

Hands On, Minds On

Dr Paul Swan examines the use of mathematics manipulatives materials in the teaching of maths, something that is promoted worldwide as a good pedagogy...

To help teachers make the best use of mathematics manipulative materials, Edx Education has teamed up with Dr Paul Swan to create this Manipulative Reference Manual, a simple guide that explains the following:

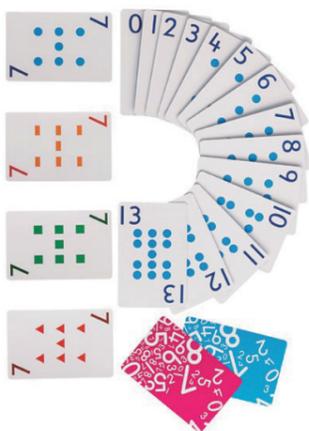
- > Common uses for specific manipulative materials.
- > The language associated with the use of the manipulative.
- > The mathematics content that the manipulative will help develop.
- > Support materials that help teachers gain the most from the manipulative.
- > Quantities required when working with a class of students.

What is a mathematics manipulative?

A mathematics manipulative is an object or series of objects that can be touched and turned by an individual in such a manner as to promote conscious and subconscious thought about the mathematical concept or idea being studied. Some manipulative materials are structured with a single purpose in mind (e.g. fraction bars) whereas others (e.g. pattern blocks) are less so and can be used to help teach a variety of mathematics concepts.

Virtual manipulatives

With the advent of the internet and the introduction of interactive whiteboards and tablets into the classroom, we've seen the development of virtual – or online – mathematics manipulatives. But while these certainly have a purpose, it's important that students also handle real manipulative materials so they have a tactile experience. Fortunately, there is no shortage of resources in this regard. Calculators, measuring instruments, demonstration models and cards games are all examples of the tools we use in the teaching of mathematics – as are charts.



Justification for using mathematics manipulatives

There is an ancient Chinese proverb that is used to justify the use of manipulative materials in the teaching and learning of mathematics:

*I hear and I forget
I see and I remember
I do and I understand*

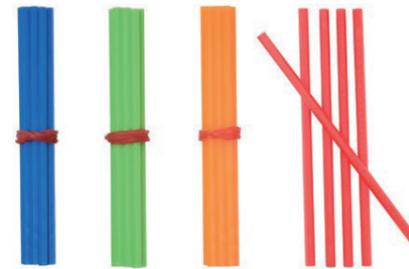
While this appears logical, sceptics might well ask, "Where is the evidence?"

The research

The use of manipulative materials in the teaching of mathematics has been widely researched. Baroody (1989), summed it up in the title of his paper, 'Manipulatives don't come with guarantees'. Like any tool, the results depend on the skill of the user – in this case the teacher. What is clear is that students may not 'see' manipulative materials in the same way we do. For example, some students view the large base 10 block as 600 because they can see six faces of 100. We already understand the concepts, whereas, children are still learning them.

Suydham (1986) found that manipulative materials were linked to an improvement in achievement. However, there is a caveat, that is, the appropriate manipulative has to be used at the right time. Using the example of the base 10 material, students need to

have experienced bundling discrete materials into 10s, before using pre-bundled materials such as base 10 blocks. What is clear is that teachers need to 'know their stuff', that is, the mathematics and the pedagogy, the best way to teach the mathematics concept. In most, but not all the cases, manipulative materials will help.



Using mathematic manipulatives

One thing is clear, before the manipulative materials can be of assistance, teachers must master some basic management strategies for distributing and packing away the materials. They need to link the use of materials to the language that's appropriate for the subject being taught. Probing questions should also be asked to check students' comprehension.



Physical Materials -Manipulatives

- seeing (visual image)
- experiencing (hands on)

Language

- talk about
- write about
- read

leads to

Symbols

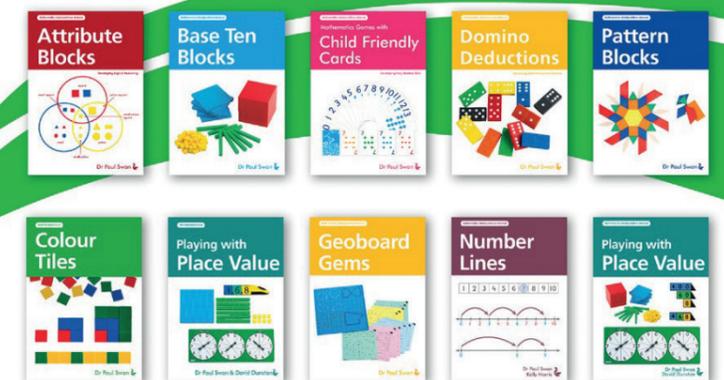
- representation



Support for using mathematics manipulative materials

To make the best use of mathematics manipulatives, teachers require support, which may come in various forms: manuals, activity cards and short video clips. Find some at the EDX Education YouTube channel (goo.gl/R3Sr4T).

Dr Paul Swan's Books



Dr Paul Swan is an award-winning author and mathematics educator, and is working with Edx Education to develop high-quality maths resources. The Edx Education range is distributed in the UK by Commotion Distribution – for more information call 01732 225 821, email info@commotiondistribution.com or visit commotiondistribution.com