babcock

Making Multiplication Memorable

M3

Set H

Introduction

> *The aims of the National Curriculum are to develop fluency and the ability to reason mathematically and solve problems. Reasoning is not only important in its own right but impacts on the other two aims. Reasoning about what is already known in order to work out what is unknown will improve fluency; for example if I know what 12 × 12 is, I can apply reasoning to work out 12 × 13. The ability to reason also supports the application of mathematics and an ability to solve problems set in unfamiliar contexts.*
>
> NCETM (2014)

Children often memorise multiplication and division facts without understanding the operations of multiplication and division and how they are connected, both with each other and with fractions. This limits children to answering questions for which they can remember the answer or to using counting. The aim of this resource is to support children to know and understand the multiplicative composition of numbers so that they reason when solving problems involving multiplication and division.

Multiplicative composition of numbers involves understanding how a number can be partitioned into whole numbers which when multiplied together produce that number, just as additive composition involves understanding how a number can be partitioned into whole numbers which when added together total the number. For example:

- Understanding the additive composition of 5 means knowing that it can be thought of as:
  5 and 0, 4 and 1, 3 and 2, 1 and 1 and 1 and 2 etc.
- Understanding the multiplicative composition of 12 means knowing that it can be thought of as:
  12 × 1, 6 × 2, 4 × 3, 2 × 2 × 3 etc.

Understanding the multiplicative composition of numbers includes understanding multiplication and division facts and the relationship between them as well as properties of numbers, including: factors, factor pairs and common factors; multiples and common multiples; square and cube numbers.

Central to the resource is a focus on:

- understanding different multiplicative representations.
- connecting known multiplications with other multiplications.
- connecting known multiplications with divisions.
- understanding the structures of multiplication and division.

Understanding different multiplicative representations

> *Memorizing some mathematics is useful, but the researchers' conclusions were clear: an automatic command of times tables or other facts should be reached through "understanding of the underlying numerical relations." Additional evidence tells us that students gain a deeper understanding of math when they approach it visually—for instance, seeing multiplication facts as rectangular arrays or quadratic functions as growing patterns. When we think about or use symbols and numbers, we use different brain pathways than when we visualize or estimate with numbers.*
>
> Boaler and Zoido (2016)

Recent evidence from brain research shows that different brain pathways are used when visualising numbers compared with thinking of symbols. This supports long-standing approaches to mathematics which promote understanding through connecting different representations of mathematics. NCETM (2015) suggested that one of the ways we know if a pupil really understands a mathematical concept is if they can:

> *Represent it in a variety of ways (e.g. using concrete materials, pictures and symbols)*
>
> NCETM (2015) based on Holt (1964)

Section 2: Making the connection

Connect two

Organisation: Pairs

Cards: 6, 8, 10, 38, 39, 40, 49, 51, 53, 65, 67, 69

Activity:

Give each pair a set of the twelve cards and ask them to lay the cards out on the table in front of them, face up. Explain that they are going to take it in turn to select two cards they think are connected and explain the connection to their partner.

Model this with cards 8 and 39 (slide 33) explaining the connection. Ask the children if they agree that the cards are connected. Then look at cards 8 and 69 (slide 34) and say there is a connection because the dartboard shows a score of five lots of nine. Ask the children if they agree that the cards are connected. Expect them to disagree; the dartboard shows three darts each scoring nine.

Explain that they will do this with their partner and if they agree they are connected (like card 8 and card 39) the child who selected them keeps the cards and then their partner takes a turn. If they do not agree about a pair of cards, (like cards 8 and 69) these are put to one side for discussion with the whole class. They keep going until they have used all the cards.

Key questions:

- These two cards have been matched; can you explain why?
- Did you match these two cards or did you connect them with different cards? Can you explain why?
- Could any other cards be matched to this pair? Can you explain why?
- Can you make your own card that would match these two cards?
- Were there any pairs of cards that you disagreed about? Why?
- Can you suggest a pair of cards that can't be matched and explain why they don't match?

Variations:

- One child chooses a card and the other child selects a card to match and explains why.
- Match more than two cards and explain.
- Use more than twelve cards or alternative cards from the set to focus on different connections e.g. division, scaling, using connected multiplications (× 2, × 4, × 8).
- Work in threes or fours with everyone having to agree.

9×7

9×5

9×3

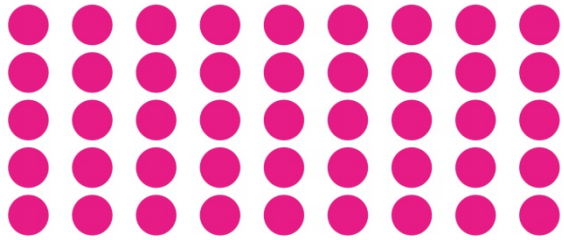
lots of
nine

nine
multiplied by

groups of
nine

9 9 9

5



5

2


9p
9p
9p
9p
9p


WINMAU
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