

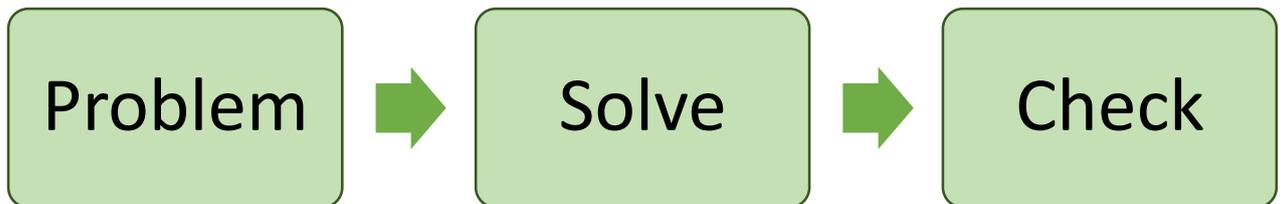
Module 5 - Teaching competences and values

Guidance material	5.4.1 Teaching Problem Solving Grade 1-6
What is the purpose of this material?	<ul style="list-style-type: none"> This is a selection of teaching strategies and teaching templates to support the teaching of problem solving
When to use this material?	<ul style="list-style-type: none"> When introducing the competences to teachers to support them in implementing this competence in their class programme.
With whom to use this material?	<ul style="list-style-type: none"> Teachers
Have you considered these materials first?	<ul style="list-style-type: none"> Introduce teachers to the SCF through: <ul style="list-style-type: none"> 1.1 What is the SCF? 1.2 Structure of the SCF 1.3 Definitions matching activity 1.4 Prior knowledge brainstorm activity 1.5 Close reading – Executive summary 1.6 Close reading – Framework Requirements and Exemplifications 4.1 What are competences? Introduce teachers to this competence through: <ul style="list-style-type: none"> 4.1.4 What is Problem Solving?
How to use this material?	<ul style="list-style-type: none"> This resource can be used in a range of ways, for example: <ul style="list-style-type: none"> Share with teachers and discuss it in staff meetings or team meetings. Encourage teachers to plan using the ideas in this resource. Encourage teachers to adapt the teaching strategies and templates below to meet their grade level, curriculum area and student's needs. Discuss the ideas and then ask teachers to share their own ideas for teaching this competence. For more information on each competence read the <i>Framework Requirements & Exemplifications</i> section of the <i>Abu Dhabi Education Council Student Competence Framework (SCF) for Private Schools - Competences for Abu Dhabi's 21st Century Learners (2014)</i>. Note: All websites were checked at the time this guidance material was created. Any website used in an educational context should be checked for accuracy and appropriate content. Links to other websites from this material should not be taken as endorsement of those sites or of content/products offered on those sites
What resources or equipment are needed?	<ul style="list-style-type: none"> Copies of the <i>Framework Requirements & Exemplifications</i> section of the <i>ADEC SCF for Private Schools (2014)</i>.

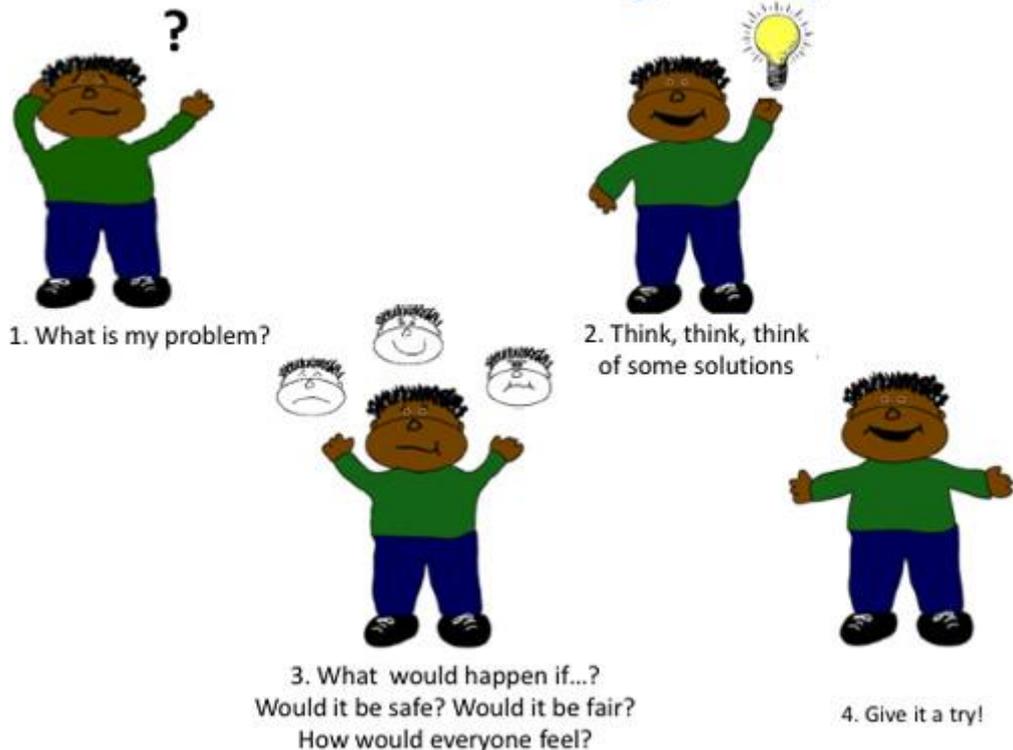
Teaching Problem Solving Grade 1-6

Here are some strategies and teaching approaches to try in your classroom to promote problem solving:

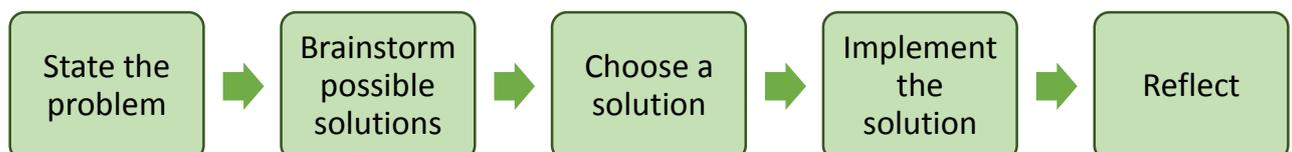
- Ask students to follow a problem solving process. Here are some different problem solving processes, from simple to more complex:



Problem Solving Steps



<http://csefel.vanderbilt.edu/resources/strategies.html>



Pólya's four stages of problem solving:

<p>Step 1: Understand and explore the problem</p> <ul style="list-style-type: none"> • What do you already know? • What do you not understand? • What are the causes of this problem? • What are the effects of these causes? • What are the obstacles? 	<p>Step 2: Devise a plan</p> <ul style="list-style-type: none"> • Have you seen a similar problem before? • Which strategy will you use to solve this problem? • What steps will you take to solve the problem?
<p>Step 3: Carry out the plan</p> <ul style="list-style-type: none"> • Carry out your plan to get to a solution 	<p>Step 4: Look back and reflect on the solution.</p> <ul style="list-style-type: none"> • Can you check your solution? • Did you select the best strategy? • What would you do differently next time?

Although Pólya's four stages of problem solving are listed in order, for difficult problems it may not be possible to simply move through them consecutively to produce an answer. You might need to move backwards and forwards between and across the steps.
(Pólya, George (1957). *"How to Solve It"*. Garden City, NY: Doubleday)

- Model the problem solving practice together so students learn the steps.
- Apply prior learning to the problem.
- Allow students time to plan and hypothesise various solutions, and experiment with finding the correct solution.
- Use drawing to show abstract ideas in a concrete manner, helping students visualise and solve the problem.
- Ask students to look for a pattern to help solve problems.
- Give students the opportunity to verbalise and share their thinking in coming up with solutions, this allows them to refine and extend their thinking skills.

SCF Pilot School Case Study

Identifying obstacles to solutions

SCF Pilot School

Al Bahya Private School

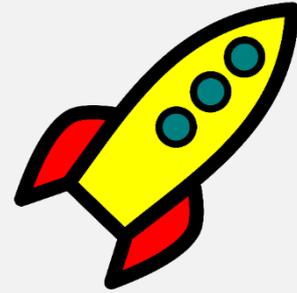
SCF Lead Teacher

Wafaa Saeed

Ms Wafaa's Grade 1 English class are learning about characters and setting. They are learning to identify characters in a story and describing the setting of the story. The students are also learning how to solve problems (problem solving competence). The story they are reading is about a mouse called Bo who wants to go to the moon. After learning about Bo being a character in the story Ms Wafaa and the students talked about Bo's problem – how to get to the moon. Each student drew a picture of their solution to Bo's problem.

Unsurprisingly many students drew rockets, however the pictures Ms Wafaa shared with the class were the solutions that were different or unique...

- A jet back pack
- Superman carrying Bo to the moon
- A very long ladder
- A car
- A helicopter



Ms Wafaa commended the student's unique ideas and as a class they talked about each solution. With prompting from their teacher students were able to identify the obstacles to the solutions, for example the ladder would need to be very long, Bo would need oxygen while climbing and he would be very tired once he got to the moon. When the students were challenging each solution Ms Wafaa made sure this was done in a way that still encouraged students to come up with unique solutions and that identifying the obstacles with your solution is a positive experience for a student.

Ms Wafaa's students **solved a problem** and they were encouraged to **consider other ways to solve problems**. They **communicated their solutions** through their pictures. Through the class discussion they **analysed the solutions** of their classmates and they **identified the obstacles** to those solutions.

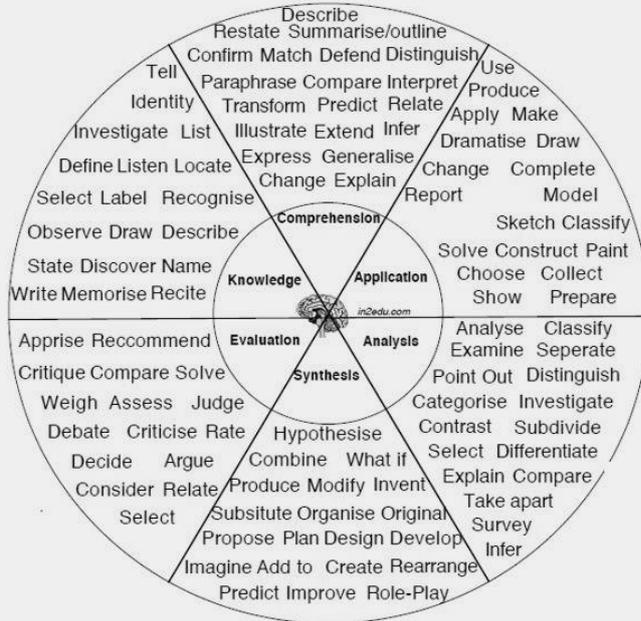
- Ask questions to stimulate problem-solving thoughts, such as:
 - “Why do you think...”
 - “How could we solve that?”
 - “What could we do about that etc...”
- Ask children to work out real world and meaningful maths problems, for example:
 - How many school buses are needed for a field trip?
 - How much material should be ordered to complete a class project?

SCF Pilot School Case Study

Blooms action verbs

SCF Pilot School

Bright Riders Private School



Many teachers are familiar with the [Blooms Taxonomy Action Verbs wheel](#), but Bright Riders Private School have taken this tool one step further. They have reorganised the action verbs into the SCF competences. Teachers use the action verbs when writing their learning outcomes. They start their learning outcome with an action verb that matches the major competence they and their students are focussing on.

Blooms action verbs for: **Problem Solving**

e.g. By the end of this lesson students will be able to **compare** different approaches to solving the fraction problems.

Action verbs:

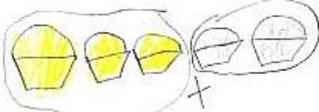
Identify	Perform	Generate	Act
Solve	Demonstrate	Debate	Justify
Observe	Predict	Compute	Show
Analyse	Explain	Categorise	Apply
Infer	Judge	Tabulate	Calculate
Record	Examine	Discover	Compare
Hypothesize	Employ	Analyse	Undertake
Provide	Consider		

- Support students to identify the obstacle for the solutions they come up with.

My solution:	Obstacles to my solution:	Changes I could make to my solution:

- Teach students how to solve problems in different ways. Support them to reflect on which way they chose and why.

Draw a picture	Draw a picture that shows the solution. The picture does not need to be detailed, it should only contain enough detail to solve the problem
Draw a diagram	Draw a diagram that shows the solution. A diagram is different from a picture. It might include images, text and numbers. A diagram often shows the relationship between things, for example a Venn diagram shows differences and similarities.
Guess and check	Guess the solution and check it. You might check your solutions against the correct solution, other people's solutions or an example from your teacher.
Act it out	Role play the solution. Act out the people, events or actions within the problem.
Use equipment	Use equipment to help you work out the solutions. This is works really well with mathematics problems.
Make a list	Think about all the parts of the problem and your solution, out them in an order that makes sense. There are lots of ways to order your list, for example: What happened first → What happened last Most important → Least important Similar things → Different things
Research it	Find out more about the problem and other solutions that have been tried.

Different ways to solve mathematics problems... Plan – Solve - Check	
Act it out 	Use cubes 
Draw it 	Write it 
Guess and check 	Expanded form $23 + 16 =$ $23 = 20 + 3$ $16 = 10 + 6$ $30 + 9 = 39$

- Teach students how to use diagrams when solving problems.

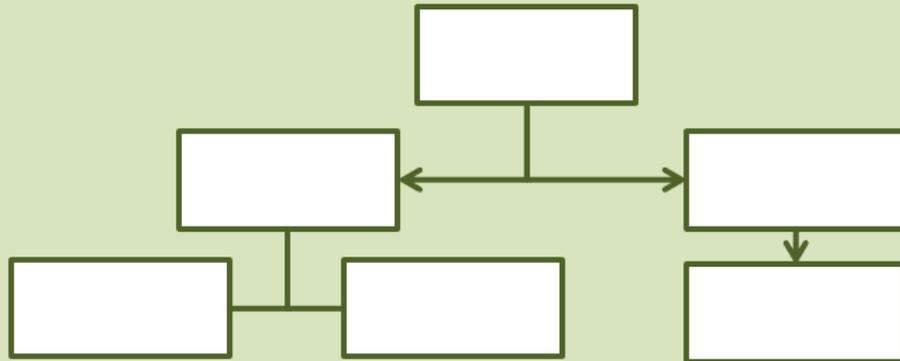
Chain diagram

Chain diagrams usually represent a *sequence* of events needed for a solution. The elements of the problem are set out in words, usually placed in boxes, and positioned in different places on a sheet of paper, using lines to represent the relationship between them.



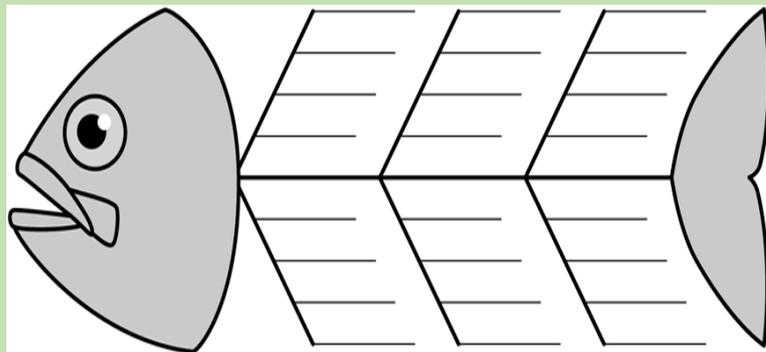
Flow charts

Flow charts allow for inclusion of branches, folds, loops, decision points and many other relationships between the elements. In practice, flow charts can be quite complicated and there are many conventions as to how they are drawn but, generally, simple diagrams are easier to understand and aid in 'seeing' the problem more readily.



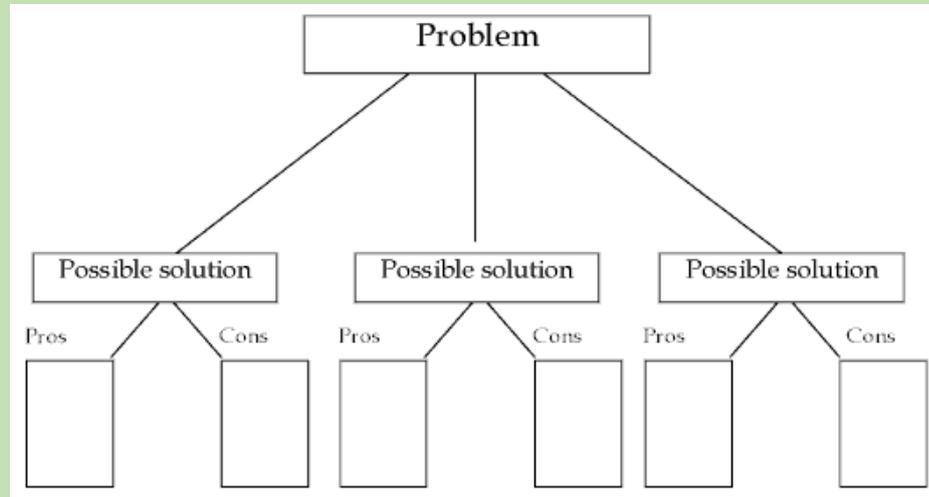
Fish bone, cause and effect

Write the problem in the fish head. Beside each long diagonal bone write the causes of the problem. Beside each small horizontal bone write the effects of the causes.



Consequence diagram

A consequence diagram helps you see the pros and cons with each solution.



- Use graphic organisers to support students through the problem solving process.

<p>What do you already know?</p>	<p>Brainstorm ways to solve this problem</p>
<p><i>What is the problem?</i></p>	
<p>Try it here</p>	<p>What did you learn by solving this problem?</p>