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Problem Solving Y2: Mastermind

Introduction

This is a computer version of the board game Mastermind. It can be simplified by limiting the use of colours. A two-colour game is very straightforward and a good way to introduce children to the reasoning processes required to play the game.

What will the children learn?

Problem solving and investigatory activities do not have a ready-made or widely accepted place in the curriculum of most schools. Perhaps it is right that they should not. Problem solving is not an extra subject; it is an approach, a series of skills and strategies, which can underpin much of the curriculum.

Children need time and a diversity of experience to develop and apply problem-solving skills effectively. Very few schools offer this at present. There is a need to give more time to activities such as:

- practical investigations in mathematics and science
- logical games such as Mastermind or draughts
- problem posing and solving with the computer.

Games in particular (both on and off the computer) provide a wealth of opportunities for children to acquire and practise the use of a wide range of problem solving skills and strategies. In games children encounter problems, often of their own making, under sets of conditions that are clearly defined and well understood by the players. Games are microworlds for learning and could have a valuable place in the school curriculum.

Logical games develop:

- problem solving skills such as trial-and-error investigation, hypothesis testing and searching for relationships
- reasoning skills such as inference, deduction analysis and evaluation
- social skills of cooperation, communication and constructive argument
- life skills such as perseverance, and the ability to see initial failure as a challenge and to learn from it.

The games provide opportunities to stretch the abilities of all pupils and allow these basic problem solving skills to be applied in novel and motivating contexts.

Equipment

- A computer with Internet access
- An interactive whiteboard is useful for demonstration
- The software can be found at http://www.vtaide.com/png/puzzles.htm - select More Thinking Games from the menu and then Mastermind.

The activity

As in the board game version, the aim is to deduce the sequence of four coloured pegs the opponent (in this case the computer) has selected at random from the open trays on the right. These pegs are hidden at the top of the board and revealed when the correct sequence is discovered.

The first task is to select the set of colours to play with. The default set contains six colours, like the classic game. Clicking on a tray in the box on the right will toggle the cover over it, excluding it from the set for the current game.

Pressing the **Start** button begins the game.

Four pegs must now be placed in the four holes in the bottom row by dragging from the storage tray. This first attempt will be a blind guess, although some strategies may be more helpful than others (see below). When the **Guess** button is pressed the computer will mark the guess by awarding one counter for each correct peg. The counter will be black if the peg was the right colour in the right place; white if the colour was correct but in the wrong place. There is no information about which of the pegs is correctly placed.
If the sequence has not been discovered by the 10th guess, the computer will reveal it and the game ends.

If the children are unfamiliar with the board game it would be helpful to introduce it to the whole class using a large display. Begin by playing with just two colours.

Before discussing strategy allow all the children to play a few games. It is helpful for the children to begin by playing in pairs against the computer. This allows for discussion and development of ideas and strategies.

Allow the children to play a few games and then bring them together to discuss what they have discovered about strategy.

Ask the children what colours to place in the bottom row. Several strategies are possible. If all holes are filled with the same colour the feedback give straightforward information about how many pegs of that colour are correct. For example, when playing with red and blue colours only, if the row is filled with blue pegs and the computer response is one black counter, then it is clear that the correct sequence contains one blue and three red.

The next 'guess' should not be a blind guess, but should build upon the information already acquired. Placing 1 blue and 3 red will be sure to give a response of 4 counters. Black ones indicate a colour in the correct place; white ones in the wrong place. Subsequent goes involve trying the pegs in different places until the correct sequence is guessed, the top row of pegs is revealed as a complete match and the word 'Congratulation!' (sic) is displayed.

Pressing **Start** again gives a new game.

Careful analysis should allow any two-colour set to be guessed in 5 attempts.

Why are we using ICT?

The use of an electronic whiteboard or other large display allows the teacher to demonstrate the activity to children and explain the puzzle. The on-screen version allows for endless experimentation until the solution is found and provides instant (and accurate) feedback on each entry.

Where do we go next?

Once the children have mastered the two-colour game encourage them to play with increasing numbers of colours. This increases the complexity and makes the deduction more difficult. Discourage blind guessing – try to encourage children to work strategically.

You will find other interesting activities on this website.