



## **Numeracy and Mathematics – Information Sheet**

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DSA Education Consortium 2005*

### **How do pupils with Down's syndrome acquire mathematics skills?**

Generally, pupils with Down's syndrome encounter significant difficulty acquiring mathematical concepts. However, their developmental stages and consequently their acquisition of mathematical concepts, although a great deal slower, appear to be similar to that of their typically developing peers. Number competence is linked to their general level of knowledge and understanding and language development and not to having Down's syndrome.

Acquiring new mathematics skills and concepts depends heavily on previously learned skills. Before introducing new concepts consider existing background knowledge and ensure prerequisite skills have been achieved. Reinforce these skills for several days to assist recall and use the relevant operations and skills in new or more complex operations.

### **What impact does language delay and short-term memory have on the development of mathematics skills?**

Difficulties in processing language together with remembering what to do and in which order may restrict the capacity to complete tasks. Calculations and word problems all require language therefore it is important to teach all mathematics vocabulary and the associated concepts together.

Some every day vocabulary used in a mathematical context may be ambiguous and be potentially confusing, such as 'higher' and 'lower'. Literally speaking there are no 'higher' or 'lower' numbers on a horizontal number line. Illustrate the new meaning with a number ladder placed vertically in a menu holder.

### **Which areas of the mathematics curriculum are most useful?**

It is essential to provide a mathematics curriculum that will prepare pupils to function independently after completing their education. For example, pupils need to acquire skills in money, time, measurement, and a basic knowledge and understanding of number in order to function effectively in daily living.

## What strategies will aid the understanding of basic number skills?

Capitalise upon the pupil's strong visual memory and introduce number names as words as well as the symbols together with number shapes such as dice or Numicon™ to facilitate early practice in rote counting. This will provide a visual prompt, reduce the stress upon the short-term auditory memory and help overcome sequencing difficulties. Instruction should be in simple language, be relevant to the task and be backed up with demonstration or pictorial representation.

Teach the basic counting sequence, "one, two, three," and focus upon the learning of the basic concepts and the rules that apply to counting effectively, which are:

- One to one correspondence - only one word tag (e.g. one, two) is assigned to each counted object
- Stable order - the order of the word tags (e.g. one, two, three), must not vary when counting sets
- Cardinality - the value of the final word tag represents the quantity of items in the counted set. If the pupil understands cardinality then s/he will repeat only the last number word
- Abstraction - objects of any kind can be collected and counted
- Order-irrelevance - items within a set can be counted in any order and any direction

Many pupils with Down's syndrome have difficulty retaining facts. Instead of teaching all addition facts within ten it may be beneficial to teach only addition and subtraction of 1, 2, and 3 from given numbers. The pupil may then achieve a degree of competence in mental numeracy. Practising rote counting in 1s, 2s and 3s forward and backward may develop this skill.

## Which numeracy skills will benefit money skills?

Teach rote counting, in 1s, 2s (odd and even), 5s, 10s, 20s, and 50s. Practise counting from numbers other than zero or one. This will provide a basis for counting coin amounts and giving change. Introduce activities that require the pupil to round up money amounts to the nearest pound in order to give sufficient money and get change back.

**Always use real coins** and never plastic imitation money. Create opportunities for real situations for handling money. Don't worry if your pupil does not understand the equivalent value of coins, e.g. that 2 pence has the same value as two 1 pence coins. Instead, teach the recognition of coin groups by matching and categorising real coin groups and real coin flash cards to the word cards with equivalent money values to enable the pupil to intuitively understand for example, that 2 x 1p can buy the same thing as 1 x 2p etc. Use practical number shapes to establish value for example, relating 2 pence to the 2 plate from Numicon™ or the 2 rod from Cuisenaire™. Using these resources together will reinforce money and number skills together. Immerse the student in the concept by creating real meaningful opportunities and practical activities for shopping.

## How can we develop the understanding of time?

Teach the understanding of the concept and the language of time together with the associated processes. Teach clock times and the understanding of the concept the passage of time. Utilise real activities such as events in a typical school day. Focus upon familiar times of the day e.g. waking up, breakfast and coming to school. Use a daily calendar and practise yesterday, today, tomorrow, days of the week and months and seasons of the year. Give plenty of opportunities to experience the concept of, first, next and last.

## When should we introduce the calculator?

Introduce calculator skills as soon as the pupil begins simple addition facts. Tasks can be reduced to smaller units by checking answers after a selected set of algorithms for example,  $2 + 2 = 4$ . Later, use the calculator when the pupil understands the process but is slow in computation. The calculator will free the student to work more quickly, remain motivated, and undertake more complex tasks when computation is the only difficulty.

## How can we facilitate the transition from informal to formal mathematics?

Pupils with Down's syndrome generally encounter difficulty associating practical mathematics experiences to written mathematics formats. This happens more slowly and often mathematics is perceived as a set of unconnected facts. Pupils require time, a variety of experiences and carefully directed teaching. Worksheets with pictorial representations are semi abstract and purely symbolic. If introduced too early, they may confuse the delicate links being formed between existing concepts, language and formal written number problems. Use structured, concrete materials throughout all concept development stages from early years to higher-level mathematics. These allow the pupils to visualize numerical concepts by making them much more real.

## How can we promote generalization and adaptation of mathematics skills?

Full understanding of the abstract nature of mathematics requires considerably more time with structured, concrete, 'real' materials, in other words, understanding that 2 pence is a value of a coin and not a quantity of objects or that a picture of three objects although being one object is representational in the same way that the symbol 3 and the word three represent or describe the quantity 3. Create real situations with real, everyday objects to count, such as counting and giving out pencils and exercise books for the group or setting the table for a given number of people. These real situations will provide opportunities to;

- Consolidate counting
- Develop one-to-one correspondence
- Understand that anything can be counted
- Understand that there is a purpose to counting.

It is important that the pupil realises that there is a real purpose to mathematics and that it is not just a classroom-based activity.

Commercially produced materials such as counters, cubes, Numicon™ or Cuisenaire™ although necessary for practising numeracy skills are nevertheless, in a sense unreal since they do not feature in everyday life. Additionally, they may inhibit learning by being used as toys rather than for the task.

## Summary

- Development is slower
- Number developmental stages are similar to typical peers
- Accomplishments vary
- Motivation is more relevant than IQ or the syndrome label
- Teach new concepts in real situations and ensure understanding
- Learning should take place in carefully graded steps
- Teach the language of mathematics and associated concepts together. Ensure pupils understand what is being asked
- Support verbal instruction with visual representation of task such as demonstration, pictorial representation or a completed example.

### Remember!

**Make it visual  
Make it interesting**

**Make it real  
Make it fun**

## Useful Reading

Alton, S. (2001) *Children with Down's syndrome and Short-term Auditory Memory* Information Sheet, Down's Syndrome Association.

Alton, S. et al (2003) *Education Support Pack for Schools*, The UK Down's Syndrome Education Consortium, Down's Syndrome Association.

Bird, G. & Buckley, S. (2000) *Number skills development for children with Down syndrome, Down's Syndrome Issues and Information*, DownsEd Syndrome Educational Trust.

Woodbine House Maths Book (title to follow when I get home Sunday 20th)

## Mathematics Resources

Numicon Ltd., Unit D, Prospect House, The Hyde Business Park, Bevendean, Brighton BN2 4JE. TEL: 01273 609991

## Computer Software

1,2,3,CD and Number Train,  
Sherston Sopftware Ltd., Angel House, Sherston, Near Malmesbury, Wiltshire SN16 0LH.  
Tel: 01666 843200.

## Number Shark

Whitespace Software Limited  
8 Upper Saint Martin's Lane, London WC2H 9DL, U.K.  
Tel: 020 7240 0208

## Scally's world: Number and sums

Topologika Software Ltd, Harbour Village, PENRYN, Cornwall, TR10 8LR  
Tel: 01326 377771

National Office: Langdon Down Centre, 2A Langdon Park, Teddington, Middlesex TW11 9PS  
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