**Problem Solving in Primary Education**

The key skill of problem-solving involves pupils in developing the skills and strategies that will help them to solve problems they face in learning and in life. Problem-solving includes the skills of identifying and understanding the problem, planning the ways to solve a problem, monitoring progress in tackling a problem and reviewing a solution to a problem (National Curriculum, 2000).

**Some indicators of problem-solving**

Children may demonstrate that they can:

* understand the concept of cause and effect;
* apply prior learning to a problem;
* recognise and can talk (or otherwise communicate) about a problem;
* consider a range of possible solutions;
* ask questions and select and record information relevant to the problem;
* plan the steps and strategies they will use;
* predict possible effects of different solutions or modifications;
* respond to a problem or task using trial and error;
* use a cycle of trial, error and improvement;
* review what has been done and recognise the outcome (i.e. that the problem has been solved or a different course of action is needed).

By the end of Key Stage 2, children working at or above age-related expectations can recognise and explain a problem, and hypothesise about the causes and possible solutions. They can plan and trial possible solutions using appropriate tools. They are able to undertake on-going monitoring, modification and review of the steps towards a solution, seeking additional and relevant information when necessary. They are able to evaluate their solutions by reflecting on the process undertaken and the outcomes. They can make judgements about the quality of the solution and the processes they undertook, using relevant success criteria.

**Examples of problem solving in the curriculum**

These examples illustrate how problem solving is embedded in the National Curriculum and *Curriculum Guidance for the Foundation Stage*. This is not an exhaustive list. Further examples can also be found in Planning, *Teaching and assessing the curriculum for pupils with learning difficulties* (QCA, 2000).

**Areas of learning, Foundation Stage**

* Have a positive approach to new experiences.
* Use developing mathematical ideas and methods to solve practical problems.
* Investigate objects and materials by using all of their senses as appropriate.
* Negotiate an appropriate pathway when walking, running or using a wheelchair or other mobility aids, both indoors and outdoors.
* Make three-dimensional structures.

**Programmes of Study, Key Stage 1**

* Select tools, techniques and materials for making their product.
* Investigate the possibilities of a range of materials and processes.
* Choose sensible calculation methods to solve whole-number problems (including problems involving money or measures), drawing on their understanding of the operations.

**Programmes of Study, Key Stage 2**

* Find different ways of approaching a problem in order to overcome any difficulties.
* Use a range of orienteering and problem-solving skills.
* Suggest alternative ways of making their product, if first attempts fail.
* Investigate and combine visual and tactile qualities of materials.

**Examples of practice: problem-solving**

**Geography, art and design/**Cross-year, Stifford Primary School

Children of all ages were presented with a real-life problem to solve associated with improving their school grounds. The problem was to use different parts of the grounds to represent the continents of the world. They researched the continents using questions generated by the teacher or practitioner, by local business ‘ambassadors’ and within their own groups. Each group created a design that represented one continent.

Classes presented their design solutions to the whole school and children voted for the best one. The agreed design solution was then reviewed against other challenges, such as the availability of different trees and the expense providing sculptures of different animals or landmarks. There is on-going work involving trial, error, improvement which involves surveying the school grounds. The eventual outcome of this long-term project will be the development of the school grounds into six distinct areas, with trees, sculptures and stimuli for play that represent the different continents.

*Foundation Stage*

The Reception children worked on a solution to the problem of which sculpture to select for a designated area. Once they had collected the information, they came up with a list of suggestions. These suggestions were then put through the ‘six hats thinking test’ (de Bono, 1985). The children were able to predict possible effects of the different solutions and came up with a single recommendation for consideration by the school:

*A snowman would be good because all children like them and we can only make them when it snows and then they melt.*

This suggestion was to put the whole school and won unanimous support as the sculpture to represent Antarctica. A fuller case study is available on the *Learning and teaching in the primary years* CD-ROM.

Further guidance and exemplification may be found in Problem-solving – a CPD pack to support the learning and teaching of mathematical problem-solving. Problem-solving is a key learning skill in mathematics and across the curriculum. This pack of materials addresses the problem-solving strategies that children might use and be taught in their mathematics lessons. The materials include guidance for two staff meetings, lesson plans and activities for all year groups from Foundation Stage to Year 6, and video sequences to illustrate key teaching approaches that help to develop children’s problem-solving skills.

**Community involvement, history, science: the Ancients’ appliance of Science/**Year 5, Brampton Junior School, Fitzwilliam Museum, University of Cambridge, Faculty of Education.

The year 5 children spent the morning in the Egyptian gallery of the Fitzwilliam Museum, Cambridge, where the education officer guided them in thinking about how the Egyptians would have lived and worked in the harsh environment of ancient Egypt. They were encouraged to question the ancient Egyptian objects in ways that explored the problems and challenges faced in the construction of the sarcophagus of Rameses III and how they would have been solved be the development of technology in ancient Egypt. They considered the construction of coffins, fuelling a fire, the process of mummifications, smelting metals, making the ropes to move the stones, moving the stones cross the desert and the problems of dehydration for the workers.

This was followed by a workshop at Homerton College, where problem-solving activities linked to the problems explored during the morning had been set up: dragging a brick across the ‘desert’; floating a brick across the ‘Nile’, raising a brick using a sand ramp; preserving living tissues (experiments on drying out); using ramps, levers and inclined planes. Working in groups and supported by the science tutor and trainee teachers, the children explored the challenges and identified solutions. In a plenary, each group shared their results with the whole class and evaluated their solutions.

A fuller case study is in the unit *Key aspects of learning across the primary curriculum.*

**Mathematics/**Year 1, St Lukes CE Primary School.

Children were set the problem of finding all the different ways of paying for lollipops when the shopkeeper had asked for the exact money only. The scene was set using visual and practical resources. The teacher introduced the problem and worked with the children on finding solutions. Children then worked in pairs to find the range of possibilities, using coins to help them. They recorded theirs solutions as number sentences. These were then discussed to decide whether their solutions were the same or different. The teacher commented on the things she had observed, making clear what she valued in the ways the children were working. The lesson was structured to allow for mini-plenaries so that ideas could be shared and children could build on each other’s ideas. The teacher encouraged children to record systematically and demonstrated some of the processes that could be useful to promote systematic working.

The teaching is this lesson was based on the first of the two Year 1 lessons from the mathematics Problem-solving pack.