Function Machine   2.1.4

Introduction

Investigate addition and subtraction as inverse functions and Investigate the effect of repeatedly adding a number.

Resources

- Function Machine
- Recording Table
- Numbers 1 - 100
- Function Machine – arrows, rules +1; +2; -1; -2; and blank rules and digit cards.
- Mini Whiteboards
- Whiteboard markers
- Partitioning Part Whole Cards
- Early Years FISH Kit
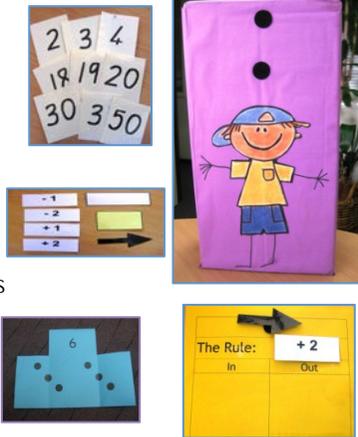
Time / Classroom Organisation

This activity can be introduced with small or whole group. Allow 20 minutes to introduce each activity process. Use the function machine regularly for small group and transitional activities.

Australian Curriculum

Year level: Two

ACMNA029 Explore the connection between addition and subtraction (ACMNA029)

ACMNA030 Solve simple addition and subtraction problems using a range of efficient mental and written strategies (ACMNA030)

ACMNA036 Solve problems by using number sentences for addition or subtraction (ACMNA036)

Partitioning --- Part Whole Cards

1. Hold up the partitioning card with both flaps closed.
2. Open one flap up for the students to see.
3. Ask students to guess what number of dots is hidden underneath the closed flap.
4. Ask students how they worked out the answer – using combinations to ten, doubles, count on or count back.
5. Record this number story on the whiteboard, for example:

   3+3=6

6. Repeat the activity but this time open the other flap first and ask students to complete a subtraction number story with the numbers shown. Record this number story, for example:

   6---3=3

7. Discuss with students how they worked out the answer to the second problem.
8. Repeat with other numbers. Ask students to record the part-part-whole card as addition and subtraction number stories.
9. Discuss with students the relationship between subtraction and addition algorithms.

Activity Process –
The Function Machine: Following the Rule

1. Place a rule on the front of the function machine e.g. "+ 5" and an arrow pointing to the right.
2. Place the blank cards and whiteboard pen behind the machine
3. Select two students to act as 'the function workers' sitting behind the function box.
4. Hand out the 'in' cards (numbers 0-10) to students.
5. Ask students (with the 'in' cards) to come out one at a time and stand on the left of the machine.
6. Read the rule on the machine and ask them what they think will happen to their object as they place it in the machine.
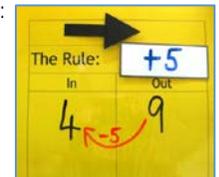
4. Place their number into the left side of the machine and walk in the direction of the arrow.
5. The 'function workers' apply the rule and write the new number on the blank card. They then pass this through the right side of the machine. For example: 4 *goes in/ +5 / 9 comes out*.
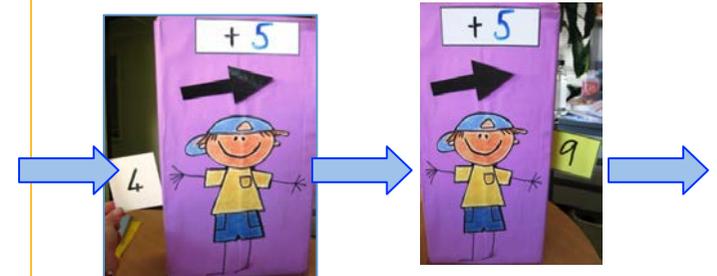
6. Ask a student to represent this on a table:
7. Ask another student to represent this as an equation: *4+5=9*

$$4 + 5 = 9$$

11. Turn the arrow to point to the left. Discuss what will happen if rule is REVERSED (-5).
12. Insert the numeral (9) in the right side of the function machine. The function workers apply the rule (-5) and send the numeral (4) out through the left side of the machine.
13. Ask a student to draw an arrow on the table to indicate the reverse of the function:

$$4+5=9$$
$$9-5=4$$

13. Ask a student to represent the inverse function as an equation:
16. Discuss **inverse relationships**. *Addition and subtraction are inverse operations and can undo each other.*
17. Repeat with addition and subtraction and different representations of the operation: +5; add 5; 5 more; +10; add 10 etc. Use numbers to 50 as students are ready.

   Source: E deVries & E Warren

Variations and Extensions

1.   Function Machine – Finding Patterns

Resources: Function Machine, recording tables, arrows, rule cards
and digits.

Place a rule on the top of the function machine, for example: +10
Draw a table on the board, with the rule (+10) on top and two
columns underneath labelled – 'in' and 'out'
Have two students stand at the board as the students enter the
number into the function machine.
Continually pass the number that comes 'out' of the right side of the
function machine back through the 'in' (left) side of the function
machine.
Record the numbers as they go in the function machine, and as
they come out of the function machine.
Discuss the patterns, for example: *the tens numeral is changing but
the ones numeral stays the same.*
Reverse the arrow and repeat the process using subtraction (-10)
Source: E deVries & E Warren, 2008

What strategy can I use?

I can use a model

Interactive Whiteboard Resources
http://www.ideal-resources.com.au/index.php

Sum Sense (Addition)
Drag and drop the number cards to make 'sum' sense. When you think
the cards are in the correct place press the 'Next' button for another
question.

Sum Sense (Subtraction)
Drag and drop the number cards to make 'sum' sense. When you think
the cards are in the correct place press the 'Next' button for another
question.

Contexts for learning
Play:
Allow students to play with the function machine as an activity
choice during maths groups.
Investigation:
Number Fun: Give students 2 single digit numbers. Ask students to
work out as many addition and subtraction number stories that they
can using those 2 numbers.
Real life experience:
Write the number of students present each day as an addition and a
subtraction story, for example:

> 29 in our class, 27 here today, how many absent?
>
> 27+2=29
>
> 29---27=2

Routines and Transitions:
Use the **Function Machine** as a transitional activity.

Assessment
- demonstrate how addition and subtraction are inverse operations (U)
- use bundling of objects to model addition and subtraction
- recognise which strategy worked and which did not (U) (R)
- explain or demonstrate how an answer was obtained (R)
- describe what has been learnt from creating patterns, making connections with addition and related subtraction facts (U)
- students can consistently follow a given rule (addition and subtraction of numbers to 10); and reverse the rule to change a number back to its original value. Students represent the inverse operations.

Background Reading
Functional thinking is essential for building thinking skills and for
preparing students for the study of algebra. Algebraic building blocks
include:
Building **rules** for representing functions including recognising
patterns and making generalisations
Doing and undoing – understanding the process and being able to
work backwards. Addition and subtraction have an **inverse
relationship** (7+3=10 / 10-3=7); and multiplication and division have
an **inverse relationship** (2x4=8 / 8÷4=2).

Source: Caprano,Rangel-Chavez: http://tsg.icme11.org/document/get/382

Year three NAPLAN Numeracy links
2009 Question 9 – Identifies process to match/solve addition
problems
2009 Question 21 – Reads a table to solve a subtraction problem

Links to other MAG's
1.4.2   Number Lines – adding and subtracting
2.2.4   Addition and Subtraction strategies
2.3.2   Number Sequences - 2