

Hydrocephalus Mathematics For Teachers



The Ability to Progress in Mathematics may Involve

- Perception: ideas about e.g. spatial relationships, based on previous experience
- Short term memory (especially visual memory)
- Thinking skills

Many students with Hydrocephalus, and Spina Bifida, will have trouble with mathematics irrespective of their general ability level. These difficulties may include (i.e. the list is not exhaustive):

- Remembering number facts, e.g. addition facts and multiplication tables;
- Using mental arithmetic strategies;
- Ideas about spatial relationships and symmetry;
- Identifying different ways to sort objects, and using e.g. a Carroll diagram (see end of this document for examples);
- Handling instruments e.g. compasses, protractors, rulers, and pens/pencils.

Co-Ordination and Perception

Co-ordination

The majority of other children will have picked up basic ideas about shape, size, movement, and angles in their toddler years. Because children with hydrocephalus often have a weak hand grip, and balance problems, they will usually not have been as active as other children, resulting in limitations concerning:

- Viewing objects from different angles;
- Moving at different speeds across given distances in their home environment ('fluency' of movement);
- Of manipulating objects in different ways (e.g. folding; rotating in different places and through different angles);
- Proprioception, i.e. an internalised image of their own bodies and their own 'personal space'.

Many will have difficulty with spatial relationships e.g. 'under' and 'in front of'. Temporal concepts develop after spatial concepts are established, and so many of these children will have little or no concept of time. The more abstract ideas involving relationships, including the concepts of 'balance', exchange. And direction, may not even exist in embryo.



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Perception

Initially, they may need help to know exactly what to focus their attention on (whether auditory or visual stimuli). Some children may need to be taught how to use different eye movements:

- Bi-directional scanning (left-right-left, up-down, diagonal);
- 'narrow and 'wide' focusing (i.e. close-up analysis, and global scanning).

Perceptual development relies on gaining confidence in one's own judgement, beginning with the physical world. The 'feel' of objects, and of body movements in space and in interaction with objects, contributes to this. Estimation 'games' are helpful, especially if reinforced at home.

Auditory perception may be improved if children are taught to repeat (whisper to themselves) any instructions they are given, and explain what they have to do. In many cases, unless this is done, it may appear that they are ignoring whole-class instructions. (This technique can also be used when reading maths problems – first 'whisper' it, then read it again, aloud, then explain what has to be done.)

Short-term Memory

Both visual and phonological (speech-based) working memory may be limited, and so the same information should be presented in different ways.

Concrete materials allow 'touch' and 'movement' to be linked to "words" the child's own expression of the meaning of the event). Giving children the "formula" will not help. They will remember their own words better than someone else's words. Once the understanding is established, the written symbols will help compensate for limitations in short-term memory.

Thinking Skills

Pattern recognition is an important thinking skill that begins simply with the ability to perceive 'same' 'and 'different'. Students then need to learn how to group information into different categories by identifying associations. At higher, more creative levels of understanding, they must also learn to how to re-classify information.

Children with hydrocephalus may need more help than other children when learning these skills. Although there are "stages" in the skill levels, the same skills (from comparison, to re-classification) are used right from the earliest work on colour patterns, to the most advanced statistics.

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Activities that can Help Children make Progress

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There will not be enough time in school to give the children the amount of sensory experience they will need. It will be helpful if homework activities can be designed to provide the extra experience (e.g. with the use of practical estimation activities in the kitchen). Large key calculators (desks-top calculators) with tiltable displays are useful: with extra space between keys children have more confidence that they will key in the right number.

Perception, co-ordination and fine motor control

- Duplo, in early years, and interlockable cube, e.g. multilink (maths Cubes) from Junior infants through to 6th class. (They may need help, initially, to click multilink cubes together, but this activity may result in the added bonus of better pencil/pen control.)
- Measurement and estimation with non-standard units of measurement (length, capacity/ volume, time and also angle/directions);
- Handling real coins and associating the feel of the two faces and the edge, the colour, and the 'weight', with the denomination;
- Nets of cubes and cuboids using durable materials (e.g. Clix, although the children will probably have to give instructions to an assistant in this work as they might not be able to manipulate Clix themselves);
- 'Transformation' activities;
- Learning 12-hour clock times, starting with meaningful events in their daily routines.



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Activities that can Help Children make Progress

Pattern recognition

- Copying, continuing and devising colour patterns (e.g. with multilink);
- Using listening and touch (with eyes closed) to perceive patterns (simple, i.e. two or three, sound sequences; sandpaper shapes; different shapes of beads);
- Copying 'towers' of multilink and using appropriate prepositions to describe the spatial relationships;
- Working out how to share a set (e.g. of multilink) between two people, and searching for patterns in the results;
- Identifying number patterns (e.g. multiplication tables) in the 100 square;
- Using a calculator to predict patterns;
- Using Clix combined with Multilink to explore surface area and volume, at an intuitive level, i.e. before the need for 'formulae' is introduced.

Re-classification

- framing 'new' concepts
- 'counting on' using a die, and a game-board with numbers printed in each square;
- learning the concept of 'fairness' in exchanging coins of different denominations
- Using a game to illustrate 'movement' on the number line (e.g. 'Tug o' War', using only one counter, with zero in the middle of the number line);
- Using + and - cards for the digits 1 to 9, and a separate one for '10' to decompose e.g. '16-9' and know that the +16 and -9 can be 'swapped' round. (This also puts less strain on short term memory.)
- Using Carroll diagrams for sorting according to e.g. colour and material, size and shape.



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Carroll Diagrams

Prime	Not prime
2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53	1, 4, 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21, 22, 24, 25

	Prime	Not prime
Even	2	4, 6, 8, 10, 12, 14, 16, 18, 20
Not even	3, 5, 7, 11, 13, 17, 19, 23, 29	1, 9, 15, 21, 25, 27, 33, 35, 39