

Problems allow children to investigate concepts in new and varied situations. Any problem worth solving takes time and effort – that’s why they’re called problems!

Problems are designed to develop and use higher order thinking. Allowing children to grapple with problems, providing minimal support by asking strategic questions, is key.

Differentiating problems allows children to solve simpler problems, before solving more complex problems on a concept.

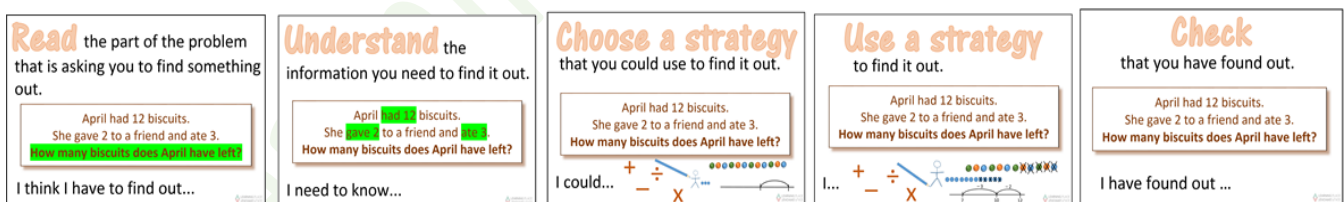
For professional learning on Problem Solving, with in-depth explanation of each step, select Professional Learning on the home page, then Mathematics, then Problem Solving.

Problems may not always be solved the first time they are presented – or at all.

The focus of problem solving is the development of problem solving understanding and capacity – not mastery! Returning to a problem after further learning, develops both resilience and increased confidence as children take the necessary time and input the necessary effort.

After solving problems, children also create their own problems.

Create 3 levels of a problem. GUIDE children through the first level using the problem solving steps (*described below*) included with all problem solving in all levels of all concepts:



Allow children to investigate the second level with friends, with minimal guidance. Allow children to investigate the third level INDEPENDENTLY. Children create their own problem.

The problem solving resources, included with EVERY level of EVERY concept at A Learning Place A Teaching Place, are designed to allow you to engage children in differentiated problem solving.

As Dan Meyer perceived, children are often pre-loaded with viruses when it comes to problem solving! They lack initiative, perseverance and retention, have an aversion to word problems and are often eager for formula. (Dan Meyer - TED talk)

Paul Lockhart proposed ‘A good problem is something you don't know how to solve. That's what makes it a good puzzle and a good opportunity’. (Paul Lockhart A Mathematician's Lament: How School Cheats Us Out of Our Most Fascinating and Imaginative Art Form)

Problems are designed to develop and use higher order thinking. *John Wesley Young explained, 'It is clear that the chief end of mathematical study must be to make the students think' and John Dewey added 'We only think when confronted with a problem'.*

Allowing children to grapple with problems, providing minimal support by asking strategic questions, is key. Problems may not always be solved the first time they are presented. Returning to a problem after further learning, develops both resilience and increased confidence as children take the necessary time and input the necessary effort. *Albert Einstein felt that, 'It's not that I'm so smart – I just stay with problems longer'.*

Differentiating problems allows children to solve simpler problems, before solving more complex problems on a concept. *George Polya found that 'If there is a problem you can't solve, then there is an easier problem you can't solve: find it'.*

As the expert in your classroom, you may differentiate the problems, and the problem solving process using the levels of understanding demonstrated by the children in your class.

These are some steps that good problem solvers use:

Step 1: READ the part of the problem that is asking you to find out.

The first step is read. But we don't need (or want!) to read the whole problem! To solve a problem, the first thing we need to know is what we are being asked to find out – so this is the part of the problem that we read first!

A great way to train children to read the part of the problem that is asking them to find out is to display the problem with everything except this part covered. Children then engage with it, thinking about and discussing what information, whether in written or visual form, they expect to find and will look for in the problem before it is revealed.

Children may otherwise attempt to read the whole problem, from top to bottom. This means they will read irrelevant as well as relevant information, causing confusion and information overload. Until we know what we are being asked to find out, we do not know which information is relevant and which is not.

Step 2: UNDERSTAND the information you need to find it out.

Once children know what information they are looking for, whether in written or visual form, their success rate at finding it improves! Children identify the relevant information, and ignore the irrelevant information. Thus reading every word in a problem is almost never necessary!

Step 3: CHOOSE A STRATEGY that you could use to find it out.

Now that children know what they need to find out, and have identified the information they need to find it out, they are well-placed to come up with a strategy to work it out.

Strategies need to be explicitly taught, but not in isolation. Most problems can be solved using a variety of strategies, and using a combination of strategies. Problems that can be solved using objects, can also be solved by drawing pictures. Problems that can be solved by guessing and checking / trial and error also involve looking for a pattern and arranging guesses / trials in lists assist the process.

Rather than teaching problem solving strategies in isolation, presenting problems that may be solved in a variety of ways then having children share strategies both during and after the problem solving process is key.

Step 4: USE A STRATEGY to find it out.

Children then work either in pairs, small groups or independently to use their strategy to solve the first and second levels of the problem. Most of the problem solving process time is spent in this step – problem solving takes time! Children confer with other children and with the teacher. As the teacher, the message during this step is 'be less helpful!'.

Trust that the children can become successful problem solvers. Once the children realise you are not going to solve the problem for them, they will engage their intuition! Children may not solve the problem the first time it is presented. Children develop the understanding that it is the problem solving process that is important, and not getting an answer to one specific problem which they will never see again.

Step 5: CHECK that you have found out.

Many children stop once they have arrived at an answer, without concerning themselves about whether their answer is logical.

Checking by simply rereading the part that asked them to find out and checking that they have found it out takes but a few seconds but could mean the difference between getting the marks for all of the time and effort and not getting the marks!

After solving problems, children also create their own problems. They use the part of the problem that asked them to find something out as a base for a new problem.

Einstein explains that 'the formulation of a problem is far more essential than its solution, which may be merely a matter of mathematical or experimental skill'.

alearningplace.com.au