Why we teach problem solving

Providing children with the skills required to solve mathematical problems in life should be the principal aim of any maths curriculum. It is therefore crucial that, in addition to teaching number skills and number fact, children are exposed to rich mathematical problems during their time in school. Though skills teaching is of course essential, a curriculum focussed solely on developing competence with number, and where rich problem solving opportunities are not provided, is akin to learning scales on a piano but never playing music.

To help illustrate the value of the kinds of problem solving that we teach here at Coleridge, we have drawn the distinction between '*doing maths'* and '*being mathematical*'.

Doing maths is the process of improving proficiency in number skill. It is done by ascertaining the child's level of competency in one area of the maths curriculum and then moving it forward through progressive skills teaching and routine application exercises. This has been the main thrust of primary maths teaching in the UK for many years and perhaps explains why, when asked to describe 'what is maths?', most primary aged children in a study conducted by Nrich, responded by saying that it is 'learning facts about numbers to pass tests'.

Being mathematical, by contrast, is the process of applying maths in a meaningful context, using the kinds of skills which real mathematicians use on a daily basis. Trial and improvement, working systematically, reasoning, conjecturing and generalizing are all essential in the process of solving problems and yet they do not appear amongst the objectives of the National Curriculum.

It is our belief that a mixture of teaching children *to do maths* **and** to *be mathematical* will ensure that children develop into effective problem solvers and will help them to value mathematics as something which is fundamentally useful.

How we teach problem solving

The process of solving problems is one which has to be taught to children. If children are to develop resilience and enjoyment around problem solving, then the skills must be taught consistently and progressively across the primary age range in an organised way. The problem solving skills that we aim to teach children at Coleridge are:

- Trial and Improvement

- Working Systematically

- Pattern Spotting

- Working Backwards

- Reasoning

- Visualising

- Conjecturing, Generalising and Proving

When teaching problem solving, it is important that the development of the problem solving skill - rather than the development of the number skill - becomes the main focus. If children are to learn to work systematically to find all the possible combinations of coins which total 50p for example, then they must already be proficient in adding numbers to 50. If they are unable to do this, then the maths skill, or lack thereof, acts as a barrier to learning the problem solving skill. (For this reason, Home Learning exercises with a problem solving focus may sometimes appear to contain maths skills that are too easy for your child).

Once an appropriate problem has been selected based on the objective being covered and on the level of maths skill contained within the problem, the teacher will guide the children through the following stages of the problem solving process:

- **Getting started** - understanding the problem and discussing it with others (what is being asked of me? what strategies may be helpful in solving it? What resources do I need?)

- **Working on the Problem** - exploring the problem using learned problem solving strategies.

- **Taking it further** - the children themselves generate questions about the problem and find answers to these (how many combinations would there be if there were 6 beads instead of 5?)

- **Concluding** - making generalisations and explaining findings in a way that makes sense to others

During the problem solving process, it is important for the teacher to facilitate rather than to lead the conversation or thinking in the classroom. If you are working on a problem with your child at home and can see a suitable approach or answer, try to avoid leading your child to it. Children must make sense of a problem - and any applicable problem solving strategy –in a way that is meaningful to them. The process of making mistakes is extremely important, and one which children must learn to value if they are to become proficient problem solvers.

Ben Strange and Louise Foulkes 2014

* Further information about these skills and examples of problems which help to develop them, can be found in the accompanying PowerPoint presentation.