Counting Cards

http://nrich.maths.org/1843

A magician took a suit of thirteen cards and held them in his hand face down.

He took the top card off the pile and put it at the bottom , saying 'A' as he did it. He took the next card and said 'C' as he put it at the bottom. He took the next card and turned it over, saying 'E' as he did it - and the card was an ACE!

He carried on with the letters T-W-O and as he said the 'O' he turned over the card and it was a TWO!

He carried on with T-H-R-E-E, the FOUR and so on, and in each case as he said the last letter of the name he turned over the card and everyone was amazed that he had predicted what it would be.

How did this work?

Try with a slightly simpler version: Starting with ten cards numbered 1 to 10, can you arrange them in such a way that - starting with the arranged pile face down - you can spell out each card and reveal it as you announce its last letter?

Can you explain a way of doing this systematically so that you can quickly arrange any number of cards to make the trick work?

And the really hard bit: What would happen if you counted the number of cards equal to the value of the next card (so, if the next card was due to be a six - you would put five cards on the bottom of the pack and reveal the sixth)?

You Will Need:

- A standard deck of cards

Why do this problem?

Most children like to be able to do 'magic tricks' and this one is firmly based on the mathematical thinking skills of working systematically and working backwards. But it is challenging!

Possible approach

This works brilliantly if you practise it first and do it as a magic trick in front of the children. Your street credibility will go up! If you can get hold of a giant set of playing cards so much the better. Or, arrange the cards in the correct order and ask a child to come and move and count them in the way described in the problem, and then express amazement that they have managed to do such a clever magic trick.

After displaying the magic touch, ask the children what they think the trick involves. Ask them to work only with 2–10 and give then time to 'get into' the problem and after a short time draw everyone together to ask how they are starting their problem-solving work.

Some children will want to work by themselves and will already have thought of working backwards, or perhaps recording in some way. Others may not be able to get started and you may want to suggest that they try with a smaller set, say 2–6.

Allow some time for the children to solve the problem and then have the satisfaction of demonstrating their new trick. It works well as an activity that 'simmers' over a few lessons - and the children return to whenever they have free time or have finished their set work.

Key questions

What's the first word you're going to spell out?
How many letters does it have?
What's the last letter of the word?
Which card must that be?

Possible extension

The problem as presented has plenty of challenge and those who need more can make up their own. Can they do it backwards (King, Queen etc), or do all the even numbers first ...?

Possible support

Working with a smaller set of cards such 2–6 is more manageable but there will be some children who will find this too challenging. You might choose to make them feel a part of what is going on by being the magician's assistant and turning over the cards that someone else has ordered.