups, is it the same? If not why not?	Allow for group interactions After 7/8 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
Problem 7	5 mins	As before: First few minutes reflection time before splitting into groups of 2/3	Allow for group interactions	*Goal* To improve problem solving skills, and

With the support of the Erasmus+ programme of the European Union

		Group work/discussion to solve If found a solution – direct towards extension problems	After 7/8 minutes, show solution on slides – facilitate group discussion.	enhance understanding of problem solving strategies *Assessment* Peer assessment, group discussion
Problem 8 In the 2012 Olympics, Usain Bolt from Jamaica won the gold medal in the 100m race with a time of 9.63s. In the first ever event of the modern Olympic games in April 1896, Thomas Burke from the US won the 100m race in a time of 12s. If both athletes ran in the same 100m race repeating their respective performances, what would be the distance between the athletes at the finish line?	10 mins	As before: First few minutes reflection time before splitting into groups of 2/3 Group work/discussion to solve If found a solution – is there another way to solve this problem?	Allow for group interactions After 7/8 minutes, show solution on slides – facilitate group discussion. Any alternative approaches?	*Goal* To improve problem solving skills, and enhance understanding of problem solving strategies *Assessment* Peer assessment, group discussion
Problem 9 The volume of a shape is 216. What can it be?	10 mins	As before: First few minutes reflection time before splitting into groups of 2/3 Group work/discussion to solve If found a solution – are there other options for a solution?	Allow for group interactions After 7/8 minutes, show various possible strategies on slides – facilitate group discussion. Discuss any new/different shapes	*Goal* To improve problem solving skills, and enhance understanding of problem solving strategies *Assessment* Peer assessment, group discussion

With the support of the Erasmus+ programme of the European Union

Problem 10 Two different families of frogs want to move over to the opposite side of the pond (i.e. the green frogs want to get to the right hand side and the yellow frogs want to move to the left hand side).  Frogs can jump over each other onto an empty stone or they can slide onto an empty stone which is immediately in front of them. Only one frog is allowed on each stone at a time and they cannot move backwards. The challenge is to do this in as few moves as possible. Each individual slide and jump counts as 1 move. Begin with 1 frog on both sides and record the number of moves taken. Once you have this done, see if you can do it for a different number of frogs. Can you find a rule that predicts how many moves a given number of frogs will take?	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 – attempt one of extra problems	Allow for group interactions After 7/8 minutes, show various possible strategies on slides – facilitate group discussion. Discuss any new/different strategies	*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	10 mins	Group discussion/questions on problems and strategies One thing I learned today	Facilitate discussion	*Goal* To recap ideas of the day

With the support of the Erasmus+ programme of the European Union

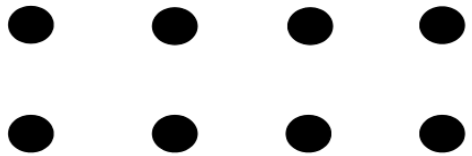
		One thing I would like to know more about (Fill in via Poll.Ev.com)		*Assessment* Group discussion Online poll

Extra Content:

Throughout the session, the following extension problems can be used (either with small groups or the whole group) for further activity if time allows:

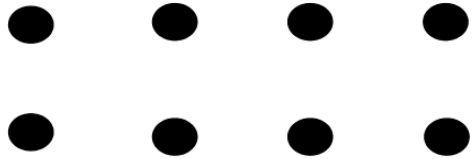
Extra..... Problem 11

How many squares can you make using any four points from the grid shown as corners?



Extra..... Problem 12

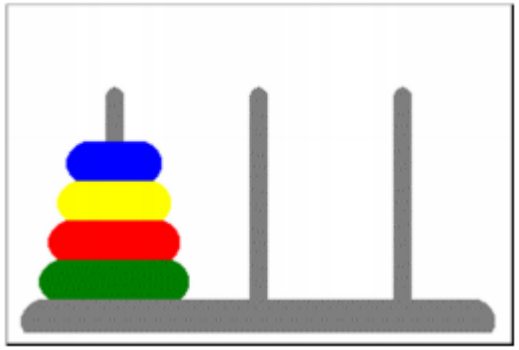
How many equilateral triangles can you make using any three points from the grid shown as corners? (diagram as above)



With the support of the Erasmus+ programme of the European Union

Extra..... Problem 13

In this problem we have a set of n disks all of different sizes, and we have three pegs. All of the disks are on the first peg, and they are in order of size with the largest disk on the bottom. The goal is to move all the disks from the first peg to the third peg, moving only one disk at a time. There is only one catch. You can never put a larger one on top of a smaller one. Can you find a rule that predicts the minimum number of moves a given number disks will take?



Extra..... Problem 14

Albert and Bernard just became friends with Cheryl, and they want to know when her birthday is. Cheryl gives them a list of 10 possible dates: May 15, May 16, May 19, June 17, June 18, July 14, July 16, August 14, August 15, August 17. Cheryl then tells Albert and Bernard separately the month and the day of her birthday, respectively.

Albert: I don't know when Cheryl's birthday is, but I know that Bernard does not know too.

Bernard: At first I didn't know when Cheryl's birthday is, but I know now.

Albert: Then I also know when Cheryl's birthday is.

So when is Cheryl's birthday?

Extra... Problem 15

In a long hall of the Arts Block, there are 100 lockers numbered 1 to 100. In preparation for the beginning of term, the custodian cleans the lockers, resets the combinations, and closes the locker doors. When the students return from summer vacation, they decide to celebrate the beginning of the college term

With the support of the Erasmus+
programme of the European Union

by working off some energy. Student 1 runs down the row of lockers and opens every door. Student 2 closes the doors of lockers 2, 4, 6, 8, and so on to the end of the line. Student 3 changes the state of the doors of lockers 3, 6, 9, 12, and so on to the end of the line. (This means the student opens the door if it is closed and closes the door if it is open.) Student 4 changes the state of the doors of lockers 4, 8, 12, 16, and so on. This continues until every student has had a turn. When all 100 students have finished, which locker doors are open?

With the support of the Erasmus+
programme of the European Union