STUDENTS WITH SPINA BIFIDA AND/OR HYDROCEPHALUS

A Guide for Educators

Fourth Edition

Printed with the generous support of
Ronald McDonald House Charities

Spina Bifida and Hydrocephalus Association of Canada

Mission Statement

To improve the quality of life of all individuals with spina bifida and/or hyrocephalus and their families through awareness education and research.

Canadian Cataloguing in Publication Data
Meldrum, Mary, 1964-
Students with spina bifida and/or hydrocephalus in school:
A guide for educators

3rd ed.
Includes bibliographical reference and index.
ISBN 0-9680530-4-1

1. Physically handicapped children – Education
2. Spina Bifida – Patients – Education
3. Hydrocephalus - Patients – Education
4. Hydrocephalus in children – I. Lloyd, Angus

II. Spina Bifida and Hydrocephalus Association of Canada
III. Title

LC 4125.M44 1997 371.91 C97-900938-3

Printed and bound in Canada
4th Edition
1997 1998 1999 2000 2002 2010

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A special thank you is extended to the Spina Bifida and Hydrocephalus Association of Canada Educational Development Committee in providing valuable input in to the updating of this guide.

Thanks also to Phyllis J. Agness, Ed.D., for permission to use copyright material, pages II-6.6 –6.7, that appeared in her book, Learning Disabilities and he Person with Spina Bifida c 1994; Epilepsy Canada for permission to use an excerpt, page 2.3, from the brochure Answers to Your Questions, and Holland Bloorview Kids Rehabilitation Hospital for permission to use diagrams, page I-3.6

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Introduction

You are going to have a student with spina bifida and/or hydrocephalus in your class. This guide will help answer many questions you may have.

As a teacher, you already know the most important thing about children with spina bifida and/or hydrocephalus – they are, above all, simply children, with the same hopes and dreams as other children.

This guide is designed to give you, as an educator, the information you need to teach a child with spina bifida and/or hydrocephalus.

Part One provides background information about spina bifida and hydrocephalus, and includes sections on medical conditions, accessibility, social development, and physical education.

Part Two gives specific information on teaching children who have learning disabilities most commonly associated with spina bifida and/or hydrocephalus. It includes sections on understanding the learning disabilities which include Attention Deficit Disorder and Non-Verbal Learning Disability, teaching skills, teaching learning strategies, and modifying teaching methods and approaches.

Part Three includes resources for further information, such as details on provincial spina bifida and hydrocephalus organizations, personnel information, and a glossary of terms. Some guides may include a list of local resources.

Valuable information can also be obtained from previous teachers, special education personnel within your own school board, the Spina Bifida and Hydrocephalus Association in your local area and province, and of course, your student's parents.

We know that as you learn more about spina bifida and hydrocephalus, and are more able to accommodate the disability and build on the abilities of your student, you will have provided the best possible environment for learning. We wish you and all your students a rewarding and successful year.

Educational Development Committee
The Spina Bifida and Hydrocephalus Association of Canada

PART I

GENERAL INFORMATION

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CHAPTER ONE

About Spina Bifida and/or Hydrocephalus

What is spina bifida?

Spina bifida is the name given to birth defects that affect the neural tube, the structure in the developing fetus that develops into the spinal cord and brain. Meaning, literally, "split spine," this neural tube defect (NTD) occurs within the first four weeks of pregnancy. The vertebrae, spinal cord, or both fail to develop properly in the fetus, resulting in varying degrees of damage to the spinal cord and nervous system. The damage is permanent.

What causes spina bifida?

There is no single known cause of spina bifida. Research continues into the effects of factors such as hereditary, nutrition, environment, pollution, and physical damage to the embryo. Research has proven that folic acid plays an important role in reducing the occurrence of spina bifida.

What is hydrocephalus?

Hydrocephalus is the excessive accumulation of cerebrospinal fluid (CSF) in the brain, caused by failure of normal CSF circulation, absorption, or both. This results in compression of the brain, and possibly, enlargement of the head.

Hydrocephalus is usually controlled by surgically implanting a flexible tube called a shunt into the cavities of the brain. The shunt controls the flow of fluid and drains into another region of the body to be reabsorbed. This reduces pressure on the brain that could, without treatment, result in permanent brain damage or death.

What causes hydrocephalus?

Hydrocephalus can be caused by a variety of medical problems. But in the case of spina bifida it is due to congenital malformation in the ventricular system or Sylvian Aqueduct Syndrome. It can be present at birth or acquired at any time during a person's life as a result of a brain hemorrhage, meningitis, brain injury, tumors, or an unknown cause.

What are the effects of spina bifida and/or hydrocephalus?

Eighty to ninety percent of children born with spina bifida also have hydrocephalus, so teachers will frequently be looking at the effects of both conditions.

Infants born with spina bifida sometimes have an open lesion on their spine where significant damage to the nerves and spinal cord occurs. Although the spinal opening is surgically repaired shortly after birth, the nerve damage is permanent. As a result, people with spina bifida will experience varying degrees of paralysis in the lower body, depending largely on the location and severity of the lesion. Even with no visible lesion, they may have improperly formed or missing vertebrae and accompanying nerve damage. This nerve damage results in reduced or absent sensation and may cause people with the condition to experience lower limb paralysis, fine motor impairment, incontinence of the bladder or bowels, or all of these.

For individuals with hydrocephalus, the brain can show lasting effects, both short and long term. These may include impaired vision, headaches, sensitivity to changes in external pressure, hearing sensitivity, muscle weakness, hormonal imbalances, or seizures.

In additional to physical and mobility difficulties, many individuals with spina bifida and/or hydrocephalus may have some form of learning disability. This means that they may have learning problems in school, in spite of having average or above-average intelligence. These individuals may also have been diagnosed with attention deficit disorder and/or intellectual disability.

How are spina bifida and/or hydrocephalus treated and managed?

Treatment for the variety of effects of spina bifida and hydrocephalus includes surgery, medication, therapy, and the use of physical and learning aids. Many people with spina bifida and some with hydrocephalus require support (such as braces or crutches) to walk, many use wheelchairs, and many have some form of bladder and bowel dysfunction. These conditions are not outgrown. People with spina bifida and/or hydrocephalus learn to manage and live with them. Ongoing therapy, medical care and often surgical treatment will be necessary to prevent and manage complications throughout an individual's life.

Medical and educational professionals help manage these conditions. Parents usually act as a liaison between medical and educational teams.

From birth, children with spina bifida and/or hydrocephalus will be treated by a team of specialists, including neurosurgeons, orthopedic surgeons, pediatricians, urologists, neurologists, occupational therapists, physiotherapists, speech and language pathologists, social workers, nurses, and orthotists. This team sometimes operates through local spina bifida clinics.

As a child approaches school age these professionals should counsel parents about schooling. Ideally parents will contact the school prior to enrolment (when their child is two to three years old) to determine their child's needs in the school environment. School personnel should then ensure that accessibility issues are addressed and that the school environment is set up for the child upon entry. Before, or shortly after school entry, appropriate diagnostic testing to identify problems should be initiated.

Appropriate testing could include

- educational assessment
- psychological assessment
- assessment by an occupational therapist
- assessment by a physiotherapist
- assessment by a speech and language pathologist
- assessment by an audiologist
- assessment by an opthalmologist
- neuro psychological testing

From the results of these tests school personnel should devise a program plan that incorporates specific accommodations and modifications

The role of parents

No one knows your student s needs and abilities as well as his or her parents no one will be a better ally in the child s education Get to know your student s parents and let them get to know you

One way to ensure that there is a free flow of information between you and the child s parents is to use a communication book The child carries this between home and school in it parents and teachers communicate daily on how the child is doing This is a good way to keep track of any changes in the child s behavior performance or physical condition This book can also be used as a reminder of homework assignments

It s important to remember that when one member of a family has a disability it affects the whole family Parents devote extra time and energy to meeting the needs of their child with a disability Before calling upon parents to provide extra help with school work at home ask whether they are willing and able to do so

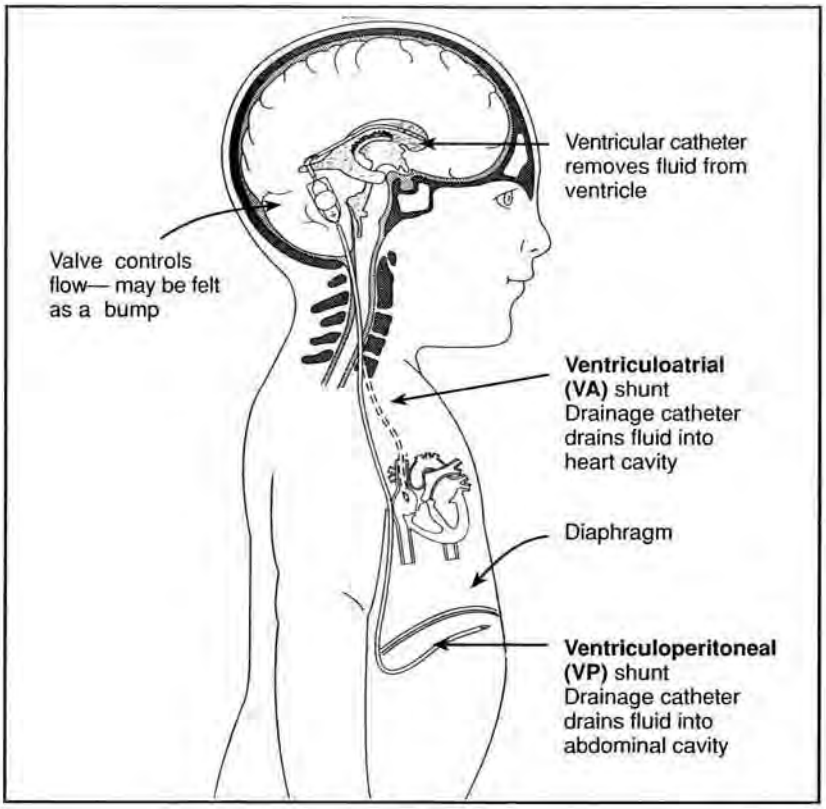
CHAPTER TWO

Medical Conditions Associated with Spina Bifida and/or Hydrocephalus

Shunts for hydrocephalus

Most persons who have hydrocephalus will have a shunt inserted into the ventricles of their brains to drain away excess cerebrospinal fluid (CSF) Although shunts generally work well they are not foolproof and may stop working if they disconnect get kinked become blocked or infected or are outgrown If this happens the cerebrospinal fluid begins to accumulate

Shunts



again and several symptoms develop This may happen quickly or over a long period Therefore it is important that parents and teachers keep one another informed about any changes in the child's behavior or school performance

Signs of shunt malfunction in children

- veins on skull stand out
- fever
- projectile vomiting
- irritability
- sleepiness or lethargy
- downward looking of eyes
- decline in school performance
- a loss of previous abilities
- headache and/or neck-ache
- decreased coordination
- seizures
- swelling or redness along the shunt tract
- changes in sleep patterns

The Arnold-Chiari malformation

Many children with spina bifida have a malformation of the brain stem called the Arnold Chiari malformation The malformation results when the posterior part of the brain is displaced into the cervical spinal canal The primary cause of hydrocephalus in persons with spina bifida the Arnold Chiari malformation may cause upper-body weakness and learning difficulties In some individu als the Arnold Chiari malformation may cause other symptoms and problems These include

- breathing problems
- swallowing difficulties
- poor fine motor coordination
- headaches
- sensitivity to touch and noises
- spasticity
- visual disturbances
- an inability to maintain a steady body temperature

Treatment for this condition depends on the type and severity of symptoms It may include surgery to lessen the pressure on the brain stem More often however symptoms diminish over time or stay the same

Seizures

Many people with hydrocephalus including those with spina bifida will have at least one seizure during their lives Seizures are caused by a sudden burst of electrical activity in the brain This causes either the sensory or motor part of the brain or both to malfunction temporarily Depending on what part of the brain and how powerful this power surge is seizures will vary in type and intensity

A seizure disorder cannot be cured It can however be controlled with medication There are several different medications available to treat seizures but sometimes finding the right medication or combination of medications is a matter of trial and error Antiseizure medications may cause side effects that can affect the child s behavior or performance Try to ensure that your student or your student s parents alert you to changes in medications and possible side effects

Most teachers will eventually have to deal with a student having a seizure However most people are unaware of the first aid procedures to follow when this happens These procedures are not difficult the most important thing to

remember is to protect the person from harming him or herself then wait for the seizure to pass

Epilepsy Canada recommends the following when administering first aid for seizures

- Do not insert objects between the teeth It is physically impossible to swallow one s tongue and forcing the mouth open with a hard object could damage gums
- Move dangerous objects out of the way
- Remove glasses and loosen tight collars and clothing
- Do not restrain or try to move the person relocate the person only if in a dangerous position
- Let the seizure run its course It is pointless to try and stop it Don t panic if the person seems to have stopped breathing momentarily
- Turn the person gently on his or her side to keep air passages clear Place something soft a folded jacket for example under the head
- It will probably not be necessary to call an ambulance Get emergency aid only if a seizure lasts more than five minutes or if a second seizure imme diately follows
- As consciousness returns talk to the person in a soothing reassuring way Let him or her rest for a few minutes help him or her get reoriented
- When a person recovers from a seizure he or she is often greeted by a crowd of gaping onlookers You can make recovery much more pleasant simply by knowing what is happening and how to respond

If you know (or suspect) that a student has had a seizure alert his or her parents immediately If possible try to let them know what the child was doing before the seizure started what happened during the seizure how long it lasted and how the child felt afterward This information will be invaluable in making a diagnosis

For further information about seizures contact your local or provincial branch of Epilepsy Canada

Latex allergies

Because of frequent surgeries and treatments that involve repeated exposure to latex products people with spina bifida are at an increased risk for devel oping a latex allergy Reactions can range from mild itching to difficulties in breathing If any of your students have severe allergies you should be briefed in advance about what things they must avoid and what to do in case of a reaction (see latex allergy lists following pages)

MEDICAL PRODUCTS

FREQUENTLY CONTAIN LATEX	SOURCE FOR ALTERNATIVE PRODUCTS
Airways	Hudson airways Oxygen masks
Ambu Bag (black reusable) check with manufacturer	Clear disposable ambu bags
anesthesia circuits	Neoprene circuits
Bandages	Curad plastic strips Snippy Band (Quantasia) Redi bandages
Blood pressure cuff tubing	Use over clothing or stockinette Cleen cuff (Vital signs) Dinamap (Critkon) Nylon (Plymatt) Saran Wrap
Bulb Syringe	PVC (Davol) Medline Rusch
Catheters Red rubber Latex	 Silicone Foley Mentor Malecot (Cook)
	MMG O Neil sterile field intermittent catheter
Condom	Clear advantage (Mentor) Pro SyS NL (Conva Tec) Coloplast Rochester
Indwelling	Silicone (Argyle Band Kendall Rochester Rusch Vitaid)
Leg bags drainage systems Straps	 Velcro nylon PVC (Dale Mentor) Bard systems
Straight & Coude catheters	Bard Coloplast Mentor Rob Nel (Sherwood)
Urodynamics	Bard Cook, Lifetech Rusch
Rectal pressure	Cook Lifetech or make one with vinyl glove
Casts: Delta Lite conformable (J&J)	 Scotchcast soft cast Delta Lites Fiberglass fabric (J&J) Caraglas ultra
Chux (washable rubber pads)	Disposable Underpads

FREQUENTLY CONTAIN LATEX	SOURCE FOR ALTERNATIVE PRODUCTS
Dressing Micropore (3M) Coban(3M) Dyna flex (J&J) BDF elastoplast Action wrap	 Curad Telfa Plus Duoderm (Squibb) Reston foam (3M) opsite Venigard comfeel (coloplast) Xerofoam (Sherwood) PinCare (Hollister) Bioclusive Montgomery straps (J&J) Webrill (Kendall) Metalline Selopor Opraflex (lohman)
Elastic bandages Ace Wrap (Check with manufacturer) Elastic Wrap: Esmarch Zimmer Dyna flex Elastiken (J&J)	TEDS elastic bandages (Baxter, Adban adhesive) CoNco all cotton elastic bandages X Mark (Avcor) Comprilan (Jobst) Exmark (DeRoyal)
Electrode pads bulbs grounding	3M Baxter EEG pads Dantec EMG, Con Med valley lab Vermont Med
Endotracheal tubes	Berman Mallinckrodt Polamedco Portex Rusch Seridan Shiley
Enemas – Ready to use (Fleet latex valve)	Glycerin, babylax (Fleet) Theravac Bowel Management tube (MIC) Cone irrigation set (convatec)
G Tubes buttons	Silicone (Bard MIC Stomate Rusch)
Gloves, Exam & Surgical White perry (Smith & Nephew) Ortho (Smith & Nephew) Neutralon Brownmilled (seamless)	Exam: Elatyeren (ECI Medical Tech Inc) AMG (Baxter) Baxter Diamed Dispos-A-Glove (J&J) Fisherbrand Royal Shield (SmartPractice) Safe & Touch Sensicare (Becton Dickinson) Sime Vinyl Tru touch (Becton Dickinson) N Dex (Best Glove)

MEDICAL PRODUCTS

FREQUENTLY CONTAIN LATEX	SOURCE FOR ALTERNATIVE PRODUCTS
	Surgical: Elatyren (ECI Medical Tech Inc) Certainty (Smith & Nephew) Tactyl 1 & 2 (SmartPractice) Dermaprene (Ansell) Neolon (Becton Dickinson) Allergard (J&J) Neoprene Polymer gloves Nitrex Duraprene Trifex (Baxter) Meditouch
IV tubing injection ports Y sites, bags buretrol ports PRN adapters needleless systems	IVAC (do not use Y connector) Baxter Abbott Cover Y sites & do not puncture Use stopcocks for meds Flush tubing do not puncture bag parts to add meds Polymer injection caps (Braun) Walrus Gemini (Imed) Braun Baxter buretrols SaFsite (Braun) Clave
Jobst spandex products	Jobst has non latex material
Medication vials (check with manufacturer many are packaged in vials with synthetic stoppers)	Eli Lilly Fujisawa
Moleskin	adhesive FeH (acme)
OR – masks hats, shoe covers Oxygen masks cannulas	Replace elastic band with twill tape ties Remove elastic bands check content of valves
Penrose drains	Jackson Pratt silicone tubing Zimmer Hemovac (PVC)
Pulse Oximeters	certain oxisensor (Nellcor) cover digit with tegaderm
Reflex Hammers	cover with plastic
Respirators – tb (3M9970)	advantage (MSA) HEPA Tech (Uvex)

FREQUENTLY CONTAIN LATEX	SOURCE FOR ALTERNATIVE PRODUCTS
Resuscitators manual	Silicone: PMR 2 (Puriton bennett) SPUR (AMBU) Vital Blue Respironics Laerdal Armstron Rusch
Stethescope tubing	cover with Webril PVC tubing cover with Stockinette or Scope Coat
Suction tubing	Mallinckrodt Yankauer Davol PVC (Laendal Superior) Mediline Ballard
Syringes disposable syringes	BD Concord portex Draw up Med in syringe right before use Terums medical Abboject Norm Ject (Air Tite) Abbott PCA Epipen certain 1cc 60cc syringes (BD)
Tape: Cloth adhesive bandages paper tape Porous pink waterproof (3M)	Microfoam Blenderm (3M) Curad Duraspore (3M) Curad Curasilk Transpore (3M) Curad Tenderskin Derma clear Dermicel Waterproof (J&J) micropore mastisol liquid adhesive
Tourniquet	Place over clothing stockinette children s med ventures Grafco Velcropedic X tourn straps (AVcor)
Theraband strips and tubes	cover with cloth Exercise putty (Rolyan)
Tubing sheeting	Plastic tubing – Tygon LR 40 (Norton) Elastic thread sheets (JPS elastomerics)
Vascular Stockings (Jobst)	Compriform custom (Jobst)

*A product s inclusion does not imply endorsement from **SBHAC** Individuals with latex allergies should seek medical advice regarding allergy control, and use of product alternative **SBHAC** recommends verification with manufacturer for exact contents of product*

NONMEDICAL PRODUCTS

FREQUENTLY CONTAIN LATEX	SOURCE FOR ALTERNATIVE PRODUCTS
Art supplies: Paints Glue erasers Fabric paints	Elmers (school Glue Glue all Glucolors carpenters wood glue Sno Drift Paste) Faber Castel art erasers Crayola products (except for rubber stamp erasers) Liquitex paints silly putty
Balloons	Mylar balloons
Balls Koosh tennis rubber Basketball	Vinyl Thorton sports balls PVC (Hedstrom sports ball) Leather ball and use light weight sports glove
Bowling balls	Use gloves or purchase an acrylic ball
Bath Mat Bathroom throw rugs (non skid latex backing)	Gerry baby products pound pales 100% cotton reversible throw rugs
Bungee cords	nylon tie downs
Clothes: Elastic hems underwear	cloth or Velcro closure cloth covered Neoprene (Decent exposures NoLatex Industries) Underwear without elastic Cover waist elastic and launder prior to use
Crutches: Tips Axillary pads handgrips	cover with cloth or tape
Condoms Diaphragms Contraceptive sponge	Natural skins over/under latex if female/male sensitivity Trojan Naturlamb Avanti Female (reality) Polymer male (Avanti) Polyurethane
Camera eye piece Binoculars eye piece	
Carpet backing Gym floors	Provide barrier cloth on mat wooden floors
Chewing gum	Warner Lambert Bubblicious Chiclets Trident Dentyne Clorets Cinnaburst Wrigley s Doublemint Juicy Fruit Freedent Hubabuba Big Red

FREQUENTLY CONTAIN LATEX	SOURCE FOR ALTERNATIVE PRODUCTS
Cleaning/kitchen gloves	Solvex nitrile glove (Ansell) Vinyl PVC Myplex (magla) cotton liners (Allerdam)
Cosmetic applicators Sponges (Buff Puffs)	Q Tips, synthetic make up sponges cotton balls
Dental Dams cups bands root canal material (check with manufacturer)	Wire springs dental sealant (Delton) Any synthetic alternative
Dental braces with Rubber bands (check with manufacturer)	Wire springs Any synthetic alternative
Disposable diapers incontinence pads Rubber pants	Huggies, First Quality Gold seal Tranquility Dypers Attends (some read contents)
Feeding nipples	Clear & soft (Gerber) Silicone Evenflow Soft flex MAM Ross Mead Johnson nipples
Food handling gloves	Synthetic gloves Use utensils and wash hands Wax paper
Foam rubber lining on splints braces	Line with cloth felt
Feminine sanitary pads	Kimberly Clark products Possibly others (read contents)
Infant tooth brush massager (NUK)	soft bristle brush or cloth (Gerber)
Lottery tickets (instant win scratch off is latex)	
Blueprints and glossy papers (these are dusted with latex)	
Pacifiers	The First Years (Kip) Pur (Infa) Clear & Soft (Gerber) Soft flex (MAM) Binky Childrens Medical Ventures
Plants	_____
Hoses	_____
Tires	_____

NONMEDICAL PRODUCTS

FREQUENTLY CONTAIN LATEX	SOURCE FOR ALTERNATIVE PRODUCTS	FREQUENTLY CONTAIN LATEX	SOURCE FOR ALTERNATIVE PRODUCTS
Sports equipment grips handles golf clubs bats and racquets	Vinyl leather handles use light weight sports glove	Toys teething rings water toys Stretch Armstrong old Barbies	Plastic cloth or vinyl toys PVC Jurassic Park Figures (Kenner) 1993 Barbie and Disney dolls (Mattel) many Fisher Price toys Little Tikes Playschool Discovery Trolls (Norfin)
Rubber bands	String spring clips Plastic bands		
Rubber Coats hats gloves made with natural rubber	Must be made with PVC or plastic coating		
Scuba and swim equipment (check with manufacturer)	many are made with silicone or neoprene	Wheelchair cushions (RoHo)	cover with cloth
		Wheelchair tires	propel with leather gloves
		Zippered plastic storage bags	wax paper plain plastic bags

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Skin care

People with paralysis often cannot tell if their skin is being injured because they don t experience the usual warning signs of pain and discomfort

Children with paralysis are at a high risk for skin injury not only because they can t feel, but because they often wear potentially irritating casts and braces drag their legs and feet on the floor or the ground sit in the same place for long periods of time and suffer from prolonged contact with irritat ing chemicals from urine and stool Their immobility causes decreased blood circulation This not only contributes to injuries but slows the healing process

Skin injuries are among the most devastating complications of spina bifida A pressure sore may take months or even years to heal For treatment children must at the very least stay off the affected area and remove any braces At the worst they must spend long periods of time away from school and undergo aggressive medical treatment often in the hospital Occasionally skin grafting may be necessary Having to wait out the long healing process can impair a young person s physical intellectual and social development

Preventing pressures sores is not difficult but it does involve commitment and vigilance

- Keep skin clean and dry at all times
- Change position regularly (about every thirty minutes) to help keep the blood circulating and to prevent pressure areas from developing While this is not a major concern in the early grades where students move from activity to activity fairly frequently it can become a problem in higher grades where longer classes don t encourage much movement In older

students a beeping wristwatch may help to remind them to change posi tion or to do a few push ups on the arms of their wheelchair

- Most important be vigilant Look for brace parts that may be rubbing rough spots or foreign objects in shoes seams on clothes and socks or items placed in pockets—all of these can cause injury Note any sign of redness or irritation and report this to your student s parents

Note Because of reduced circulation children who have little sensation or motion in their legs may have cool skin with a mottled appearance This is not a major cause for concern However decreased circulation may slow healing when there is an injury to the area This is also a good reason for promoting standing and walking whenever possible

Things to consider in summer

Summer brings further skin hazards

Hot things The summer sun can heat certain materials to the point where they can burn skin Watch for hot wheelchairs seat belt buckles playground equipment underwater swimming pool lights and sand and concrete

Wet skin Soggy skin is especially prone to scrapes caused by concrete so be cautious of the sides and edge of the swimming pool Students with paralysis might wish to wear ordinary socks aqua socks (a waterproof neoprene sock) or even flesh colored tights when swimming

Sand When using sandboxes or sand tables sand gets everywhere a child with paralysis is unlikely to notice the presence of abrasive sand in his or her pants or shoes

Bugs and sunburn. Insect repellent a high SPF sunblock and keeping skin covered will help protect children who are oblivious to stings bites and burns Remember that bits of food or spilled pop can attract insects Try to ensure equipment is clean

Things to consider in winter

Frostbite When temperatures drop far below the freezing point frostbite is a danger for everyone but children with paralysis are especially at risk Not only are children unaware of the cold decreased circulation and lack of movement in their legs cause frostbite to occur more quickly If you suspect frostbite slowly and gently warm the affected area without rubbing Report suspected frostbite to the student s parents

Other hazards

Burns Beware of radiators hot air vents hot water taps and hot food or drinks that can spill onto laps Watch for friction burns caused when children drag their legs or feet along carpets

Splinters Ensure that wooden surfaces are smooth rough wood can leave splinters

Irritation from waste. Urine and stools contain chemicals that can burn skin. Children who have no sensation may not tell you that their pants are wet or dirty—they don't always know. Try to get pants or diapers changed as soon as possible.

Ordinary skin injuries. Treat superficial cuts and scrapes just as you would any other child's but with one important exception use latex free gloves and/ or bandages (see lists on page 2 4). As the likelihood of an allergic reaction to latex increases with exposure this is good practice to follow even with a non allergic student.

Fractures

For many reasons people with paralysis are more susceptible to sprains, strains, dislocations and bone breaks than the general population. They can't always feel their legs and may not be aware that they are hurting themselves.

They may also have poor balancing skills. This can cause frequent falls. As well people who have paralysis may have weak bones (osteoporosis) due to a lack of circulation and muscle stimulation. Thus the first line of defence is to strengthen bones and encourage the student to use his or her legs as much as possible.
Although children with paralysis cannot feel their legs and feet they must learn to have respect for them.

Fracture warning signs

- Swelling of a limb
- Sudden appearance of a deformity or unevenness of a limb or joint
- Localized heat or redness in the limb
- Fever
- Children report a funny feeling in the leg

If you suspect that a child has broken a bone (or dislocated a joint) immobilize the area by splinting or wrapping it in a bulky dressing and seek medical attention immediately.

Incontinence

Incontinence is the inability to control the bladder and/or bowel. The nerves that control these areas are located in the lower part of the spinal cord. As a result many children with spina bifida and some with hydrocephalus have varying degrees of paralysis of the musculature of the bowel and/or bladder (the sphincter muscles). This causes urine and stools to leak out spontaneously or to back up causing kidney damage chronic constipation or a bowel blockage.

There are several methods of managing incontinence. However any management program must be tailored to the needs and abilities of the child —what works for one person may be totally ineffective or inappropriate for another. It can take several years of trial and error to develop a good routine. Sometimes the routine will change as the child's needs or conditions change.

Ideally, by the time a child begins school, he or she will have already developed a bladder and bowel routine.

Following are some options for managing incontinence.

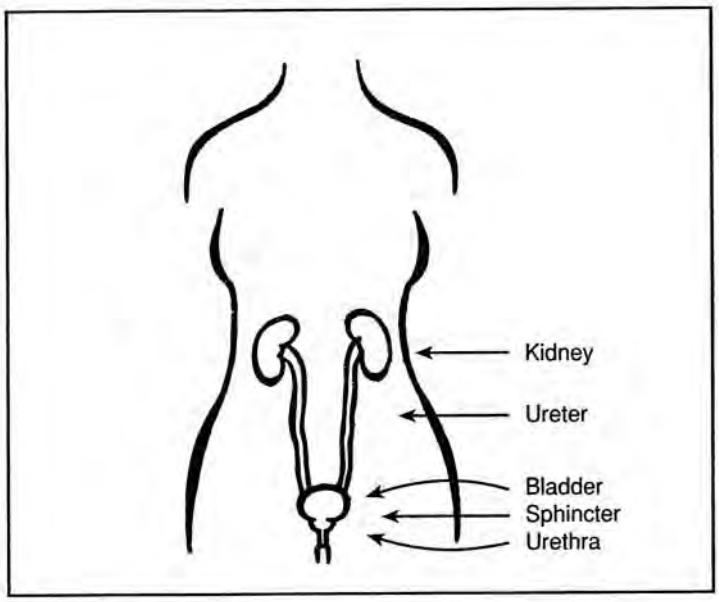
Bladder management

Catheterization. Oral medication, Clean Intermittent Catheterization (CIC) or a combination of both are the preferred methods of dealing with urinary incontinence. A catheter (tube) is passed through the urethra (the passage leading from the bladder to the outside of the body) into the bladder, allowing urine to flow out and is subsequently removed when the bladder is empty. This is done following a schedule. Often, CIC, can be self-administered. A health care professional should assess the student's ability to catheterize and make recommendations if other help is needed.

A physician, usually an urologist, will have prescribed a specific plan for each child's catheterization procedure. The person responsible for CIC should be provided with appropriate training. Regulations may differ from province to province as to who is authorized to perform catheterization and who is required to provide training. Your student's parents will also be a valuable resource regarding the catheterization procedure.

Other important considerations:

- Ideally, the procedure at home and at school should be the same
- The health room or bathroom should be private and clean, with easy access to sink and toilet.
- To reduce infections, the number of people involved in this procedure should be as few as possible
- When the child is able to self-catheterize he or she may need adult supervision



Medication. Medication is often used alone or with other bladder-management techniques to help improve the muscle tone of the bladder. Some medications may cause side effects that could affect the child's behavior or school performance. Some children also take antibiotics routinely as a preventive measure against urinary-tract infections.

Habit or recognition training. Some children can learn to empty their bladders by the clock rather than waiting until they "have to go." There may be little advance notice of the need to use the bathroom, and occasional accidents. Some children require diapers or pads as a backup.

Surgical treatment. Sometimes, surgery may be necessary for children who have had no success with other methods of management and whose incontinence is causing them serious health problems. Surgery, mitrofanoff, usually involves diverting the flow of urine to an artificially created opening outside the body, often the abdomen. The urine is drained regularly through the opening by catheter.

Incontinence pants. For some people, the best option is to simple soak up urine and stools as they pass from the body. As a teacher, you can help by discreetly alerting the student to any odors, dealing with changes quickly and quietly, and ensuring that the student has a change of clothes available. Remember, because they experience no sensation, children may not be aware that they are wet or soiled. As well, people often develop an insensitivity to their own odors and may not know that they smell. It may be a good idea to work out a code or a hand signal to alert the student that a change is necessary.

Bowel management.

Often, by the time a child reaches school age, he or she will have a regular routine for bowel management. Usually bowel programs are performed at home, either early in the morning or after dinner. Speak with the child's parents if you have concerns about bowel management during school hours. The family can then consult with health professionals to develop the best curse of action for management.

Some children have complete control of their bowels, others may have an occasional accident, and still others may soil almost constantly. However, even children who are usually continent can lapse due to a mild case of the flu or diarrhea. This can also be a problem during stressful times. If you note any changes, such as a child who seldom soils beginning to have daily accidents (or even one who suddenly stops soiling), alert the parents.

Constipation. The most important precaution in any bowel program is to protect the child from constipation or worse, impacted bowels. Though constipation may seem "convenient" in that there are no accidents, chronic constipation can cause serious medical problems. Backed-up stools can interfere with urinary and shunt function and may lead to permanent stretching of the rectum or tearing of the anus.

Following are the symptoms of constipation:

- the child feels generally unwell
- then child's abdomen appears full or distended
- the child suffers headache
- the child frequently passes small button-like pieces of stool
- light brown, watery stool may not be diarrhea, but overflow from a blocked bowel. This condition requires prompt medical attention.

Many people with physical disabilities have said that it is their incontinence that handicaps them more than any other aspect of their condition. This is especially true of those with "hidden disabilities." You may be able to help your student cope by facilitating a class discussion about the disability and its implications. This should be done, of course, with the permission of the student and in consultation with his or her parents. It is imperative that the student with spina bifida and/or hydrocephalus knows why he or she wears diapers or a bag or has to catheterize.

Because gaining control of bodily functions is such an important rite of passage in our society, children with incontinence must learn to manage their bathroom needs as much as possible. Although teachers may often find it faster and more convenient to "do" than to teach, they should resist this urge. Children will gain much more self-esteem if they can take responsibility for their own personal care.

CHAPTER THREE

Accessibility

Accessibility considerations

Independence and achievement of full potential are important goals for all children. For a child with spina bifida and/or hydrocephalus independence adds significantly to self-esteem and feelings of worth. To help promote those goals, the school building and grounds should be accessible. This may require a minimum of modification and a little ingenuity. Even when appropriate modifications have been provided some students may still require assistance. On page 3.5, you will find information on wheelchair specifications that can help when adapting space.

Following are a few questions to ask about the accessibility of your school.

School exterior

- Is there a drop-off and pick-up area for vehicles transporting children with disabilities to load and unload?
- Is the path from the drop-off area to the entrance of the school kept free from snow and ice?

Playgrounds

- Is there a clear pathway to the playground or sports area, enabling students with disabilities to participate in physical activities at lunch and recess?
- If there is a playground, is there at least one piece of equipment that is accessible to students who use wheelchairs or have limited mobility?
- Is all playground staff aware of and comfortable with the student using the equipment

Ramps and doors

- Is the slope of the ramp gradual enough so that a child can manoeuvre it independently?

- Is there more than one entrance with a ramp in case an alternate exit is needed in an emergency?
- If the door opens outward, is the landing area large enough to allow a child to be able to open it and enter the building without sliding back down the ramp?
- Is the door easy to open? Is the door handle within reach of someone who is using a wheelchair?

School interior

Hallways/lockers

- Is the water fountain accessible, or, alternatively, are proper cups available?
- Can the water fountain be used by someone who requires both hands for support when standing?
- Are classroom doors wide enough to accommodate a wheelchair?
- If a student cannot reach the top half of a locker and requires more storage space, is a second locker next door available?
- Are various classrooms the student uses as close to one another and the washroom as possible?

Stairs

- If there are stairs, do they have nonslip treads flush with the vertical riser, no edge on treads, and a handrail? The ideal stairway is no stairway at all!

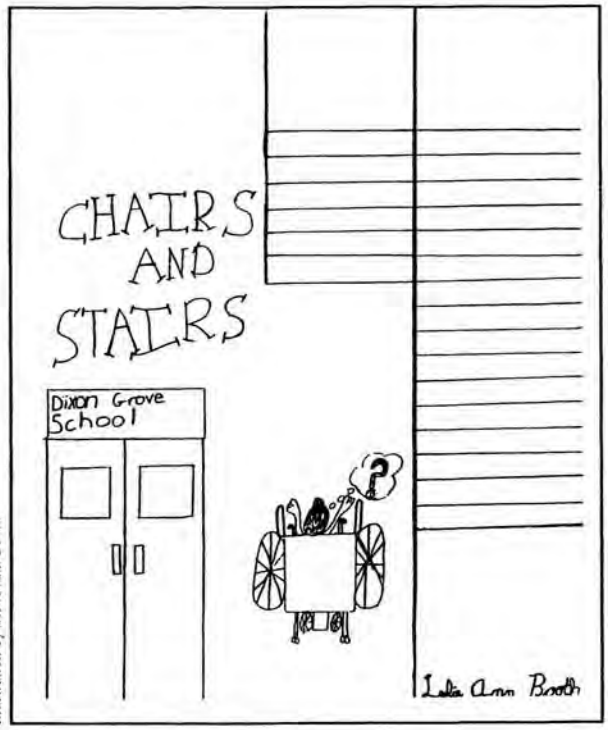


Illustration by Leslie Ann Booth

- If the student uses a wheelchair and there is no elevator, can you arrange for his or her classes to be located on the main floor?
- If it is necessary, on occasion, to carry a student in a wheelchair up or down stairs, have you considered both the safety and the dignity of the student? The student may feel it is more dignifies to be lifted in his or her chair rather than be carried separately. The student should be asked his or her preference.
- Devices such as a portable stair track or a chair glide are available.

Washrooms

- Is there at least one stall with appropriate placed toilet and grab bars, and a sink inside the cubicle? Is it large enough to accommodate a wheelchair and an aide?
- Are the sink and taps within reach?
- Is there a clear area underneath the sink or counter to accommodate a wheelchair?
- Are mirrors, soap, and towels accessible?
- Can you arrange for a storage cupboard for the student's personal hygiene equipment inside the cubicle in the washroom? This way, the student can go unencumbered to the bathroom, like the rest of the

students. (Many students, particularly older ones, may prefer to carry their equipment, and may wish to keep extra supplies in their locker or in a designated area such as a health room.

Classrooms

- If your student uses a wheelchair, are aisles in the classroom wide enough to accommodate that chair?
- Is there room at the back, front, and sides of the classroom for the wheelchair to turn around?
- Is furniture placed appropriately for the student who walks with or without aids?
- Do desks and tables have sufficient space underneath to accommodate a wheelchair?
- For children who would prefer to sit in a regular chair or desk, are there a table and chair with a back available? This is more convenient than a one-piece desk. (Whatever the seating arrangements, they should closely match what the rest of the students are using?)
- Are classroom fixtures such as pencil sharpeners, coat-racks and shelves mounted at an appropriate height?
- Is a seat available for the student who needs both hands free to use a piece of equipment?
- Are students seated where they will receive the greatest benefit, keeping in mind vision, eye level, attention span, and access to washroom?

In some classes, work is performed at a high bench or counter, where even students who stand and walk find it difficult to maintain balance and handle chemicals or machinery safely. Options here may include a portable ramp or platform or a lower table.

Fire!

- Has the fire department been notified of an students or staff in your school who may require assistance to evacuate? (Remember, elevators cannot be used when there is a fire. This may cut off the escape route for those who are unable to use the stairs).
- Has a plan been developed with fire officials for fire drills and other evacuations?
- Is the entire school staff familiar with the fire drill procedure?
- Is the student with the disability completely familiar with emergency procedures?

Class Trips

There are several questions to ask when planning a class field trip:

- If visiting a building, is that building accessible? Does it have accessible washrooms?
- If the student with spina bifida and/or hydrocephalus has an assistant of the opposite sex, is there a washroom that they can both enter?

- Is accessible transportation available? (Preferably, this should not separate the student from the rest of the class).
- If visiting an outdoor site, is the terrain accessible for a student in a wheelchair, braces, or crutches? Is an all-terrain wheelchair available?
- Are washrooms accessible?

Devices

Physical development is inextricably linked with learning and social development; as children develop physically, they learn about their world and how to manipulate it. When children miss any stage of physical development, they may also miss the learning opportunities that go with it. Aids and devices such as braces, crutches, walkers, and wheelchairs allow children with physical disabilities to pass as normally as possible through the milestones of development.

Wheelchairs

If a person with a physical disability, a wheelchair is a ticket to freedom and independence. Children who are capable should be encourages to stand and walk whenever possible. Sometimes, however, a wheelchair is the best option. In a wheelchair, a child can travel faster, further, and more independently than he or she could otherwise. This means that the child will have more opportunities to participate in activities with others.

Eventually, many children who have spina bifida and/or hydrocephalus moving into adolescence and adulthood choose a wheelchair as their means of transportation. Increased size, weight, spinal curvature, or other conditions make it more difficult to walk; they want to expend their energy on other activities, like shopping, sports, or socializing. With a wheelchair, they find it much easier to keep pace with their peers.

Handling wheelchairs. Usually a student who uses a wheelchair will be competent in its use and can explain how it works in specific situations.

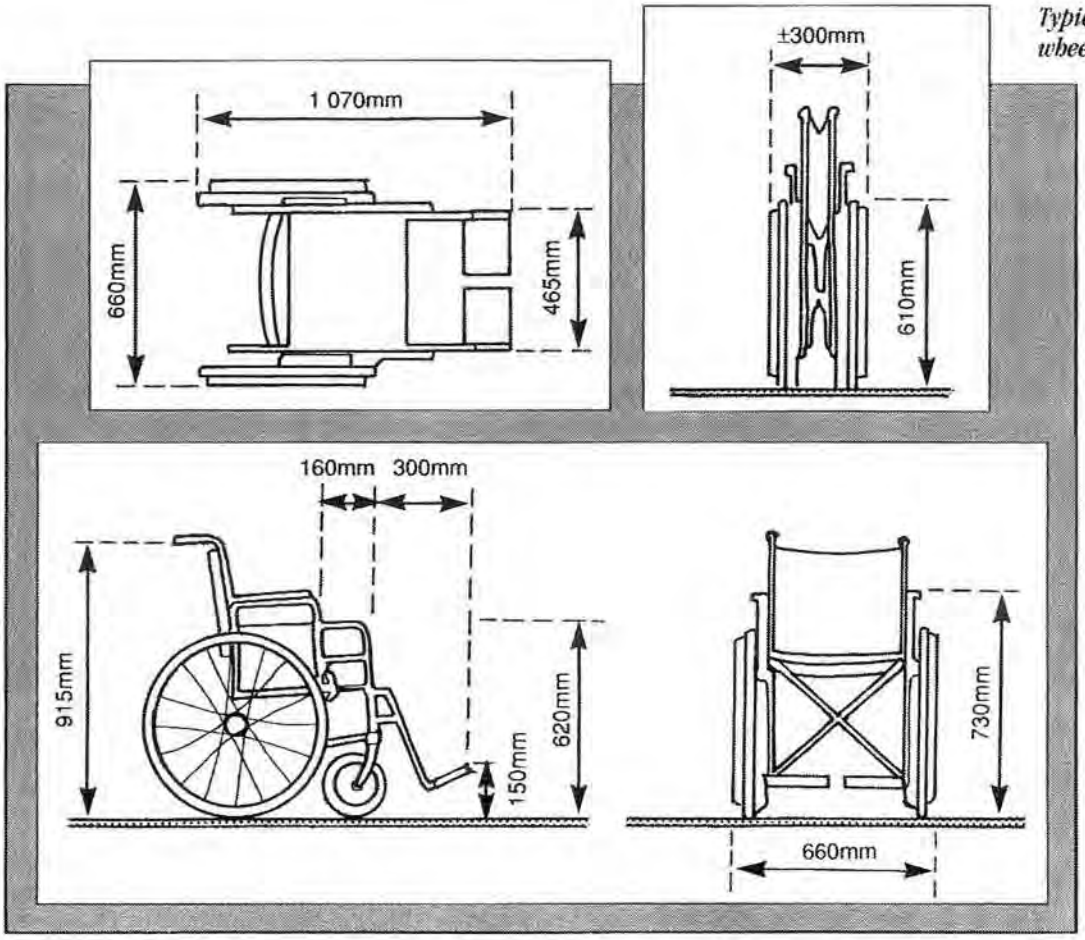
Following are several things to know when a student does need help with the chair:

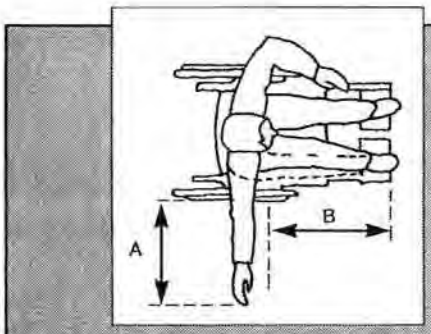
- Over soft or uneven terrain, it may be easier to turn the chair around and pull it.
- To get up curbs, tilt the chair backwards slightly so that only the large wheels roll over the curb.
- To go down a step, tilt the chair backward slightly and roll only the large wheels down the step.
- When boarding elevators, the chair should be turned around and backed in; the person can then wheel out properly. If the person does not require assistance, press the "open door" button to hold the doors while the person backs in.

In school, keep the wheelchair nearby if the student prefers to sit in a regular seat. The student may choose to sit in the wheelchair at a desk or table, Some wheelchairs have lap top trays that may be large enough to hold books and papers.

Adapting spaces for wheelchairs. The chart and illustrations (previous page) will help when planning or modifying spaces for students in

Typical wheelchair

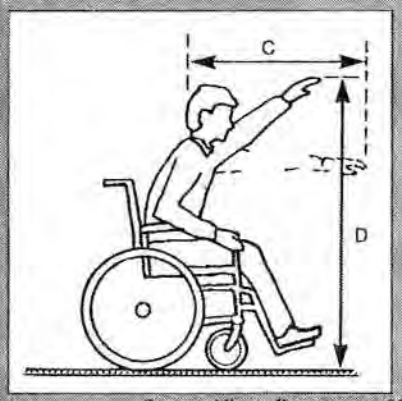


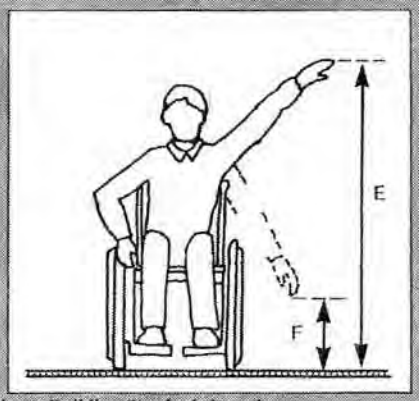


Key	Male[1]	Female[2]	Child[3]
A Easy side reach	505mm	439mm	300mm
B E sy forward reach	541mm	513mm	389mm
C Maxim m forward reach	922mm	869mm	668 nm
D High reach (forward)	1410mm	1308mm	965 nn
E High reach (side)	1641mm	1506mm	1237mm
F Full reach (down)	338 nm	439mm	508mm

(1) Mal h igh 1740mm (2) Femal h igl 1 16(5mm (3) Child h igl (6–9 ye rs) 1245mm

Reach of persons in wheelchair





Source: Alberta Department of Labour, Building Standards branch.

wheelchairs.
OR – the school should meet with the student and assess the amount of space needed.

Braces

Children with spina bifida and/or hydrocephalus, may use bracing to help with mobility and to keep bones and joints straight. Some students may have short leg braces on one or both legs while others may require bracing from ankle to chest. Most braces are now manufactured from aluminium and molded plastic to make them lighter in weight. If there are any special levers or locks on the braces, your student or your student's parents can probably show you how they work. As children grow, their braces may need adjustment or replacement.

Other devices

Canes, crutches, and walkers should be kept as close as possible to where the student is sitting. A bit of Velcro will keep them in place on the side of the desk or on the back of the chair.

It is important that the other students are taught not to move or touch crutches, walkers or wheelchairs without permission from their owner. People who rely on these devices need to know that they are safe and nearby at all times.

Common types of braces are:

Knee Ankle Foot Orthosis (KAFO)

KAFOs support the knee and ankle and allow the child to stand and walk with or without crutches or a walker.

Socks must be worn under the braces to protect the skin. Regular clothing can be worn over the braces.

Knee Ankle Foot Orthosis: KAFO

Ankle Foot Orthosis (AFO)

AFOs are splints which hold the feet straight for standing and walking with and without walkers or crutches.

Remember to wear AFOs over wrinkle-free socks worn inside out to avoid developing any red sores on the skin.

Ankle Foot Orthosis: AFO

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CHAPTER FOUR

Social Development

As students with disabilities grow up it is important that they reach the social milestones of their peers. Social maturation in students with spina bifida and/or hydrocephalus may be impeded by learning disabilities, extended absence from school for health reasons, segregated school settings, complicated needs that make it difficult for them to develop independence, or by adults who (unwittingly) thwart their efforts at independence.

Teachers can assist these students by helping them develop good social skills and by being aware of the special obstacles faced by their students who have disabilities.

Students with disabilities may be used to being catered to, getting lots of attention at home, at school, at therapy, or when in hospital. They need to learn at the earliest possible age that their own needs will not always be the first met. As a teacher you can try to ensure that no double standard exist in terms of what you expect from all of your students. Be as consistent as possible when praising, disciplining, and attending to your student's needs.

Prejudice

As a teacher and role model, you have an opportunity to educate your students about peoples' differences. This creates an atmosphere that supports the students with disabilities and teaches sensitivity to classmates. Use resources such as books, videos, and puppets, and role-playing activities to help all students explore myths and stereotypes. Ensure that your students with spina bifida and/or hydrocephalus have access to information about spina bifida and hydrocephalus and are able to deal with questions about their disabilities. Teach all of your students conflict resolution strategies.

Isolation/rejection

We've all felt left out at one time or another. It can be especially difficult for a child with a disability to understand that being let out of things from time to time is a part of life.

As a teacher, you can help by assigning teams and partners rather than allowing students to choose for themselves. In the classroom, design cooperative rather than competitive activities – such as recycling, collecting canned goods for local food bank, or making a wall mural – that will create a bond the your students understand one another's needs.

Learning about different disabilities helps all students develop understanding and empathy, especially when the teaching focuses on how people are more alike than different. A disability-awareness program is a great way to help your students understand one another's needs.

Situations such as bullying may occur which require teacher intervention and conflict resolution training may help all students to avoid confrontations.

Circles of friends

Sometimes schools need to "legislate" inclusion for a child with a disability. Many schools organize "circles of friends" for students with a disability, in which nondisabled schoolmates agree to participate in regular group activities with the children with disabilities. These circles usually operate outside regular school hours as a structured group, with set activities and schedules guided by an adult facilitator. The goal is for the group to evolve into something more than natural and spontaneous.

Independence

Sometimes, the greatest gift one can give a child is the opportunity to fail. By supporting students' attempts at independent thought and action – even when those attempts result in skinned knees or bruised egos – parents and teachers provide children with great opportunities to learn and grow.

Teachers may find them selves falling into the trap of "doing for" rather than teaching, because some children take minutes, months, or even years to learn certain skills. But children must "do" for themselves. Teachers are really not helping their students by doing things for them and shielding them from failure. Often when children learn to rely on others, they learn to resent those whom they feel have made them dependent and have underestimated their potential. This not only interferes with learning and development but can establish unhealthy behaviour that may carry on into adulthood.

Children must learn not only to be as physically independent as possible but emotionally self-reliant. All children need to feel secure and loved, but the significant adults in their lives can teach them that their parents aren't the only ones who can take care of them. (Parents sometimes need to learn this too!) Children whose parents come to perform services for them at school may never learn to break free physically or emotionally. Therefore, parents should not come to the school to perform catheterization or to act as a classroom aide for their own child.

For many children, independence may come by way of wheelchairs and other aids. The child will develop a good attitude to his or her equipment of the family and the school encourage independence by including the child in integrated or adapted activities.

Self-expression

Children will develop a strong sense of self-worth when they are encouraged to play creatively. Dress-up, role-playing, doll and puppet play, art and music activities all encourage children to work out their anxieties and problems. They can try on different roles and define themselves, their world, and their relationship to it through creative activity.

Disability and awareness and acceptance

It is important for a child with spina bifida and/or hydrocephalus to know that his or her disability is permanent. Teachers can help by accepting the disability is an integral part of the child's identity, not merely as a handicap. Find real and fictional role models who are disabled to incorporate into lessons. Scientists like Stephen Hawking or leaders like Franklin Roosevelt, for example, could easily be included in a science or history lesson. Children's books that feature characters with disabilities can also be integrated into lessons and reading.

Precocious (Early) Puberty

The onset of puberty in children with spina bifida and/or hydrocephalus may start as early as age seven or eight. Bone growth in the long bones of the arms and legs stops during puberty. This will result in shorter than average stature for those affected. These factors have both a physiological and psychological impact on the student. Hormone therapy may be successful in halting or delaying precocious puberty.

Sexuality

Children with spina bifida and/or hydrocephalus have sexual feelings and expectations just as their peers do. Historically, people with disabilities were considered nonsexual; they were not expected to experience physical intimacy, marriage, or children. Often, the significant adults in the life of the child with a disability avoid discussions about sex in an effort to spare the child. This is unhealthy, because a person who is perfectly capable of giving and receiving love and affection (both physical and emotional) grows up believing that he or she is either unworthy or incapable. Teachers must give students with disabilities the same information about sex and sexuality that they would to all students.

Sexual Functioning

Most children want to know if they will get married or be parents when they grow up. Perhaps the best way to answer this question is "probably," or "maybe". Most females with spina bifida can conceive and bear children.

Most males with spina bifida have difficulties with erection and/or ejaculation. This may make it difficult, though not necessarily impossible, for them to become fathers in the usual way. Regardless, all people can find ways to both give and receive pleasure.

Privacy

Privacy can be a real issue for children with physical disabilities, as they may require help with dressing and going to the toilet long after other children have learned to do so independently. Those who help with dressing and toilet activities must respect the child's privacy by using the appropriate rooms and closing doors. It is also important that helpers are acceptable to the child.

Sexual abuse

People with disabilities are as susceptible to sexual and other forms of abuse as anyone. Please be especially vigilant with your students with disabilities. Most schools help their students to be aware of, and beware of strangers, inappropriate touching, and so on, but a traditional sexual-abuse prevention program may be confusing for a child who requires a great deal of hands-on care. The child can't always discern between appropriate and inappropriate touching. If your school participates in "Feeling Yes, Feeling No," or a similar program, the school team should address this. They must first define what is appropriate and inappropriate touching in the special situation of receiving care, then discuss this with the child.

Adolescence

All children go through physical and emotional changes as they grow older, and many rebel against the rules and limits imposed upon them by their parents. During adolescence, routines (such as bowel or bladder management) may become a source of conflict or tension. Children who were once obedient about sticking to their diets and bathroom schedules may grow tired of the lifestyle restrictions of their bowel management program – the special foods, the time constraints imposed on them, and so on. They may, in an attempt to assert their independence, decide to take over their care without really understanding the importance of the routine. They may opt to neglect bathing and changing, either as a simple act of rebellion or, paradoxically, so that they can blame their disability for a lack of friends or dates.

Dealing with this rebellion is a sensitive process. It would be easy if you could guarantee your students' popularity if they would bathe daily, wear clean clothes, and change their pants regularly – but you can't. For people with spina bifida and/or hydrocephalus, personal care is more than a matter of social acceptance; it is essential to physical health and well-being.

To overcome this rebellion, it helps of the student with a disability has a relationship with someone whom he of she trusts or respects, other than a teacher or parent. Preferably, this should be someone of the same sex. Most young people have at least one close friend or an older sibling to confide in during the turbulent and confusing years of adolescence, but some young people reach high-school age without ever having found a confidante. Many high schools have developed peer counselling or

peer mentor programs. Such programs may benefit a student who needs someone his or her age to talk to.

Transition to Adulthood

For a variety of reasons the transition from adolescence to adulthood can be more difficult for students with disabilities. They may lack confidence in their ability to get or keep a job, or to cope with post-secondary training. They may not have the skills or confidence to care for themselves, or feel they are not worthy of friendship or capable of romantic partnership.

Suggestions for the early grades

- Introduce your students to various careers. Invite people (with or without disabilities) with different jobs to visit your classroom.
- When out in the community with your students, point out people working. Use that to initiate discussion about different career possibilities.
- Tour work places to open student's eyes to what is available in the work world.
- Ask your students which particular jobs they would like to do.
- Encourage as much self-determination in your students with disabilities as possible.
- Involve your students in useful activities that will help them feel good about themselves. This will help them gain the confidence and motivation needed to compete in the work force. These could include such everyday activities as helping younger students, helping the teacher organize classroom spaces, or acting as a messenger.
- When teaching students skills that they are able to master, ask them to come up with ideas about what jobs might require those particular abilities. Also, identify skills necessary for jobs and work on these with your students.

Suggestions for older students

- Ensure that career exploration and work experience are a part of the student's Individual Education Plan)IEP). Even temporary placement in the work force can be of enormous value.
- Encourage your students to be involved as much as possible in the community. This helps build a network of contacts that will be helpful in a job hunt. Volunteer work can be an excellent way to build a resume and acquire job-related skills.
- Once students graduate, many families find themselves in limbo, as many agencies provide services for children and adults but little for older teenagers. Help these families search out services for their young adult; include representatives from these agencies in transition planning sessions.

Perhaps the most important thing you can do to help your student with a disability make a successful transition is to assume that he or she can and will find work and be productive, will live independently, and will have meaningful relationships. Many people with disabilities are handicapped by others' assumptions about them. It can also work the other way. Encourage your students to dream. Then help them interpret those dreams by recognizing what is possible within the scope of their abilities.

CHAPTER FIVE

Physical Education

The goals of physical education for all students should be to experience enjoyment and satisfaction, to develop the skills needed to participate in recreational activities at school or at leisure, to help increase their physical fitness level, and to develop social skills.

The philosophy of the physical education program must be one of inclusion—that is, creating an environment that allows students of all abilities and interests to participate fully. A quality phys-ed program benefits students with spin bifida and /or hydrocephalus by allowing them to develop independence, make choices, take appropriate risks, and enjoy social interaction with their peers. During all games lessons, allow students with disabilities to take a full part within the limits of their mobility.

Ball Skills

Phys ed for younger students

Because many spots and games require ball skills, these should be emphasized throughout the school years. Students without an adequate repertoire of basic ball skills are excluded from many group games. Therefore, it is critical to expose them to simple forms of ball play from an early age.

An occupational therapist or physiotherapist can assess the extent to which sensory and motor difficulties impede a particular child. He or she can also help select play material according to that child's abilities. In the early learning stages of ball-skill practice, teachers should use more direct and formal teaching methods than they would normally. They should simplify activities so that students not only participate but experience success. This success will motivate students to continue practicing. The following suggestions may be useful when planning lessons and physical education activities:

- Ball flight can be modified to simplify the perceptual problems encountered when catching can hitting. A ball in flight must be assessed in three-dimensional space, whereas a ball that is rolled along the ground need only be assessed in two dimensions.

Bouncing balls are simpler to track visually than balls in the air.

- Use larger balls for students with sensory and/or motor difficulties; large balls are considerably easier to catch or hit than smaller ones. This simplifies motor performance, which becomes more of a gross-motor skill using the arms than a manipulative skill using hands only.
- Use multicoloured play balls, which are easier to track against the normal gymnasium background by students with visual-motor disabilities.
- Provide light plastic bats and thin-handled play bats to make it easier for students to hit the ball.
- For many group and team games, assign children with decreased mobility a definite place or position on court (for example, net position in volleyball and badminton.

Other activities

Teachers can promote other phys-ed activities that are suitable for children with disabilities:

- In gymnastics, encourage students with spina bifida and/or hydrocephalus to use any apparatus that stimulates the use of unaffected body areas. These devices include wall bars, rings, climbing frames, and ropes. Used properly, they help to develop upper-body strength, which is important for propelling wheelchairs and for transferring independently. This increased strength is also an asset in other sports.
- Promote scooter-board activities. These offer young students with spina bifida and/or hydrocephalus easy mobility and help to build arm and shoulder strength. Scooter-boards also act as an equalizer when students with disabilities participate in activities with other students.

Adapting spots and games

Adapt sports and games for students with disabilities. Keep the character, spirit, and rules of the game as near to the real thing as possible. If, when adapting a game you have changed the original rules significantly, call it something else.
Following are suggestions for adapting sports and games:

- In team games such as softball, have a teammate act as a runner for the student who has a physical disability.
- Decrease the playing area; move targets closer; reduce the number of bases; increase or decrease the size of the goal area.
- Consider alternate equipment. For example, substitute beanbags for fast-moving pucks or balls, larger bats and balls for regulation size, a tennis racquet for a bat.
- Reduce the playing time or number of points necessary to win.
- Modify the rules. For example, allow more bounces, more swings at bat, and so on.
- Invite students to come up with suggestions.

- Encourage older students with physical disabilities to participate in adapted-sport activities at either a competitive or a recreational level. These may include basketball, tennis, quad rugby, track and field, sledge hockey, archery, bowling, swimming, or weight lifting.

Phys ed for older students

All students with disabilities can participate in school phys-ed opportunities such as aquatics, dance, gymnastics, the intramural program, and outdoor activities. School phys-ed departments may provide appropriate equipment such as sledges, special skiing devices for youth with disabilities, and aquatic aids, to make this possible. This equipment may be available through local agencies, associations, or rehabilitation centers.

The "umpire dilemma"

As students grow older, and their nondisabled peers grow more proficient at physical activities, students with disabilities are often called upon to be scorekeepers or referees. There are valid arguments both for and against this practice.

For. Students with disabilities, taught to umpire and referee matches for their peers, thus feel that they are making a positive contribution in a variety of sporting activities. These positions provide an avenue toward social acceptance in a field where personal active performance may not be possible.

Against. Being an umpire not only sets a student apart, it also makes him or her into "the bad guy." As well,, perceptual problems may make scorekeeping difficult. The time spent on the sidelines could be better used learning the leisure time activities that will contribute to a student's future physical and social well-being.

PART II

TEACHING CHILDREN WITH SPINA BIFIDA AND/OR HYDROCEPHALUS WHO HAVE LEARNING DISABILITIES

CONTENTS

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By Angus L. Lloyd, M.Ed.

Many (but not all) children who have spina bifida, hydrocephalus or both, also have learning disabilities. This is a consequence of their condition. Learning disabilities interfere with the way in which students process information, particularly information that is carried through symbols, such as letters or numbers. These disabilities affect language processing, visual-spatial processing, or both. The effects of learning disabilities usually become apparent when children are in school attempting to learn literacy and numeracy skills.

Research has shown that children with spina bifida and/ or hydrocephalus are likely to have learning disabilities in specific information processing areas.[1] When teachers know what to look for, they can anticipate learning difficulties, be alert to potential problems, and to address these when they arise.

Research has also shown that for children with spina bifida and/ or hydrocephalus the profile of learning disabilities and their effect on language processing changes as the children grow older.[2] As children with spina bifida and/or hydrocephalus get older, they are likely to improve less in certain language skills compared to children who do not have this disorder. Thus teachers should remain alert to potential learning problems as the child moves through the grades. Problems may emerge in grade four that did not seem to exist in grade three, and so on. This is partly because of the demands of the curriculum change, and partly because language learning is a developmental process. Children continue to learn to use and understand increasingly complex language structures as they are growing up.[3] Children with spina bifida and/or hydrocephalus may be slower to develop certain language abilities, such as rapid word retrieval or understanding figurative language. Consequently they may become confused when they are reading, listening to the teacher, or talking with other children.

To meet the needs of children with spina bifida and/or hydrocephalus in the special education or regular classroom, teachers need to :

- anticipate learning problems and identify them when they arise
- teach specific skills to prevent problems before they arise
- give extra attention to weak areas
- teach learning strategies that help students become more independent
- modify and adjust teaching methods

CHAPTER SIX

Understanding the Learning Disability

Children with spina bifida and/or hydrocephalus have a range of intellectual abilities as do typical children. Some are average to above average in intelligence but a greater proportion of them have low to below average intellectual abilities relative to the general population. Some have intellectual disabilities. Regardless of their level of intellectual ability, children with hydrocephalus often have areas of difficulty which can impact their learning and behaviour. These may take the form of learning disabilities in those of average to above average ability, and learning or challenges in those whose intellectual abilities fall below the average range.

Hydrocephalus thins and distends the brain. While shunting restores the ventricular system and allows for normal growth of the corpus callosum, many tissue changes that are caused by the condition (and that exist before shunt insertion) remain. Hydrocephalus affects some regions of the brain more than others. For example, the occipital lobe, the area considered responsible for "executive" functioning. (Executive functions govern other areas of the brain, and include planning, goal setting, and checking or evaluating performance.)

Some research suggests visual impairments in gaze and eye movement, common in children with hydrocephalus, may lead to impairments in nonverbal information processing as children grow older. This may lead to later problems with informational processing that involves the analysis and integration of visual stimuli.[5]

Research into group differences in oral language processing also showed some specific processing difficulties.[6] Children with early-onset hydrocephalus may:

- have normal language in social situations (conversational or interpersonal rhetoric) but have difficulty using and understanding more precise language (e.g., defining a noun, describing a sequence of events)
- need more time to process language when they are listening and talking
- have more difficulty talking fluently and smoothly, and may stop and start perhaps searching for a word
- have more difficulty recalling precisely what was just said
- have problems interpreting sentences that contain words that have multiple meanings (for example, park: "We can park the car," and We can play in the park") and sentences that are ambiguous (for

example, 'The man drew a gun"; "Please paint the picture.")

- have difficulties understanding and producing figurative language (idioms, metaphors, similes, proverbs)
- tell and write stories that are wordy; conciseness is a problem
- make fewer connecting statements so that stories don't flow easily
- fail to take account of their listener's needs when they talk by not supplying sufficient context (for example, by starting the story in the middle)
- use more stereotypical phrases and clichés than normal
- go off on tangents that are irrelevant to the discussion
- fail to monitor their own language when they are talking to make sure they are making sense and the listener understands them

Problems with oral language processing are also likely to affect the development of written-language skills. These writing problems may also be complicated by poor pencil control caused by visual-motor and visual-perceptual problems.

Learning disabilities most significantly affect children when they are learning to read. This is a complex process that begins with decoding words and quickly progresses to deriving meaning from text. Children with spina bifida and/or hydrocephalus rarely have difficulty with the first stage. They may learn to decode and pronounce words fluently and automatically in kindergarten and grade one. The problems arise when deriving information from text, particularly where nonliteral interpretation is required.[7] Children with spina bifida and/or hydrocephalus may:

- have no more trouble than other children learning to decode and recognize words, and read connected text fluently
- have problems getting information that is not explicitly stated from text. For example, in the sentence "Billy spent his whole allowance at the candy store," we know that Billy is probably a child, although this is not explicitly stated
- have difficulty connecting the ideas presented in text, or keeping the thread of the story or expository text
- have difficulty forming an understanding of the main idea of a story or expository text
- have problems understanding figurative language, such as metaphors and similes

Teachers must be aware that children with spina bifida and /or hydrocephalus are at risk for learning disabilities. These children may have problems acquiring reading decoding, reading comprehension, spelling, written language, and mathematics. They may exhibit behaviour problems and refuse to comply with instructions. They are likely to have difficulty integrating information or making connections. They may have problems making connections between prior knowledge and new knowledge. They may lose the thread of the argument if the language (oral or written) relies heavily on implicit connections carried through nonliteral, figurative language, indirect questions, or connected algorithms (such as those found in mathematics operations).

They may have difficulty with executive functions affecting their ability to initiate, plan and carry out complex tests. Thinking flexibly and executively to solve problems may be a concern, they may tend to "get stuck" in a particular way of thinking or approaching a problem.

Attention deficit disorder in children with spina bifida and/or hydrocephalus

Attention deficit disorder (ADD) is a condition that causes attention and distractibility problems in students. Because it is so clearly associated with hyperactivity, it is often overlooked when assessing students with spin bifida and/or hydrocephalus. However, attention deficit disorder does exist in isolation, without attendant hyperactivity. It is this type that is common to children with spina bifida and/or hydrocephalus, although some children may also have hyperactivity disorder.

Research shows that the incidence of attention deficit disorder is higher among children with spina bifida and/or hydrocephalus thanks among those without. Attention deficit disorder, which may or may not accompany a learning disability, can often be treated medically. Characteristics of ADD, when observed in children, should be reported to parents. They can then arrange for diagnosis and treatment.

The following information is taken from the book *Learning Disabilities and the Person with Spina Bifida, by Phyllis J. Agness, Ed.D. Copyright 1994.*

Characteristics of attention deficit disorder

Inattention and distractibility

- difficulty screening out distractions
- difficulty completing the routine repetitive tasks required for successful classroom performance.

Impulsivity

- acting before thinking
- in students with spina bifida and/or hydrocephalus this will not be manifested as hyperactive behaviour, but will instead show up in difficulty waiting for a turn in conversation or a game, not weighing the consequences of actions, or beginning assignments before waiting for instructions.

Difficulty delaying rewards

- a problem in working for long-term goals
- the need for immediate reward will be responsible for many tasks being left unfinished

Overarousal and/or hyperactivity

- rather than displaying hyperactivity, the student with spina bifida and/or hydrocephalus is more likely to demonstrate overarousal by exhibiting extremes of emotion faster and with greater intensity then is age appropriate, Many appear to be on an emotional roller coaster.

Uneven performance

- greater variation in the equality. Accuracy, and speed with which assigned schoolwork or work tasks are performed.

Charactistics of attention deficit disorder that may be present in the student with spina bifida and/or hydrocephalus:

- has difficulty following through on instructions
- has difficulty sustaining attention
- seems not to listen
- loses things necessary for tasks
- fails to give close attention to details
- is often disorganized
- makes careless mistakes
- is forgetful
- seems to be daydreaming when should be attending
- lies to cover impulsive tasks or work not completed
- requires an unreasonable amount of time to complete school work or other tasks
- doesn't complete or forgets homework
- often appears absent-minded
- requires supervision to complete work

If a child with spin bifida and/or hydrocephalus also has attention deficit disorder, the following will also be affected:

- learning – all educational tasks
- physical therapy, occupational therapies and all other therapies
- instruction of self-care and medical procedures (catherizatons, etc)
- parenting
- vocational planning
- effectiveness of counselling

Other obstacles to learning in children with spina bifida and/or hydrocephalus

Fine motor skills

Research has indicated a significant incidence of abnormal upper extremity function in individuals with spina bifida and/or hydrocephalus, resulting in poor fine motor skills. This may cause the student difficulty with the self-help activities, participating in games, printing and cursive writing, cutting with scissors, tracing, and art work. Handwriting may be unevenly spaced, the quality may be poor, and execution very slow, with production limited.

Visual motor skills

Studies have shown that individuals with spina bifida and/or hydrocephalus may exhibit delayed visual-motor skills or hand-eye coordination. Children with this problem may have difficulty developing their writing skills, copying accurately from the blackboard or a worksheet, completing drawing, tracing and cutting activities. There may also be an effect on playground activities and physical education.

Visual perception

Research has indicated that individuals with spina bifida and/or hydrocephalus often have deficits in visual perception. Different aspects of visual perception, figure ground, form constancy, spatial relations, visual discrimination and visual memory may be present. As a result, the student may have difficulty focusing on the teacher in the classroom, locating specific books in a desk, identifying an item in a picture with distracting background, learning letters and numbers, remembering words and identifying shapes in different locations.

Individuals with perceptual disturbances may also be unable to group or classify objects, find it difficult to follow directions and to recall letters and numbers. Comprehension of reading material may also be affected.

Organizational skills

Many children with spina bifida and/or hydrophalus will experience problems with organizational skills. These children may require additional structure. Instructions with more than one step will be difficult. The neatness and quality of the student's work will also be affected.

Modifications, intervention strategies, and accommodations

The following is a list of suggestions for intervention strategies, modifications and accommodations to assist the student with spins bifida and/or hydrocephalus who may have fine motor, visual motor, visual perception and organizational difficulties to reach their fullest potential.

- use graph paper for mathematics and other related activities
- use a thick grip soft lead pencil
- use ruled paper as often as possible
- use a calculator
- use a word processor (computer) for lengthy assignments or to improve productivity
- use a tape recorder for lengthy lessons or instructions
- use a note-taker, obtain a set of notes from the teacher, or have a peer provide a copy of their notes by utilizing NCR (no carbon required paper)
- use a timer or a watch with an alarm
- use schedules and lists whenever possible
- reduce clutter in work area
- position desk close to blackboard or where distractions are reduced
- provide an extra set of books for use at home
- verbal reporting to be an acceptable alternative to writing
- provide additional time to complete timed tasks such as tests and assignments
- provide a separate room for writing exams, away from distractions
- use a scribe for written exams or tests
- quantity of written work may need to be decreased
- use highlighters to focus on specific passages in text or material to be copied
- tasks and instructions to be broken down into small clear steps
- use a homework book, organize, or notebook to keep track of homework assignments.

Non Verbal Learning Disability in children with spina bifida and/or hydrocephalus

Many individuals with spina bifida will exhibit a cluster of learning strengths and weaknesses commonly referred to as Non-Verbal Learning Disorder, or "NLD". While each child is different and all students should be assessed individually in order to develop an accurate learning profile and appropriate educational plan, there are certain commonalities and typical learning patterns among students with spina bifida. Detecting early signs of such patterns can make a significant difference in remediating the deficits caused by the disorder.

The common pattern of strengths often observed in the child with NLD includes early speech development, a high vocabulary, early decoding and reading ability, auditory learning and memory and noticeably strong ability to memorize rote information, particularly when presented verbally. This pattern of linguistic strengths is frequently deceiving, as it can mask underlying learning challenges and make parents and educators less likely to detect potential problems, especially in the early years.

The common pattern of weaknesses that can emerge in the child with NLD as he or she develops includes deficits in all or some of the following areas:

Visual spatial skills
Graphomotor skills
Reading comprehension
Pragmatic language and non-verbal social cues
Non-verbal, abstract concept formation
Math concepts and estimation
Attention problems
Executive function

<u>Visual Spatial Perception</u>

The student with NLD may have difficulties processing visual information. In particular, when the visual field is very "busy", the child may have difficulty filtering out non-essential visual input and determining which specific piece of information to focus on. An example of this in a classroom setting would be that the child has difficulty focusing in on crucial information being presented on the board as he or she can become overwhelmed by the visual stimulus of charts, posters, multi- colored bulletin boards and other items that tend to cover the walls in a typical classroom. Simply put, he or she cannot focus on a particular learning task because of the distraction of other visual input in the environment.

Visual spatial difficulties can cause problems with orientation and use of appropriate spatial judgment. They may appear clumsy or bump in to things while walking or navigating their chair. This may not be due to mobility challenges, but lack of ability to judge the distance between themselves and the object they bump into.

The child with NLD may exhibit extreme difficulties with completing spatial tasks using estimation to solve novel problems. For instance, the student may have trouble judging how many books and other belongings can fit in a desk or locker. He or she may not be able to envision how a series of toys on the floor can fit back in a toy box when asked to tidy up. As the child grows, inordinate difficulties with direction and visual memory may emerge. They may get easily lost or turned around, even in environments that should be familiar. As the child with NLD gets older, these kinds of issues can prevent age appropriate development of independence.

Visual Motor and Graphomotor Skills

The child with NLD may be particularly challenged with visual motor and graphomotor tasks, such as writing, using scissors and drawing. Though the child with NLD may have exceptional oral language skills, their written expression may seem deficient in comparison. In most cases, this is not because they don't possess advanced verbal skills, but because the physical act of writing can be challenging and frustrating, so the child will write seemingly minimal thoughts. They may also have difficulty with written expression as a result of poor sequencing or disorganized thought process. Their penmanship may appear crude or even infantile, and they will often having difficulty writing, drawing or cutting in straight lines. These particular difficulties are, of course, often further complicated in a child with spina bifida, as spatial and motor deficits can be exacerbated and further complicated by mobility challenges.

Reading Comprehension

Difficulties with reading comprehension can begin to emerge in a child with NLD in the early grades, as soon as the reading task becomes more than just the act of decoding words and recalling concrete and literal facts. Although they can be quite advanced in terms of linguistic skills, students with NLD often have difficulties with critical reading skills. Though they can appear to have the ability to read advanced texts, they may not grasp main ideas, inferences, implied ideas, character motives, author intent and other more sophisticated aspects of critical reading. They may be able to recall specific factual information from reading advance texts, but may not be able to tell you what it means or why it is important.

Pragmatic Language and Non-Verbal Social Cues

Although children with NLD often possess advanced verbal skills and appear to converse on a more mature level than expected, they may experience difficulties navigating the pragmatic use of language. They may not appropriately perceive voice tone or inflexion, or be unable to "read" body language, facial expressions or other non-verbal communication tools. They may not "get" jokes or perceive sarcasm. In short, while the child with spina bifida can certainly tell you what you said literally, they may not be able to understand the manner in which you said it or why and may completely misinterpret the intent of the message.

These pragmatic language deficits in students with NLD can often lead to impaired social development and difficulty building and maintaining peer relationships. They may have a sophisticated vocabulary and appear quite articulate for their age, but may not grasp an understanding of the fact that use of language should be tempered by social circumstances and rules. For a child with spina bifida, these conditions are often further complicated by the isolation and lack of opportunity for social skill development inherent in the life of a child with a physical disability, which is further addressed in chapter 4.

Non-Verbal, Abstract Concept Formation

Children with NLD will often demonstrate difficulties understanding non-verbal abstractions. If presented with a visual representation of an abstraction, they may not realize that the visual representation is merely for the purpose of explanation of an abstract idea, and not meant to be taken literally. For example, when shown a globe or a map to demonstrate the concept of latitude and longitude as a method of pinpointing a specific geographic location, the child may not understand that the lines are meant to "stand for" something and don't really exist. In early childhood, they may not catch on as quickly as other children to the fact that the size of the container doesn't necessarily change the quality or quantity of its contents.

As students age, problems with abstract concept formation can become more evident as the school curriculum advances to more and more abstract ideas and less and less dependent on rote or factual information. While the child with NLD may have exhibited strengths in math facts, computation and basic operations, math concepts and problem solving are far more challenging for this student. Just because a child with NLD can multiply and divide accurately doesn't mean they necessarily understand what this means.

Math Concepts and Estimation

As stated above, children with NLD may perform well in mathematics up to a point. Basic math skills may be intact, but they will often have difficulty applying factual knowledge to problem solving scenarios. They may know that 3x3 is 9, but when they multiply 4x4 and make a place error and get 160 as an answer, they may not have the conceptual understanding and estimation skills to recognize immediately that this answer must be wrong. Children with NLD may have difficulty estimating time in an age appropriate manner. If you tell them dinner will be ready in an hour, as time passes, they may not be able to judge when it is about time to come to the table. While they may be perfectly able to perform multiplication problems when told to do so, if you tell them it takes 30 minutes to get to grandma's house which is 10 kilometers away and then ask them how long it should take to get to Uncle Jimmy's house if he lives 30 kilometers away, not only might they not be able to apply their knowledge of multiplication to the problem, they also may not be able to estimate a reasonable guess without solving the problem.

Attention Problems

Many children with spina bifida and/or hydrocephalus may be diagnosed with ADHD, or may exhibit similar attention related difficulties in school. They may seem easily distracted by extraneous visual or auditory stimulus and may seem at times unable to sustain concentration and focus on a singular task. They may jump from one train of thought to another, seemingly unrelated thought. They may seem scattered, disorganized and unable to complete academic tasks in a timely manner. Children with ADHD are often described as "not paying attention". This, however, is often a misinterpretation of the circumstances. The problem is not that they are "not paying attention", but that they are paying attention to everything, and unable to discriminate between what is extraneous, inconsequential and unrelated to the task at hand. Because their mind wanders from one thing to another, they are unable to complete the desired task. For children with NLD, lack of focus or concentration is often the result of either lack of ability to sustain mental effort or lack of interest in the subject matter, or both.

Executive Function

Executive function is defined by the Encyclopedia of Mental Disorders as: "a set of cognitive abilities that control and regulate other abilities and behaviors. Executive functions are necessary for goal-directed behavior. They include the ability to initiate and stop actions, to monitor and change behavior as needed, and to plan future behavior when faced with novel tasks and situations. Executive functions allow us to anticipate outcomes and adapt to changing situations. The ability to form concepts and think abstractly is often considered components of executive function."

Simply put, executive function is our ability to plan, anticipate, prioritize, project and adapt our plan of action as the changing environment calls for it. For children with NLD, this particular facet of managing their lives is in a state of dysfunction and is the cause of much of their academic challenges, specifically in later years, when the daily schedule, tasks and processes are no longer strictly regimented and regulated by teachers and/or parents. Once the child with NLD is left in charge of determining what he or she should do, how it should be done and when he or she should do it with little or no direction or regulation from the teacher or parent, academic problems abound. The older student will appear to struggle inordinately with daily routines, organizing, managing time, adhering to deadlines and generally have difficulty getting through the day. They will forget things, lose possessions (in part due to the visual/spatial challenges described above) and will sometimes seem overwhelmed with simple decisions and tasks. When this occurs, they may lack the strategic thinking skills to find a solution, and may therefore elect to simply shut down and do nothing. This behavior is not generally the result of laziness or a lack of desire to do what is asked, but rather it is due to a total lack of ability to envision a way "out of the hole", so to speak.

Teaching Students with NLD

General Teaching Tips

Use multi-modal teaching methods (combine visual, auditory and kinesthetic learning)

When demonstrating new concepts, scaffold with prior knowledge

Use specific verbal, rather than non-verbal cues to re-direct student behavior

Encourage students to use "self-talk" when working through problems

Encourage the on-going development of strengths while remediating weaknesses

Remediating weaknesses in Visual Spatial Perception

Teachers can help students with NLD by redirecting them away from visual distractions and giving verbal cues to direct them to the task at hand.

Help them pinpoint exactly what they are supposed to be working on, and exactly what they are supposed to be paying attention to. When pointing to or writing something on the board, engage them in dialogue to focus their attention.

When teaching new material that is highly visual in nature, incorporate multi-modal instructional methods. What demonstrating something, remember to show them the concept or process, tell them about it, have them do it while talking them through it, then have them do it themselves. Then give them a written description of what you did, how you did it, and why you did it that way. For a student with visual/spatial problems, to simply model a process may not be sufficient. They have to be "talked through it". This allows them to utilize their verbal strengths to digest new material.

The impact of visual spatial difficulties can sometimes be reduced over time by the practice of strategies and intentional self-talk. Instead of pushing the child's chair in between desks in the classroom, encourage the student to do it, while teaching self-talking strategies, such as "is there enough space for my wheelchair (or for me to walk) in between these rows of desks, or should I survey the area and find another route". Instead of cleaning out the student's locker or desk, engage the student in a conversation about what might or might not belong, or what might or might not fit. Eventually, these conversations will replay in the student's mind, even without prompting, and visual/spatial misjudgments will wane.

As the child with NLD grows older, visual spatial deficits may manifest in such things as directional difficulties, inability to interpret maps, diagrams and other largely non-verbal models. Always turn these things into verbal instructions. One good example in a typical classroom is the fire escape routes for classroom buildings. Students with NLD may not be able to interpret these non-verbal instructions. One example might be, "leave the classroom, turn left toward Mrs. Johnson's classroom, left again at the boy's bathroom, and out the door"(always remember that, since students with NLD might have difficulty with left and right, point left while saying 'left'). When turning non-verbal or visual diagrams into verbal instructions, always remember to go back to the map or diagram and literally show the student how the words translate into the non-verbal picture. For most people, the connection between words and non-verbal cues is natural. Students with NLD have to be taught this connection explicitly.

Remediating Visual Motor and Graphomotor Skills

Students with NLD, and particularly students with spina bifida and/or hydrocephalus will, as previously mentioned, exhibit extreme difficulties in this area. While it is a worthwhile endeavor to remediate these deficits in the early years, it is also prudent as an educator to evaluate when the introduction of assistive technology is warranted. While student should practice the development of eye-hand coordination with the understanding that these abilities can improve over time, at the same time, academic progress should not be impeded by these deficits. At an appropriate time, the students should be encouraged to utilize word processing, voice to text technology and other assistive aids that may be available to reduce the impact of visual motor and graphomotor skills. Often, the essay that a middle grades student with NLD can produce by dictating into a computer is vastly different from what he or she can produce by writing by hand. It is possible, even likely, that an adult with NLD may never be able to write script on a piece of paper without slanting severely upward or downward or while maintaining uniform letter sizes as they approach the right edge of the paper. Educators should carefully assess when is the appropriate time to abandon certain graphomotor tasks in favor of technology so as not to impede the academic development of the student.

Meanwhile, eye-hand coordination can be developed with the use of fun activities such as computer and video games. Visual processing speed is a common area of weakness in students with spina bifida and NLD that can improve somewhat over time with practice using these kinds of programs. However, it is important to remember that these practice tasks should not be used if they cause the student to experience persistent failure, as this defeats the purpose of the task. If the student experiences some success, he or she is more likely to enjoy the activity, which, in turn, will increase the likelihood that he or she will persist in the practice activity.

Remediating Reading Comprehension

As previously discussed, students with NLD may display unusually advanced verbal abilities early on, but may begin to falter as academic reading tasks move beyond decoding and rote memory recall. While for many individuals, understanding what is "between the lines" of what we read may be inherent, for students with reading comprehension problems, this is not the case. These students need to be taught explicit reading strategies to utilize for specific reading tasks. The specifics of how to teach these strategies is discussed in chapter 8. Two specific reading strategies and the types of reading tasks for which they are appropriate are outlined below.

For traditional textbook style reading, try SQ3R:

SQ3R

- Survey
- Question
- Read
- Recite
- Review

This strategy is a favorite among educators as it gives a precise and effective methodology for textual reading. It is appropriate for middle grades and above. The student spends just a few minutes "surveying" or previewing the materials to be read, looking for visual cues such as headings, boldfaced terms, margin notes in color, charts, pictures, etc. He or she then engages in a mental process of recalling and connecting prior knowledge. Once the student has an inkling of what is to be covered in the chapter or section to be read, he or she becomes an active participant in the reading process by writing down a series of questions which may or may not be covered in the reading material. The student then reads the assignment with a particular purpose in mind- to find the answers to the questions he or she wrote. Once the entire process is complete, the student is left with two things, a set of written notes that presumably reviews some of the key information covered in the reading to review later, as well as a question or two left unanswered that can serve as a method for class participation. The student has relevant questions to ask the teacher.

To assist students with reading comprehension of more narrative texts, teach story mapping strategies that reinforce things like sequence of events, cause and effect, story structure, character development, etc. Using story mapping strategies will help students learn that narrative stories do have structural patterns. However, if using story mapping strategies, remember to give the student with NLD an empty story map to begin, and not a blank piece of paper. Drawing out the map itself may prove equally challenging for the student with visual/spatial problems. The main point of both strategies is that students with reading comprehension difficulties may need to be taught specific strategies for how to read effectively and purposefully.

For more information about SQ3R, story mapping and other excellent reading strategies, consult the following sources:

http://www.ldonline.org/article/Helping_Children_with_Learning_Disabilities_Understand_What_They_Read

http://www.readingrockets.org/article/3479

Remediating Pragmatic Language and Non-Verbal Social Cue Deficits

Children with NLD may have difficulty negotiating pragmatic use of language. They may not appreciate multiple meanings of words or the influence of social context on communication. They may have a tendency to speak in an inappropriate volume, dominate conversation or misinterpret or even disregard non-verbal cues such as tone of voice, body language, eye contact or facial expressions. For most people, pragmatic use of language comes naturally as we develop and become exposed to a variety of social situations. For children with NLD, this incidental learning may not take place. For students with spina bifida, isolation and fewer repeated opportunities for peer interaction may further complicate this deficit. These students will need to be explicitly taught how to recognize and respond to the complexities of verbal and non-verbal communication.

Students may need to be taught "how" to converse, including how to listen to others and know when it's time to allow the other person to speak during a conversation. Educators and parents should explain what it means when someone rolls their eyes or looks away while conversing. They should create controlled practice environments for social interaction and review and discuss with the student what constitutes appropriate and inappropriate conversation for specific social contexts and why. As much as possible, avoid providing feedback in a punitive manner, but fully explain what was inappropriate and why, as well as providing alternative methods of communication that are more likely to elicit the desired response from peers. Certainly, unacceptable behavior must be corrected, but for the student with spina bifida and NLD, it is important to remember that seemingly rude, self-centered or otherwise inappropriate interactions are most often unintentional and should be used as instructional opportunities.

Remediating Attention Problems

Whether or not a child with spina bifida and/or hydrocephalus is formally diagnosed with Attention-Deficit-Hyperactivity Disorder (ADHD), specific attention difficulties may be present. Reducing the effects of attention problems is complex and often requires a full analysis of the scope and nature of the problem and its causes, followed by a series of trial and error before effective strategies can be discovered. However, below is a list of general strategies that may work:

Reduce the auditory, visual or tactile stimuli in the environment that may confuse or distract the student from the task at hand.

Break down lengthy complex tasks into smaller, manageable parts and provide positive feedback as the students complete the individual "pieces" of the task. Students will persist with tasks in which they experience incremental success.

Teach students to use timers and other devices to assist them in developing sustained mental effort, starting with short periods of time and gradually increasing the expectation for sustained focus. Older students should be encouraged to take frequent brief breaks in lieu of long periods of study, since their mental fatigue may prevent productive learning after a reasonable period of time.

Vary tasks periodically, shifting from one mode of learning to another with predictable schedules and with verbal cues prior to shifting tasks.

Overtly teach organizational strategies for materials, assignments, time management and daily routines. Remember that children with NLD tend to be very verbal. Organizational strategies should emphasize this innate

strength (make "to-do" lists, provide detailed verbal and written instructions, etc.)

When age appropriate, overtly teach meta-cognitive awareness. Teach students to examine their own learning process by asking themselves questions like

"Am I understanding what I'm reading?", "Does making flashcards help me remember?" and "Is this method getting it done, or should I try it another way?"

Remediating Executive Function Problems

Executive function deficits are potentially the greatest impediment to academic success for students with NLD, particularly as they age, and the learning environment demands more and more independent learning and decision-making skills. A child with spina bifida is likely to experience frustration with his or her inability to plan, monitor and evaluate the efficacy of their behaviors, and problem-solve to alter their actions accordingly. Weaknesses in executive function may be evident early and manifest in the inability to make choices when too many options exist. Young children may not be able to organize or complete a series of tasks in a logical sequence. Early intervention can reduce the impact of executive function in later years. When working with a student who doesn't seem to be able to make, execute and evaluate action plans in an age appropriate manner, use the following general guidelines:

Engage the child in continual dialogue throughout the task, asking things like, "How do you think we should do this?", and "What's the next step?","Did that work, or do you think we should try another way?" and "How long did that actually take?"

Teach the child to use the same self-questioning method when working independently.

When teaching content areas, remember that the student's inability to learn a new concept or skill may not be related to the new material itself, but an inability to develop a method for approaching the task. Engage the student in conversation to help them pinpoint exactly why they are unable to complete the task.

Teach the student how to break down lengthy, complex tasks into smaller, logically sequenced tasks. If the student cannot estimate how long it may take them to write a 6-8 page paper, have them break down the assignment into small parts (choose a topic, research the topic, collect relevant information, create an outline, write a draft, etc.) and estimate how much time each individual subtask will take, write out a plan and schedule and set deadlines for each subtask. Then, as the student begins the task, show them how to monitor and adjust the schedule and approach as needed. This is perhaps one of the most difficult things to instill in a child with NLD and may require repeated instruction and practice over time before results are observed.

NLD, Spina bifida and Learning

While all students with spina bifida may not be formally diagnosed with either NLD, executive function disorder, attention deficit/hyperactivity disorder or other related conditions, and certainly all students are unique individuals and won't easily fit into standard stereotypes or diagnostic criteria, it is likely that your students with spina bifida will exhibit at least some of the characteristics described in the preceding chapters. As educators, we must avoid the temptation to over emphasize the physical aspects of spina bifida and recognize it as a complex, multi-faceted disability with educational, social and emotional implications. Early detection and

intervention of learning challenges is crucial in optimizing potential for educational and vocational attainment and ultimately for independence. Ongoing and thorough assessment, coupled with high expectations, reasonable goal setting and effective educational interventions can have an extraordinary impact on life outcomes for children with spina bifida.

For more information about Non-Verbal Learning Disorder, Executive Dysfunction, Attention Deficit-Hyperactivity Disorder and other common learning problems in children with spina bifida and/or hydrocephalus, please consult the following:

http://www.nldontheweb.org
http://www.nlda.org
http://www.nldline.com
Ris, M.D., Ammerman, N., Waller, N., Walz, N. Oppenheimer, S., Brown, T., Enrile, B. & Yeates, K. (2007). Taxonicity of nonverbal learning disabilities in spina bifida. Journal of the International Neuropsychological Society, 13, 50-58.
Barnes, M. (2007). A model of comprehension in spina bifida meningomyelocele: Meaning activation, integration and revision. Journal of the International Neuropsychological Society, 13, 854-864.
Riddle, R., Morton, A., Sampson, J., Vachha, B., Adams, R. (2005). Performance on the NEPSY among children with spina bifida. Archives of Clinical Neuropsychology, 20, 243-248.
Burmeister, R., Hannay, H., Copeland, K., Fletcher, J. Boudousquie, A. & Dennis, M. (2005). Attention problems and executive functions in children with spina bifida and hydrocephalus. Child Neuropsychology, 11, 265-283.
Wiedenbauer, G. (2006). Spatial knowledge of children with spina bifida in a virtual large scale space. Brain and Cognition, 62, 120-127.

CHAPTER SEVEN

Teach Specific Skills

This section outlines many important skills that should be included in the teaching program for a child with spina bifida and/or hydrocephalus. These skills may be incorporated into the regular classroom program, Or they may be taught to small groups within the regular classroom, in a withdrawal setting by a resource teacher, or in a self-contained, special education class.

Academic learning may be viewed as the acquisition of skills and knowledge. Before children come to school, they have learned an enormous amount about their environment and they can use language effectively. At school, children not only acquire information about their worl, but learn skills and strategies that help them gain more knowledge and skills independently. This is a gradual process for all students. For some students, certain skills are easier to learn than others; they seem to learn more quickly and easily. Yet all students must learn basic literacy and numeracy skills. For many students specific instruction in core skills is essential.

Educational approaches and styles vary from region to region, school to school, and classroom to classroom. Some teachers prefer a holistic, student-centered approach that emphasizes cooperative groupings and learning through discovery. Others prefer a more structured approach based on a systematically arranged curriculum, where skills are taught though direct, teacher-led instruction. Others maintain a balance that reflects the best of both worlds. Whatever he teaching approach, all teachers believe that learning results from the acquisition of knowledge and skills.

Children with spina bifida and/or hydrocephalus who have learning disabilities are at serious risk. Because they have trouble processing particular types of information and making connections, they may fail to acquire the knowledge and skills hey should. Language-processing problems may manifest themselves in different ways for different children, and affect reading comprehension, written language, mathematics, or oral language. Visual-perceptual problems may affect their ability to integrate pieces of information.

With the learning problems, other problems arise. Some students appear inattentive and distracted. Some, frustrated with their learning problems, may act out. Still others find it difficult to organize themselves and keep up with classroom demands. Because of these difficulties, certain skills areas, particularly those involving language and integrative thinking, may require special attention and training.

Children with spina bifida and/or hydrocephalus often have difficulty making connections, or integrating information, when they read, listen, talk, and write.[8] Usually, readers and listeners make connections between what they have read or heard before and new information when they can connect it to information that is already in short-term memory.[9] If no connection is made, it is theorized, a bridging inference occurs. That is, the thinker connects the new information with the previous knowledge in an effort to make sense of it. If the areas in the brain that control these operations are not functioning properly, then reading difficulties result. Clearly, if the reader or listener fail to make the "right" connections (those intended by the writer or speaker) he or she becomes confused.

Our language has many connective devices to help us make these connections (such as pronouns, conjunctions, adverbs, relative clauses, and so on). Successful listening and reading comprehension depends significantly on making inferences based on these cohesive devices.[10]

Most children learn to use these linguistic devises fluently and automatically. For children with spina bifida and/or hydrocephalus, however, such connections do not come easily. They need specific skills teaching; open-ended, nonexplicit teaching methods rarely work. These students need to learn these skills and how to apply them.

Teach inference and cohesion devices

Linguistic cohesion involves the use of devices (words, phrases, and clauses) that tie clauses and sentences together. These words and clauses help tie ideas together across sentences, paragraphs, and longer units of language. Many students with spina bifida and /or hydrocephalus can read and write single sentences but have difficulty inferring information from connected text or writing coherent text. Following are five basic types of cohesion devices.[11] Each of these may form the basis for skill-building lessons in textual cohesion.

Reference. This involves the many types of pronouns, including personal pronouns, possessive determiners, and demonstrative references such as that, the, and this. Pronouns are a common cohesive device. For example, "Uncle Bob sang to the baby as he shaved." Who shaved? Or, "He gave the glasses to her friend." Do we know the gender of the friend? Students who don't understand pronoun references an get confused.

Substitution. This involves the replacement of one word or phrase with another. Substitutions can be made for various parts of speech (verbs, nouns, and clauses). For example: "Billy got an ice cream, and I got one too." One replaces ice cream.

Ellipsis. A repeated word or phrase is omitted. For example, "Would you like a mango? I have two." Repetition of mango is implied.

Conjunction. Conjunction occurs when semantic connections are made between two related ideas. Conjunctions may be additive (and, furthermore), adversative (yet, although, but, instead), casual (so, because), or temporal (simultaneously, then, afterward).

Lexical cohesion. This occurs when tow words having the same meaning and grammatical function refer to one another. For example, "The bear came down to drink. The animal was thirsty."

Research evidence indicates that children learn reading comprehension skills when:

- adequate time is devoted to comprehension instruction students attend to instruction and are engaged in meaningful activities
- teachers provide significant amounts of direct instruction I specific comprehension skills
- students are provided with feedback about their success in skill asquisition
- teachers provide practice on tasks other than those used to teach the skills
- ample and systematic practice follows instruction.[12]

Each of the five cohesive devices may be taught through a variety of activities. Students can be asked to look for language connections in books they are reading; as well, prepared lessons that focus on particular cohesive elements can be designed for direct teaching.[13]

Many teachers prefer to use commercial programs that are carefully sequenced to ensure that skills are developed systematically. [14] Many of these programs provide specific lessons on such things as how to differentiate between fact and inference, recognize ambiguities, edit run-on sentences, recognize story grammars, write coherent stories, construct complex sentences, and so on.

Teach students to integrate information as they read

Teachers can help children learn to make connections as they read by asking questions during oral reading. In this approach, the student reads aloud, or the teacher reads while the student follows. For beginning readers, start with single sentences and ask literal questions, those with answers explicitly stated in the text. For example, the sentence "Pam rode her bike up the hill" elicits the questions "Who rode up the hill?" "Where did Pam ride?" "What did Pam ride?" As children improve their reading and comprehension, include questions that require the student to make inferences. For example, "Jacob Two-Two ran off, just a little frightened because this was his first errand." Why was Jacob Two-Two frightened? [15]

Teach students how to find the main idea

A reader's ability to integrate textual information is enhanced by knowing the main idea. The main idea tells most about the paragraph. It is sometimes identified in the first sentence, which may be the topic sentence. Teachers can use illustrations, direct instruction, teacher modelling, and practice to help students learn to identify the main idea. Once the students can identify the main idea, they have a basis for understanding the passage. From there, students can be taught how to find the supporting and connected details. Teachers can illustrate this with semantic maps, or webs, and tree diagrams that show how ideas connect with one another and with the main idea.

Teach students to use sentence structure clues to find word meanings in text

Good readers use a variety of structural clues to help them understand the meanings of words found in text. Poor readers are less sensitive to these grammatical structures, but they can be taught how to identify them. Once students can put these clues together, they have the contextual information they need for making inferences. Some types of grammatical structures are presented below with examples. Teachers can develop additional examples of each type to give students plenty of opportunities for practice.

Intersentential connections. For example, students are asked to find the meaning of the word mimic in the following text: "Crows are great mimics. They can learn to talk and imitate animal sounds. They can imitate the squeak of a chicken, the whine of a dog, or the meow of a cat." Each sentence connects to the previous one due to the presence of the same, or a similar, word.

Alternatives. For example: "The cummerbund, or waistband, is worn with a dinner suit." The term cummerbund is an alternative to waistband.

Embedded clauses or phrases. For example: "The sabot, a small sailing boat, carried by the boys to the island." The embedded phrase defines the subject of the sentence.

Opposites. For examples: "He seemed always morose, never happy nor satisfied." The terms always and never signal the meaning of the word morose.

Superordination. For example, "The Siamese made a lot of noise at the cat show," or "the bureau was his favorite piece of furniture." Readers can infer that Siamese is a specific example of the larger classification cat, bureau a specific example of the larger classification furniture.

Parenthesis. For example, " A robust (overweight) man came and sat on the other end of the bench." The term overweight is the parenthesis, an additional term or phrase as an explanation or comment.

Teach students to understand multiple meanings of words

Many word in English have multiple meanings. When people read an ambiguous word in a text they retrieve all of its meanings, whether or not they make sense.[16] Readers then choose among these alternatives, and discard the inappropriate meanings. Some researchers suspect that children with certain types of neurological disorders may be slower to discard the alternatives.[17] to identify the speaker's or writer's intended meaning, the listener or reader must use the context of the sentence to infer the appropriate meaning. Many words may be used as both nouns and verbs with quite different meanings. For example, compare "I will show you my house," with "We put on a show for the parents." Or "We drove to the point to see the lighthouse," "It's rude to point," and "I think I see your point." Teachers can provide examples of words used in different contexts. They can help students find appropriate meanings according to context by discussing all the meanings of the word. Some publishing companies publish board games that can provide extra practice.

Teach students to understand linguistic ambiguity

To understand language, whether it is written or spoken, students need to identify ambiguities in text or speech and use contextual information to figure out the writer's or speaker's intention. Teachers should preview textual material for linguistically ambiguous sentences. They can then teach those sentences. They can then teach those sentences in advance to avert potential confusion. Some lessons in a language-arts program are designed specifically to teach students how to identify linguistically ambiguous sentences. Help students identify the key word that leads to the ambiguity. Illustrate alternate interpretations. (For example, "The duck was ready to eat," "The man wiped his glasses," "The boy drew a gun," are all linguistically ambiguous).

Teach idiomatic expressions

Children learn idioms (for example, "get to first base," "paddle your own canoe," "blow you own whistle") at an early age. Research shows that teachers use idioms frequently. [18] Skilled readers and listeners can distinguish between literal and figurative language and understand both. Students with language disorders, however, often interpret figurative expressions literally, which leads to considerable confusion. Teachers can begin with a short story, telling them beforehand to listen for the idioms so that they can try to figure out the meaning. Teachers should provide many opportunities to use these idioms in oral and written exercises. Students could compile a list of idioms and gather idiomatic expressions of classmates from other cultures and countries.

Teach analogies

The most fundamental way of integrating information and making connections between apparently isolated pieces of information is through categorization. Information, objects, events, and ideas are classified by their sameness. The task of categorization is in deciding what makes things the same, in identifying analogical relationships, in which two objects or ideas share some attribute. Failure to make connections between existing knowledge and new learning is often the result of failure to see the sameness, or relationships.[19] Students can develop fundamental verbal-reasonings and critical-thinking skills, and can transfer these to new situations.[20] Following are eight types of analogies that can be taught, with examples in parentheses.[21]

- Antonymous (clear is to cloudy as shallow is to deep).
- Synonymous (weep is to cry as smile is to grin)
- Characteristic property (wheel is to round as arrow is to straight)
- Part-whole (knee is to leg as elbow is to arm)
- Superordinate-subordinate (shirt is to clothing as hammer is to tools)
- Functional (time is to clock as weight is to scale)
- Sequential (Tuesday is to Sunday as Friday is to Wednesday)
- Causal (fire is to smoke as water is to steam)

Researchers have found that synonymous, antonymous and characteristic properties were the easiest to solve, followed by superordinate-subordinate and part-whole. Casual, functional, and sequential relationships were the most difficult. This suggests a sequence for teaching.

Analogical relationships can be difficult for students to grasp and are difficult to teach. Understanding them, however, is essential to the higher order thinking that students apply to all subject areas.[22]

Teach metaphors and similes

Metaphoric language is critical for understanding in all subjects, yet it can be confusing for children with spina bifida and/or hydrocephalus. A metaphor contains a term known as a topic, which is compared to another term, known as the vehicle, on the basis of one or more shared features, called the ground.[23] There are two types of metaphor, predictive and proportional. Predictive metaphors express a similarity between the topic, or subject, or subject, and the vehicle, or predicate. For example: "Her voice (topic) was music (vehicle) to my ears." The ground in this case is "pleasantness." Similes are predictive metaphors with the word like or the phrase as….as added to make the relationship more explicit. ("Her voice was like music to my ears," or "Her voice was as pleasing as music to my ears.") Proportional metaphors are analogous relationships that contain two topics and two vehicles but one topic vehicle is unstated. For example, "the bird's nest (topic) was a piggy bank is without coins (vehicle)." Bird's nest is without eggs as piggy bank is without coins; the vehicle, eggs, is not stated. The metaphor is based on the analogy: bird's nest is to eggs as piggy bank is to coins.

Teaching metaphors and similes can be done incidentally as they come up in reading, explicitly through direct instruction, or both. The advantage of using direct instruction is that the teacher has more control over the level difficulty or complexity of the examples. Similes, easier to understand because they are more explicit, should be taught first, followed by predictive metaphors, then proportional metaphors. Students will also find it easier to learn about sensory, perceptual metaphors before learning about psychological similes and metaphors.

Following is a teaching sequence for introducing metaphor and similes:

1. Teaches the concept of "likeness," or similarity, for concrete objects (for example, red), then feelings (for example, anger)

2. Teach students to recognize the functions of the parts of a simple sentence (subject and predicate).

3. Teach students to discriminate between literal and nonliteral statements.

4. Teach students to identify the topic (subject), vehicle (predicate) and to find the word like or the phrase as…as in a sensory or perceptual simile.

5. Teach students to identify the ground or basis for comparison in the simile.

6. Repeat steps four and five for similes based on feelings (psychological).

7. Teach students to convert similes to predicative metaphors by omitting the word like or the phrase as…as. Reverse the process to turn metaphors back into similes.

8. Teach students to generate their own similes and metaphors, first in isolated sentences and then in connected text.

9. Teach students to identify the topics and vehicles in a proportional metaphor.

10. Teach students to convert proportional metaphors to analogies by identifying the missing topic or vehicle.

Teach jokes

Understanding humor has been fund to help academic achievement.[24] Humor depends largely on linguistic ambiguity and getting the connection. Therefore, students who have difficulty with nonliteral language structures may miss jokes. Teachers can tell jokes, then point out the ambiguity. Or they can present comics from the newspaper, then help students find the double meaning and get the joke.

Teach written language skills

Students can learn expressive writing systematically. Carefully selected pictures may be used as writing prompts. Skills teaching may begin with sentence copying, then progress to lessons on how to write simple descriptive sentences that contain a subject and predicate. From there, students learn how to elaborate simple sentences by embedding and connecting phrases and clauses, how to use the structural rules for paragraph construction, and how to proofread and edit.[25]

Teach story grammar for narrative text

Research suggests that teaching students about common text structures improves their writing.[26] Narrative text includes certain structural elements—an organizing set of principles called story grammar. Skilled readers use their knowledge of story grammar to help them predict events and regulate their reading. Students can learn to use the elements of story grammar for relating real or imaginary events orally or in writing. The following are the elements of the story grammar that are common to most stories:

- Setting. The location, time, main characters and circumstances of the story.
- Beginning. An initiating event that starts the action in the story.
- Goal. The major objective of the story.
- Attempt. The actions the characters undertake as they try to achieve the goal.
- Plot. The series of attempts and subordinate goals that the characters engage in to achieve the major goal.
- Outcome. The consequence that depicts the main character's success or failure.
- Internal response. The character's thoughts and feelings that prompt the initiating events and actions.
- Ending. The final consequence of the story in which the characters make known their feelings about the outcome of the story.

Teach expository text structures for writing

Expository text provides factual information, and is usually found in nonfiction, text, and reference books. Structures found in expository text include compare and contrast, explanation, problem/solution, and thesis/statement.[27] Each of these structures is signalled by different semantic and syntactic techniques. For example, compare-and-contrast structures identify what is being compared, and state how they are different and how they are the same. The words *alike, in contrast to, similar to*, signal the presence of the structure. Explanatory text often presents sequences of steps for completing some task. It may include the words *first, then, after that, next, finally.* Expository text may contain many different text structures, so students must learn to identify the main theses and relationships among groups of ideas. Teachers framed outlines that provide a diagram showing the components of text planning and how each component connects. Students record their ideas directly onto the maps or diagrams before elaborating to construct the text.

Teach students to make connections in mathematics

Currently, research data on how mathematics problems manifest themselves in children with spina bifida and/or hydrocephalus is limited. Some studies have shown that these children score below nondisabled peers.[28] We do know that mathematics learning is hierarchical and cumulative; new learning depends on prior knowledge. Understanding mathematical algorithms requires the ability to integrate information and understand numerical relationships and connections. Children with spina bifida and/or hydrocephalus who have difficulty integrating information when learning language have he same processing problems when learning mathematics. Instructional approaches that teach children to connect math concepts sequentially and cumulatively are to likely to be successful for these children than approaches that rely on the student *discovering* relationships and mathematical sequences (algorithms).

Following are six elements of effective mathematics instruction.[29]

- Students must have well-founded and relevant prior knowledge before the teacher introduces new concepts. Mathematics learning is cumulative. For example, before you learn to regroup in addition, you must learn to add numbers with no regrouping.
- The teacher should control the rate for introducing new concepts.
- New concepts must be introduced through coherently presented strategies. For example, if you're teaching the concept of adding one number to a number as counting, make a coherent rule that explains what to do: "to add one, say the next number."
- Instructional language must be clear and concise to avert confusion.
- The transition from teaching to independent work should be bridged with guided practice.
- Concepts and facts already learned should be regularly and continuously reviewed.[30]

CHAPTER EIGHT

Teaching Learning Strategies

As students move from the elementary to secondary school they must become more independent as learners. For adolescents, this is one of the major and most difficult demands of schooling. Independence and success in both social and academic domains are promoted by learning techniques and strategies. A strategy is "an individual's approach to a task; it includes how the person thinks and acts when planning, executing, and revaluating performance on a task and its outcomes.? [31] Strategies that are consciously learned or invented by the learner can become habitual and automatic (unconscious) with practice and experience.[32] Some examples of strategies that students can learn are paraphrasing, word identification, sentences writing, and error monitoring, among others.[33]

These and other similar strategies can aid students in utilizing basic reading, writing and math skills. As children advance to secondary school, often they will also need to be taught specific strategies to assist with time-management, organizational skills and metacognitive awareness. Metacognitive awareness refers to one's ability to monitor his or her own learning effectiveness and to shift strategies accordingly. Many children with various types of learning disabilities lack the ability to recognize ineffective methods. As children with spina bifida age to a more independent learning environment, they must be taught specific strategies designed to help them take control of their own learning process.

Children with learning disabilities often have a limited repertoire of strategies and little knowledge of when and how they may use them.[34] In contrast, the good strategy user is one who analyzes tasks to find similarities between current problems and previous academic encounters he or she has had.[35] The learner can then formulate a plan that sequences relevant steps. In formulating the plan, the learner can see how each step in the sequence contributes to the final goal.

Once they start the process, good strategy users monitor performance, constantly making adjustments according to information gained from feedback. The ability to see the sameness, or make generalizations about a learning situation, depends on the ability to make connections among pieces of information. As we have seen, these abilities are precisely those that children with spina bifida and/or hydrocephalus are likely to have difficulty with.

Educators can help these students by teaching specific strategies and problem-solving methodologies that can be generalized to multiple disciplines and in a variety of settings.

Researchers at both the University of Kansas and Michigan State University have studied the effects of teaching learning strategies to students with learning disabilities. The results have been very promising.[36]

Both groups advocate teaching students a few strategies at a time and teaching them thoroughly. They have discovered it can be cognitively demanding for students to learn the sequences of steps in a strategy at the same time as they learn the content of a lesson. Consequently, teaching must be explicit, intensive, and extensive.[37] Following are the basic instructional principles that teachers should incorporate when designing strategy instruction

Teach prerequisite skills before strategy instruction begins

Skills that are components of a successful strategy should be mastered before instruction in the actual strategy begins. For example, when students are learning a strategy to paraphrase a paragraph, it would be wise to ensure that they can paraphrase a sentence first. Or, if students are learning a text-highlighting strategy, they should at first learn how to find the key words in a sentence. Key words or phrases can then be used to identify the main idea in a text block. Further, if a student is learning a sentence-writing strategy, he or she should be able to identify subjects, verbs, and prepositions. If students know prerequisite skills, it allows then to give complete attention to learning the strategy rather than trying to lean a new strategy and new content and skills at the same time.

Teach regularly and intensively

Regular and intensive instruction means daily exposure to strategy instruction and ample opportunities for practice. [39] It helps if students set daily, weekly, and semester goals to identify the strategies and skills they wish to learn. Teachers can help students set realistic, attainable goals. These should be described in concrete, measurable terms. For example, "I will use the steps of the strategy and score at least 80 percent on comprehension questions for at least five consecutive passages," or "By the end of the semester, I will have made summary notes on all chapters 3, 4, 5, and 6." Clearly defined goals help students keep on track with their own learning. These skills contribute to the independence that is so important for secondary-level students.

Emphasize personal effort

Successful problem-solving results from two key elements:

(1) choosing the appropriate learning strategy to solve the problem, and (2) exerting personal effort to accomplish the task. Teachers need to provide ongoing feedback that reinforces their students' hard work.

Require mastery

Students are more likely to *generalize* a learning strategy (use it spontaneously in a variety of settings when they can perform the steps of the strategy with increasing *mastery* – where mastery means correct performance and fluent use. Once students have learned the steps of a strategy, they need to practice doing it quickly and smoothly. In this way, the strategy becomes habitual and automatic. (Simply knowing the steps for paraphrasing, for example, won't ensure the students use the strategy automatically when reading literature, geography texts, or science articles.) They can gain fluency with easy-reading material before applying the strategy to higher level material.

Research has shown that when students see the purpose for learning strategies they are more likely to learn them efficiently.[40] Teachers should discuss with the student the ways a strategy might be useful and when it might be used. When teaching, teachers can continually identify situations in which the strategy might be helpful.

Integrate instruction

Covert processing is thinking that is done by the student during the strategy. May include questions the student has been trained to ask him or herself, for example: "Is the last digit more or less than five?" " What is the main idea of this paragraph?" "is this story real or imaginary?" Effective strategy teachers model and demonstrate their own covert processing by making it overt; they ask themselves these questions aloud.

Emphasize covert processing

Over time, as students incorporate more strategic thinking into their problem solving, they may begin to see other applications and variations for the task-specific strategies they have learned. As they become more fluent and familiar with methodical, sequenced approaches to problem solving, they will gain more control over, and knowledge of, the mechanisms through which they learn. Learning strategy instruction often helps students acquire metacognitive knowledge. *Metacognition* is the ability to know about how we know or to think about our thinking. As students develop better metacognition, they become more independent and self-regulating.

Emphasize broad generalizations

Following is a generic working model for teaching learning strategies.[41] The model is composed of eight stages.

The eight-stage model for teaching strategies

Stage one: Pretest and make a commitment to learn.

The purpose of stage one is to motivate students to invest the time needed to learn the strategy. Pretests make them aware of specific demands in their classes (for example, note-taking), show how they perform on this skill compared to expectations, and show that there are ways they can learn this skill. Students become aware that poor performance in this skill puts them at risk for failure (this is not inevitable, but rather the consequence of not having this particular skill). Furthermore, this skill, like any other, can be learned. Pretesting establishes a base line from which to compare later, improved performance.

Stage two: Describe the strategy.

During this stage the student becomes aware of the overt and covert processes involved in performing the new strategy. They learn how each step contributes to solving the problem and how the strategy is different from their usual practice. The teacher presents all the steps of the strategy to provide a whole picture of what is involved.

Stage three: Model the steps of the strategy.

At this stage, the teacher uses self-talk to model his or her own thought processes when performing the problem-solving strategy. This stage is fundamental to strategy instruction and deserves special emphasis. Rather than just tell students how to do something, teachers not only show the strategy themselves, but talk aloud about their thinking while doing it.

Teachers often need to practice this ahead of time to avoid making mental leaps or assumptions. As part of this stage, the teacher should [42]

- require students to use the actual words students would say to themselves when using the strategy
- provide feedback, including correction and expansion of student responses, during the exercise.
- prompt as much self-talk as possible
- engineer as much success as possible by assigning tasks that are easy for students to complete, then gradually increase complexity
- draw students' attention to good performance models and emphasize the importance of imitating the processes they have seen and heard

Stage four: Practice the strategy verbally

During this stage, students practice saying the steps of the strategy precisely and aloud without hesitation. The purpose of verbally rehearsing the words used when doing the strategy is to help students become automatic with the wording. This leaves more cognitive energy available for the task itself.

Stage five: Use controlled practice and feedback.

To learn the strategy, students should practice with instructional material that is easy for them. For example, when teaching the paraphrasing strategy, have students start with reading material that is at their independent level (no more than two decoding errors in 100 words). Or when teaching a test-making strategy, first have students practice on shirt tests with just a few items. The teacher's role at this stage is to give corrective feedback, model certain aspects, and provide explicit information on the student's progress.

Stage six: Use advanced practice and feedback.

When students have mastered controlled material, they are ready to apply the strategy to real-life situations in the classrooms. Although the goal is to have students use the strategy independently, they may need some help to make this transition. This may require extra coordination between the regular classroom teacher and the resource teacher. At this stage, students who have relied on their teacher for feedback must take control of their own feedback. Encourage students to self-evaluate and self-regulate by having them report on their own progress, perhaps managing their own progress charts.

Stage seven: Post-test and make commitments to continue to use the strategy

This stage has two phases. The first involves confirming and documenting that the student has learned the procedural and strategic processes needed to follow the strategy. Teacher and student should compare post-test results with pretest information. Naturally, students should be tested throughout to ensure they have mastered the processes. However, a final, all-encompassing assessment should be administered to ensure that the student has mastered the strategy and can generalize it in a variety of situations.

Stage eight: Practice generalization

Once students have mastered the strategy in the resource room, they must be helped to apply it independently across a variety of content settings. Instruction that promotes generalization should focus on enabling the student to

- discriminate when to use the strategy in everyday situations
- develop methods for remembering to use the strategy
- experiment with using the strategy in different situations
- get feedback and develop plans to improve performance of the strategy
- adapt the strategy to meet new demands
- make the strategy part of his or her normal approach for problem-solving

For a comprehensive list of University of Kansas strategies that may help your students, please go to:
http://www.ctserc.org/initiatives/teachandlearn/strategies.shtml#lng
For additional information about time management and organizational strategies, please go to:
http://www.ldonline.org/article/Lazy_Kid_or_Executive_Dysfunction%3F
http://www.ldonline.org/article/Teaching_Time_Management_to_Students_with_Learning_Disabilities

CHAPTER NINE

Modify and Adjust Teaching Methods

The chapter on skills teaching, pages 7.1-7.8, discusses the skill areas that were difficult for students with spina bifida and/or hydrocephalus. Teachers must decide what to teach, based on an analysis of the curriculum, but they must also be very much aware of how they teach. Children who have language disabilities are doubly jeopardized since language is both the medium and the message: not only is information conveyed through language, so is instruction. As a result, teachers must modify their instructional language for students who have difficulty processing language. Teachers can increase the chances of their students experience and by modifying their teaching appropriately. Some recommendations follow.

Make sure that students possess sufficient prior knowledge

When introducing a new topic or reviewing a previously learned topic, help students make connections to what they already know about the current topic. Introduce new vocabulary. Discuss the meaning of multiple meaning words and potential ambiguities that will appear in the upcoming text or discussion.

Give students time to respond

Many students with spina bifida and/or hydrocephalus have difficulties retrieving words quickly. They may take longer to come up with the answer. Consequently, the amount of time that the teacher gives a student to reflect before responding is particularly important. When learning a new rule, concept, sequence, or strategy, these students generally need more time to formulate answers to teacher questions. Students should be alerted to an impending question with a verbal signal, such as "get ready". The time between "get ready" and the question should be one second. The teacher will vary the amount of time given to respond based on what he or she thinks students will need to formulate an answer. Use of a signal will ensure that all students get a chance to come up with an answer, not just those who can respond the quickest.

The duration of the "thinking pause" is determined by the length of time needed by the lowest performing student to respond. For easier questions think time might be just a split second. For more complex questions, the pause might last five to ten seconds. By signalling students and controlling the amount of time you allow for their response, you can help them to increase their processing time and become more fluent and automatic.

Slow down and check for understanding frequently

Students with language-learning disabilities often process (access, associate, store) incoming language more slowly than nondisabled students. This slowness doesn't mean the student can't process fully, only that he or she can't process at an appropriate "depth" if language is presented too rapidly. Slow down language delivery. Constantly and continuously check for understanding. Allow several seconds pause between important sentences, especially when presenting key concepts or rules. Listeners and readers tend to take more time at the ends of sentences to integrate information – give them time for this. Have the student repeat key statements back to you.

Pace lessons appropriately

Pacing is critically important during instruction. Students lose track and fail to make connections when teachers pace their lessons too slowly. On the other hand, when pacing is too fast, students can become confused and overwhelmed. The art of pacing is something teachers learn to control based on the feedback from the learner. To facilitate this, students should be seated where teachers can observe them. Teachers need to attend not only to students' verbal responses but to nonverbal responses, such as facial gestures or fidgeting, to identify when to increase or decrease pacing.

Pacing is also determined by the difficulty of the material being taught; teachers must consider students' capacities for integrating the information that they are teaching. More complex ideas and relationships require slower pacing. Correct pacing requires a fine balance – not so fast that it creates confusion and not so slow that students disengage themselves from the activity.

Make corrections immediately

When students make errors, it is important that they are told the correct response immediately so that they don't learn incorrect information. A god correction procedure has four steps.:

1. Give the correct response.
2. Have the student repeat the correct response.
3. Go back to the beginning of the section or task and repeat the activity.
4. Return to the error later and retest.

It is not necessary to tell students that they have made a mistake; that will be obvious from the correction procedure.

Children with spin bifida and /or hydrocephalus may be slower accessing words that they know. Teachers can help students who have these problems by providing cues and prompts. Following are four factors that affect retrieval. [43]

Help students with word-finding cues

- to retrieve a specific item from memory, specific cues associated with the item must be present. Cues may be emotional, interpersonal, physical, or environmental. For example, a person's name may be recalled because the person is seen in the same place the name was learned or associated.
- The more frequently an item is accessed, the easier it is to find that item in the future. For example, the more frequently the name is repeated, the easier it is to retrieve.
- The probability that an item will be recalled successfully is affected by competition from other items in storage. As items are added to memory, other items become less easy to recall. To counteract this phenomenon, older items must be reviewed from time to time.
- The more recently an item was stored or accessed the easier it will be retrieved.

For students who are slow at retrieving words, try the following; [44]

- use multiple-choice frames for questions; offer two or three alternative responses, one of which is correct.
- Accept volunteer participation only. Don't increase the student's anxiety by singling him or her out by name to answer a question, unless you're absolutely sure the student can answer.
- Provide target word cues, such as initial sound or syllable, for example, *alli* for *alligator.*
- Use questions that require yes/no or true/false responses, for example "a triangle always has three sides. True or false?"
- Prime the student for questions through prior rehearsal by practicing the question and answer before it is asked in class.

Basic units of information are groups of words called *propositions*. A proposition roughly corresponds to one idea. Propositions are linked or encoded in memory. Integration of information through encoding of propositions takes place through establishing links or networks with prior knowledge. If too many words are unfamiliar or new, learners do not establish links with existing knowledge, and have trouble with subsequent retrieval. Use semantic mapping and webbing techniques with key vocabulary to present a visual display of the connections.

Preteach key vocabulary through synonyms, definitions or modelling

Identify "idea units" ahead of time, particularly when introducing new information. Remember that many ideas will not be explicit. List the ides or points on the board and check them off as you go. Introduce one idea at a time and check for comprehension by asking the students simple questions that require a statement or repetition of the statement. For example, the teacher says, "A mammals have hair, Say that." The students respond. Again, the teacher speaks. "Yes. What do all mammals have? Here's a new fact. All mammals are warm-blooded. Now you can state two facts about mammals." Students respond.

Monitor your language to ensure that you are not presenting too many ideas at once

Monitor your language for complex grammatical constructions

In spoken language; we rarely use the grammatical constructive conventions that we do when writing. For example, speakers don't always complete sentences but may speak in fragments. In written language, however, simple sentences contain a subject (a part that names) and a predicate (a part that tells about the subject). From this basic form, sentences may be modified and elaborated on to make more complex sentences. There are many ways to increase language complexity (for example, by using the passive rather than active voice or by incorporating unfamiliar vocabulary and idiomatic expressions). One of the most common is to modify the subject or main clause by inserting a phrase or a clause before it. For example:

- *Phrase:* "At the top of the page, John wrote the date," is more complex than: "John wrote the date at the top of the page." Better yet: "John found the top of the page. He wrote the date."
- *Clause:* "Because they felt the tax was unfair, the landowners rebelled," is more complex than "The landowners rebelled because they felt the tax was unfair." This example is made even more complex because the pronoun they precedes it referent, *landowners*.

Try to avoid using sentences with such premodification structures too often. Tape record yourself and identify how often you use complex constructions. When you do, be aware of the increased complexity and slow down your delivery. Check students' comprehension by asking them to restate what you've just said. Try to say the main clause first most of the time, especially when introducing new learning.

Monitor your use of bridging inferences between and within sentences

As discussed on pages 7.1-7.3, there are five main types of bridging inferences: reference, substitution, ellipsis, conjunction, and lexical cohesion. Instructional language becomes more complex the more inferences are used. Monitor the use of such devices, especially pronoun references, Restate the noun that the pronoun refers to frequently. Preteach vocabulary by stating the larger class and some defining feature or function. For example, "Cricket is a game that is played a lot in England."

Monitor your language for figurative language and multiple-meaning words

As discussed, students with language-learning disabilities often have difficulty understanding the nonliteral language found in similies, metaphors, idioms, and proverbs. Have a colleague listen to you teach and record your use of figurative language. Or tape-record yourself and analyze the tapes. Be prepared to sop and explain your figurative expressions to students to make sure they understand your illustrations and examples.

Students with language-leaning disabilities may also be confused by, or be slow to integrate, multiple-meaning words (for example, *park, watch, tower*) and homonyms. Several words may be used as both nouns and verbs; only the context identifies the intended meaning of both multiple-meaning words and homonyms.

Use multi modalities when teaching

Often, children with spina bifida will respond well to multi-modal instruction, a teaching method that combines the use of auditory, visual and kinesthetic stimuli. Children with spina bifida should have opportunities to hear it, see it and touch it. Use of multi-media and interactive lessons are encouraged whenever possible. Use concrete models and manipulatives to demonstrate abstract concepts (remembering to be careful to explain that the model only "represents" the idea, as students with spina bifida tend to be very literal). Use computers and assistive technology that encourages active participation in the learning process rather than the more traditional passive, teacher focused methods. Among the advantages of multi-media classroom activities are:

1. They often provide immediate feedback and corrective instruction
2. They help maintain attention and focus
3. They actively engage the learner in the learning process by requiring hands-on participation

In general, when planning instruction for children with spina bifida, remember that the child with spina bifida and/or hydrocephalus needs to:

1. Hear it
2. See it demonstrated
3. Read it
4. Touch it
5. Say it
6. Do it
7. Apply it in a new situation

Once these steps are followed, children with spina bifida can and will learn and achieve in your classroom.

Use scaffolding techniques

Scaffolding is a collaborative, interactive teaching process where the adult provides verbal and nonverbal prompts. With scaffolding, the teacher provides temporary support that helps students formulate answers and explanations with greater complexity, accuracy, and clarity of expression. This support is adjusted as needed. Following are some effective scaffolding techniques.

Use prompts and cues during oral discourse. These include

- **Cloze.** The teacher pauses at appropriate points so that the child can provide the required information. "You play baseball at the _____." The child should be able to fill in the answer, ***park.***
- **Gestures.** The teacher uses hand movements or points. "The boy had lost his _____." (Teacher points to spectacles.)
- Relational terms. These cues indicate that more information is required. The teacher directs the child to the type of information required by asking them to expand using additive (**and?**), temporal (**and then? After that?**), casual (so? Because?), adversative (**but? However? Except?**), conditional (**if? Unless? or?**) or spatial (**which was on the….? Next to?**) terms.

Ask graduated questions. Complex questions can be broken down into a series of simple questions to lead the student to a solution, answer, or generalization. For example, the question "How do we know these people are at a restaurant?" can be simplified to "Where are these people? How do we know?"

Rephrase or summarize. The student can then elicit further information. For example, "So, the meteor shower hit the spaceship. What happened next?"

Use direct questioning to help recall. For example, "What did Peter do after he saw the wolf?"

Clarify new words, ideas, and so on. For example, "In this sentence, prosperous means the same as successful."

Expand on ideas. Help make connections with other knowledge. For example, "That's the same thing we discovered when we did our recycling experiment."

Reinforce learning behaviours you want to encourage

Students benefit from positive reinforcement, not just because they become more engaged in their learning but because feedback (positive or negative) is vital to the learning process. Teachers should build consistent routines of reinforcement into their instruction. Brief statements that repeat students' responses provide an affirmation of their learning. Good reinforcement statements make clear the connections between their behaviour and your approval. Use such comments as "good remembering," "good waiting for your turn," "good paying attention," "good getting things right the first time," and so on.

Teachers should not give positive reinforcement each time the student makes a correct response. Too much results in students undervaluing it, while too little does not provide students with enough feedback about their progress. In general, teachers should provide reinforcement more frequently for more difficult tasks.

When a teacher gives negative attention, it often backfires, reinforcing undesired behaviour. Students need to learn that they will gain a teacher's notice with positive behaviour. For example, of a student is not paying attention, rather than single out that student is not paying attention. Later when the child who originally was not attending is paying attention, praise that child for paying close attention.

Review

After instruction, students need lots of opportunities to review what they have learned. We know students have truly acquired the new skill when they can use it not only in the format it was taught, but in new ways. Although new learning results from direct teaching, we don't really know a skill until we can do it fluently and automatically. This takes practice and is especially true for reading decoding and reading comprehension. Each lesson should always begin with a review of the last, and teachers should incorporate opportunities to practice new learning whenever possible.

Notes to Part II

1. Barnes & Dennis (1992); Culatta, & Young (1992); Dennis & Barnes, (1993); Dennis, Jacennik, & Barnes, in press; Rowley-Kelley & Reigel (1993)
2. Barnes and Dennis (1992); Dennis et al. (1987); Dennis and barnes (1993); Dennis, Jacinnek and Barnes, in press.
3. Nippold (1988a)
4. Dennis, Fitz, Netley, Sugar, Harwood-Nash, Hendrick, Hoffman, and Humphreys (1981)
5. Dennis et al. (1987)
6. Culatta and Young (1992); Dennis, et al (1987); Dennis and Barnes (1993); Dennis, Jacinnek and Barnes, in press.
7. Barnes and Dennis (1992)
8. Barnes and Dennis (1992); Culatta and Young (1992); Dennis et al (1987)
9. van Dijk and Kintsch (1983)
10. Irwin (1986)
11. Halliday and Hasan (1976)
12. Baumann and Stevenson (1986), p.96
13. Baumann and Stevenson (1986) and Pulver (1986) provide excellent suggestions for activities. Cynthia Pulver has suggested activities for teachers who prefer a systematic, explicit approach as well as suggestions for incidental teaching methods, for teachers who feel a systematic approach is not necessary.
14. *Reasoning and Writing* (SRA) by Siegfried Engelmann and his colleagues uses direct instruction methods to teach students how to use cohesive devices in their writing, along with many other important writing skills. *Reasoning and Writing* teaches higher-order thinking skills that are needed for reading, writing, and thinking. The program is intended for use with children in regular education classes from grade one to grade seven. *Reasoning and Writing* may also be used as a remedial program for students who have filed to acquire the skills that are directly taught through the program. The program uses a direct instruction approach. This means that is has been carefully designed and field tested to ensure that skills are presented through clear, unambiguous instructional sequences and that the program builds hierarchies of understanding based on a scope and sequence system. Six levels (A through F) of *Reasoning and Writing* are currently available through Scientific Research Associates (SRA)
15. Teachers will find *Direct Instruction Reading*, by Douglas Carnine, Jerry Silbert and Edward Kameenui (1990) an invaluable resource for information on teaching reading comprehension. A comprehensive scope and sequence system describes necessary skills and provides teaching suggestions that have been tested through and shown to work.

16 van Dijk and Kintsch (1983)

17. M. Barnes, personal communication, April 1994.
18. Nippold (1991) cited research by Lazar et al. (1989) which suggested that kindergarten teachers use idioms when speaking to their students almost 5 percent of the time, increasing to 20 percent for eight teachers. According to Nippold (1991) 6 to 10 percent of sentences in third to eighth grade contains at least one idiom.

19. Kameenui (1992)
20. Grossen (1992)
21. Goldstein (1962: cited in Nippold, 1988b)
22. A direct instruction approach is provided in Corrective Reading Comprehension: Thinking Basics by Siegfried Engelmann et al. (1988). In this program, students learn how to identify analogies based on synonyms, antonyms and classes through examples that increase in complexity as students improve and through clearly stated explanations and examples.
23. Nippold (1988b)
24. Masten (1986)
25. Expressive Writing (I and II), by Siegfried Engelmann and Jerry Silbert (1985), published by SRA, presents a direct instruction approach to written language that is founded on a skill sequence that increases in written language complexity.
26. Englert and Marriage (1992)
27. Ibid
28. Willis, Holmbeck, Dillon and McLone (1990)
29. Engelmann, Carnine and Steely (1992)
30. Teachers will find Direct Instruction Mathematics, by Jerry Silbert, Doug Carnine and Marcy Stein (1990: Merrill Publishing) an invaluable resource. This test includes these features: a description of essential skills and procedures for teaching major skills; procedures for evaluating, selecting and modifying mathematics programs to meet the needs of all students; techniques for effectively presenting lessons, including techniques for pacing tasks, motivating students and diagnosing and correcting errors; guidelines for individualizing instruction through properly placing students in a program and then moving them at an optimal rate through the program; suggestions for classroom organization that maximize the amount of time students spend engaged in math instruction. Also included are over one hundred formats, or scripts for teaching concepts and cognitive strategies.
31. Ellis, Deshler, Lenz, Schumaker and Clark (1991),. P1
32. Pressley, Goodchild, Fleet, Zajchowski, and Evans (1989).
33. Teachers will find the Handbook for Teachers of Students with Learning Disabilities, published by the Ontario Ministry of Education in 1986, an invaluable source of information. Specific strategies for reading, writing, spelling and mathematics (many of them based on the work of Deshler and Associates) are described and presented in a format that teachers will find easy to implement. Another resource that secondary teachers will want to have readily available is, Teaching the Learning Disabled Adolescent: Strategies and Methods by Gordon Alley and Donald Deshler (1979): Love Publications, Denver).
34. Alley and Deshler (1979)
35. Pressley et al. (1989)
36. Donald Deshler, Jean Schuumaker et al., University of Kansas; Anne Marie Palinscar, Ann Brown, et al. Michigan State University.
37. Pressley et al. (1989)
38. Ellis et al. (1991)
39. Ibid
40. Ibid
41. Ibid
42. Ibid (p 15)
43. Nippold (1992)
44. German (1992)

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Early Math Skills

By the time your child has reached the end of second grade he or she should have acquired numeracy knowledge and skills Often parents will focus their at tention on teaching addition and subtraction However remember that there are many other important math skills and concepts that your child should be acquiring as a sound basis for numeracy Here are some of the skills your child should have mastered by that time

A COUNTING

1 Rote count numbers orally to 1001

2 Skip count by 2 s 5 s 10 s 100 s

3 Count objects by 1 s and 10's (rational counting)

4 Match numerals with sets of objects (e g dominos)

5 Make marks to show a numeral s value

6 Say the days of the week months of the year and the seasons

B MORE/LESS/EQUAL

1 Circle numbers on a number line that are *more than* and *less than* a specified number

2 Identify larger and smaller numbers

3 Make both sides of an equation have the same number

4 Identify which number is less in a pair

5 Identify which number is less in sets of more than two numbers

6 Make greater than and less than signs between numbers

C ADDITION AND SUBTRACTION

1 Use a number line to calculate single digit addition and subtraction problems

2 Add two-digit and one-digit numbers with no regrouping

3 Orally find the sum by adding ten to a number

4 Orally and in writing find answers to problems that minus 10 and minus 20 (e g , 15 - 10 25 - 20)

5 Subtract two-digit numbers from two and three-digit numbers with no re grouping

6 Respond to mental arithmetic questions that juxtapose addition and subtraction facts

D PLACE VALUE

1 Write teens numbers from dictation

2 On a grid pattern write two-digit numbers (beyond 20) from dictation

3 Write tens and twenties numbers from representations such as vertical marks which are grouped

4 Work facts or problems in columns

E PROBLEM SOLVING

1 Find missing addend or subtrahend for number problems

2 Write problems and answers for stories

3 Find missing middle term (number and sign) in number problems

4 Write facts for more or less story problems using the number line

5 Indicate whether a problem calls for addition or subtraction

6 Solve comparison problems (e g taller-shorter larger-smaller earlier-later)

7 Solve problems that require = < or > sign

F APPLICATIONS - MONEY

1 Name coins - penny nickel dime quarter dollar and state each coin s value

2 Learn and apply the following rules

(a) When you count dimes you count by tens

(b) When you count nickels, you count by fives

(c) When you count quarters you count by twenty-fives and

(d) When you count pennies you count by ones

3 Write the number of cents for a row of pennies and dimes

4 Write the number of cents for two groups of dimes

5 Write the number of cents for a row of mixed pennies nickels and dimes

6 Write the number of cents for a nickel dime or quarter followed by pennies

7 Total a row of coins to obtain a price tag

G APPLICATIONS - MEASUREMENT

1 Show 5 cm with fingers

2 Find 1 cm on ruler

3 Count 1 cm units on a ruler starting from 0

4 Measure a line with a transparent ruler placing 0 on a mark and counting a specified number of Centime-

ters

5 Measure squares triangles and rectangles

6 Read a thermometer in Celsius and Fahrenheit

7 Tell time on an analog clock to the hour half-hour quarter-hour and five minutes

For more details of skills expected by the end of grade two see *The Ontario Curriculum Mathematics Grades 1-8* You can make up games and activities to help your child learn these important skills Flash cards for math facts are good but there are many more skills that require attention

Teaching Basic Math Facts

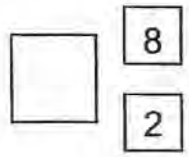
To solve problems in mathematics students must have facts at their fingertips They should recall basic number facts rapidly and accurately so that they can spend their energy on the problem, not trying to remember a fact or using a calculator to work out simple problems Learning basic facts requires practice and drill Many teachers take the first ten minutes of the math lesson to do warm-up exercises before they teach the new concept or procedure Here are several suggestions for warm-up activities that teachers and parents can use to help students improve their math fact knowledge

TEACH NUMBER FAMILIES

Relationship activities may be divided into two main groups series saying and three number fact families These exercises teach relationships among various facts through fact sequences (e g doubles doubles plus one double plus two) and fact families that are sets of three related numbers that generate four facts (e g 2 5 7 2 + 5 = 7 5 + 2 = 7 7 - 2 = 5 7 - 5 = 2) If a student knows the addition facts the student can also find the reciprocal (subtraction) facts

1 Series saying

Series saying involves having the student say a consecutively ordered set of fact statements such as the following set



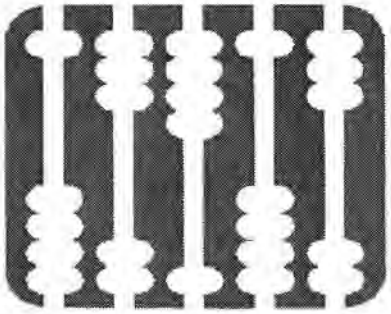
_____ + _____ = _____

_____ + _____ = _____

_____ - _____ = _____

_____ - _____ = _____

Point to the two smaller numerals and say that you want to make addition statements using the numbers 8 and 2 Ask What is the big number that goes with 8 and 2? Write that number in the box Ask the student to say one addition statement and then write that statement Ask the student to say and then write the other addition statement Repeat the process for the subtraction statements



Follow this presentation with a worksheet that is constructed like the following example

□ 2 7	□ 6 8	□ 2 5	□ 8 2
__ + __ = __	__ + __ = __	__ + __ = __	__ + __ = __
__ + __ = __	__ + __ = __	__ + __ = __	__ + __ = __
__ __ = __	__ __ = __	__ __ = __	__ __ = __
__ __ = __	__ __ = __	__ __ = __	__ __ = __

A similar approach can be used for multiplication and division facts Introduce addition facts first followed by subtraction multiplication and then division Introduce easier facts first and related facts together Teach the reciprocal facts soon after the initial series is taught

MEMORIZING EXERCISES

Exercises for memorization of facts should be done daily Facts are taken from the series saying and the number families activities Each exercise requires a worksheet There are two parts to each exercise In the first part the student should point to each fact say the whole fact and the answer The teacher should determine the pace through signalling Criterion for mastery is one fact every 2 seconds The second part of the exercise involves writing the answers The student should be timed each time and the times charted to show progress Worksheets should be set up with approximately 10 facts per row Each sheet should contain from 6 to 8 rows

Teaching Procedures

1 Oral Drill I

Touch this problem (top left). Work across the page this way Say each problem and the answer Get ready Signal Desirable rate of signal-response one fact every 2 seconds)

To correct

1 Stop the student Give the problem and the answer

2 Have the student repeat that problem and the answer

3 Starting over Get ready Signal Have the student return to the beginning of the row and repeat

2 Oral Drill II

If the student is well under the time (not on signal), or makes several errors, repeat Oral Drill I but this time say only the fact not the problem Aim for a rate of one fact per 1 ½ seconds

3 Timed Written Practice

Write the answer to each problem Work as fast as you can Start with this problem (indicate top left) and work across the page If you get stuck skip it and go on

I ll time you Get ready Go Start timer

Stop the student after 2½ minutes Count the number correct and note at the top of the page

MENTAL MATH

Mental math activities may be used as warm-up activities each day before starting the math lesson Two activities are suggested skip-counting and mental math

1 Skip Counting

A new skip-counting exercise may be introduced each day Students should practice skip counting up and down and starting from starting points part way through the sequence Skip counting sequences can be relatively easy or quite complex Students should learn to say the multiples of 2 5 10 100 25 3 4 6 7 8 9 By grade 3 students should also say fraction sequences such as ¼ ½ ¾ 1 1¼ 1½, 1¾ 2 2¼ Decimal sequences may be included next (0 25, 0 5 0 75 1 0, 1 25 1 50 ,1 75 2 0 2 25 2 50 , 2 75,) Script You re going to count _____ (up or down) Count by _____ s Start with _____ Get ready Signal (snap or clap at a rate of about one per second)

To correct

1 Stop the student

2 Start over

3 Say the sequence with the student

4 Gradually fade out your voice

2 MENTAL MATH

Design problems to practice work from previous lessons

Examples

a 20 + 30	b 200 + 70 + 30	c 550 + 40 90
d ¼ + 1¾	e ½ of 10	f $5 00 $1 25
g $ 5 64 + $1 46	h 600 x 60	i 120 ÷ 4
j 10% of 250	k 7^2	l square root of 25

Get ready to do some math in your head I ll say the problem you say the answer

First problem _____ (pause 2 to 3 seconds) Get ready Signal

To correct

1 Give the answer

2 Say the problem and the answer

3 Repeat the problem

4 Go on to the next problem

Mathematics Processes — Whole Number Operations

Before you can teach children to calculate they must possess certain pre-skills

PRE-SKILLS FOR WHOLE NUMBER CALCULATIONS

1 Rote count and rational count (counting objects)

2 Count up and down from a given number

3 Identify and write numerals

4 Understand equality of quantity

5 Match numerals with quantity

6 Place objects in groups

7 Identify place value to 100 s

8 Mentally identify one more one less ten more and ten less than a number

9 Count numerals on a number line

10 Identify ordinal positions

11 Expanded notation (e g 12 = 1 ten and 2 ones)

Two sets of skills are involved in learning the processes or algorithms, for making calculations that involve whole numbers Children establish a concrete understanding of the concept of each operation then they learn the mechanical processes they must follow to complete calculations Children usually learn the concrete concepts during kindergarten and first grade Children will learn these processes better if the skills are taught in an order that allows them to build on their knowledge a step at a time Here is a suggested order of introduction for each whole number operation

ADDITION

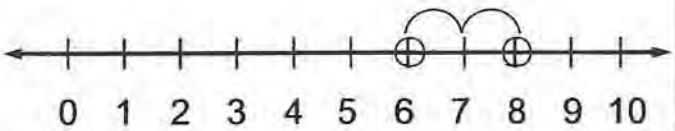
Concept Knowledge

The major objective is to teach the concept that addition is the union of sets When we add we start with two small numbers and end up with a bigger number Teach two forms of union one after the other object grouping and the number line

1 Groups of objects Demonstrate addition by placing objects in groups Count the objects Join the objects together in one group and count the joined group To avoid confusion use identical objects such as pennies or same-colour counters Graduate to different coloured

counters and super-ordinate group titles (e g two apples and three oranges equals five pieces of fruit).

2 Number line Use a number line with equal interval marks Teach your child to start at a number and **hop to the right** (one hop for each number counted) Note Make sure rational counting is firmly established before you can teach this



Process Knowledge

1 Add two single-digit numbers Write problems vertically and horizontally Teach your child to find the bigger number then count up for the other addend E g 6 + 2 The bigger number is 6 so I say 6 and count 2 more 6 7 (raise one finger) 8 (raise another finger) I ended with 8 so the answer must be 8 The critical part of this skill is raising your finger *after* you say six and *as* you say seven

2 Add three single-digit numbers Write the problems vertically (in preparation for multi-digit adding) Use the same approach as above Introduce problems with sums of more than 10

$$\begin{array}{r} 6 \\ 1 \\ +\,5 \\ \hline \end{array}$$

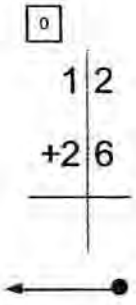
3 Teach the names of numerals in addition problems This is just rote learning but knowing the names will make later explanations much simpler The numbers we add are called **addends** The answer is called the **sum**

$$\begin{array}{r} \text{addend} \\ +\ \text{addend} \\ \hline \text{sum} \end{array}$$

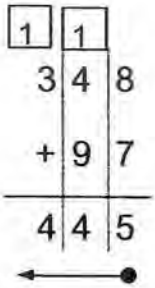
4 Re-write two and three-digit numerals in vertical form from horizontal Make sure your child lines up the numerals correctly If necessary, use 1 cm square graph paper

$$243 + 29 + 7 = \begin{array}{r} 243 \\ 29 \\ +\,7 \\ \hline \end{array}$$

5 Teach addition of two-digit addends with no regrouping Show your child where to start this operation Remember that your child has been taught to read words (left to right) and this is the opposite direction (right to left) so he or she may be confused Use the counting on method Use graph paper and make sure that the numerals in the sum are placed clearly in their columns



6 Teach addition of two- and three-digit addends with regrouping Set up the problem with a box above the first digit in the tens column Use the count-on method Expand the sum for the ones column For example the sum is 15 so that s 1 ten and 5 ones I ll put the five ones in the ones column and write the one ten in the tens column box Now add the tens column including the number in the box Have your child read the sum with correct terms (e g the sum is four hundred forty-five)



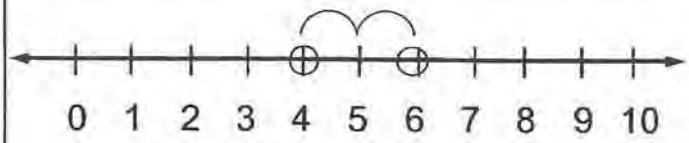
SUBTRACTION-
Concept Knowledge

The major objective is to teach the concept of removal of part or parts of a whole group When we subtract we start with a big number and end up with a smaller number Two forms should be taught objects and the number line

1 Objects Place counters or same-denomination coins on the table Teach your child to count all the objects first Then take away some objects Have your child count the objects that are left Re-state what you did I had 7 buttons I took away 5 I had 2 left What did I **start with**? How many did I **take away**? How many are **left**?

2 Number line Use a number line with equal interval marks Teach your child that when we take away we **hop to the left** Review when we add we hop to the right, when we subtract we hop left

6 - 2 = 4



PROCESS KNOWLEDGE

1 Subtract a single-digit subtrahend from a single digit minuend Teach your child to find the bigger number in subtraction it s always the biggest number (e g 8 - 3 = 5) Have your child find that number on the number line (8) Demonstrate by touching the numeral for the minuend (8) and counting to the left the number of hops shown by the subtrahend (3) **Hop first, then count** In this example start at 8 hop to 7 and say 1 hop to 6 and say 2 hop to 5 and say 3 I ended at 5 so the answer is 5

2 Teach the names of numerals in subtraction problems These are tricky but using the names will help you to teach the operations clearly The big number is called the **minuend** The quantity to be taken away is called the **subtrahend** The answer is called the **difference**

minuend
- subtrahend
difference

3 Re-write horizontal subtraction problems in vertical format Make sure columns are lined up correctly Use graph paper if necessary

7 - 3 = 4

$$\begin{array}{r} 7 \\ -3 \\ \hline 4 \end{array}$$

4 Subtract a single-digit subtrahend from a two-digit minuend with no regrouping Have your child touch the minuend in the ones column Use the number line to solve the subtraction problem Write the difference in the correct place Now move to the tens column and repeat the operation

2	8
-	3

5 Subtract a double-digit subtrahend from a two-digit minuend with regrouping To learn this process your child must already know how to expand a number to show tens and ones (e g 53 = 50 + 3 or five tens and three ones) Your child must also understand place value Write the problem in column form

5	3
-1	9

Step 1 Find out if you have to regroup or borrow Say the subtraction problem in the ones column (3 take away 9) Ask Can you do that? No So you have to borrow

Step 2 Re-write the problem as follows Explain that you have to borrow ten from the tens column and put it in the ones column Now the tens column has ten less so cross out the 50 and write 40 to show what s left after you took out the ten

Step 3 Add the ten to the ones that are already in the ones column Now you have 13 Now you can subtract 9 from 13 the difference is 4 Write that in the ones column

Step 4 Now subtract the numbers in the tens column 40 minus 10 equals 30

The difference is 30 plus four or 34

40	1
~~50~~	3
10	9
30	4

6 Subtract a two-digit subtrahend from a three-digit minuend with zero in the tens column (e g , 402 – 28) In this problem we must borrow across the zero We regroup the numbers to read three hundred ninety-twelve First change the four hundred to three hundred and add 10 tens to the tens column Now take one of those tens and add it to the ones column Now you can complete the subtraction Then contract the numbers to 374

300	90	1
4~~00~~	~~0~~	2
-	20	8
300	70	4

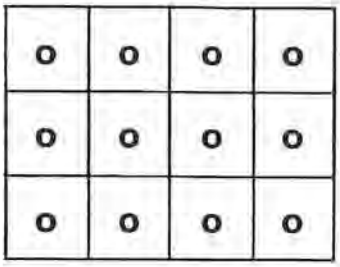
MULTIPLICATION

Concept Knowledge

The concept your child must learn is that multiplication is a faster way of adding equal size groups Groups may be displayed as objects inside a bounded fig ure or objects arranged in an array Objects displayed in an array may be grouped by rows or by columns

1 Objects in groups Place objects such as poker chips or counters inside circles made of string Teach your child that to find out how many objects there are altogether you must count the number of groups and the number in each group *Each group must have the same number* Teach the wording *x* groups of *y* equals *z* (e g three groups of four equals twelve)

2 Arrays Place the chips in columns on the table or on a grid pattern Each column must have the same number space the columns evenly Teach your child to check that the rows have the same number of objects in each row Now count the rows Wording *x* rows with *y* in each equals *z* altogether (three rows with four in each row equals twelve altogether) Now show that *x* columns with *y* in each column equals *z* (the same number)



Process Knowledge

1 Teach multiplication as multiple addition For example 5 + 5 + 5 + 5 = 20 Are you adding the same number? Yes So you can multiply What number is that? 5 How many times do you add the number? 4 Re-write the problem 5 x 4 = 20 (five added four times equals twenty)

2 The multiplication table Make a copy of the multiplication table below Show your child how to skip count by reading the numbers across a row or down a column A suggested order is 10 s 2 s 5 s 9 s 4 s 7 s 3 s 8 s 6 s With practice your child should be able to say the number sequence at one-second intervals without looking at the table

	0	1	2	3	4	5	6	7	8	9	10
0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10
2	0	2	4	6	8	10	12	14	16	18	20
3	0	3	6	9	12	15	18	21	24	27	30
4	0	4	8	12	16	20	24	28	32	36	40
5	0	5	10	15	20	25	30	35	40	45	50
6	0	6	12	18	24	30	36	42	48	54	60
7	0	7	14	21	28	35	42	49	56	63	70
8	0	8	16	24	32	40	48	56	64	72	80
9	0	9	18	27	36	45	54	63	72	81	90
10	0	10	20	30	40	50	60	70	80	90	100

3 Single digit multiplication Show your child how to use the multiplication table to solve single-digit problems For example 3 x 4 = 12 find where row 3 and column 4 intersect Write the number sentence Give your child new number sentences and have him or her use the table to find the product

4 Teach the names of numerals in multiplication problems The number of units in each set is called the **multiplicand** the number of sets is called the **multiplier** the answer is called the **product** the multiplicand and the multiplier are called **factors** The easiest terminology however is to refer to the numerals as the factors and the product as these terms are used in later math processes

muliplicand		**factor**
x multiplier	**or**	**x factor**
Product		Product

5 **Two-digit multiplicand by one-digit multiplier, with regrouping** Set up the problem as shown on the next page Explain and practice each step

Step 1 multiply the ones carry the ten to the plus box

Step 2 multiply the tens by the ones add the number in the box

```
 +1
   2 3
 x   4
 -----
   9 2
```

6 Two-digit multiplicand by two-digit multiplier Set up a problem as shown below Explain and practice each step

Step 1 multiply the ones and carry any tens to the plus box

Step 2 multiply the tens by the ones carry any hundreds to the plus box

Step 3 multiply the tens

Step 4 add the two rows

```
 +1
     7 3
   x 2 4
 -------
    ¹2 9 2
  +1 4 6 0
 -------
   1 7 5 2
```

o	o	o	o
o	o	o	o
o	o	o	o

DIVISION

Concept Knowledge

1 Removing disjoint subsets Your child should understand this concept as the opposite of multiplication In multiplication you added equal groups together to form a larger group in division you separate objects into groups by removing them from a larger group Place a number of objects and two or three containers on the table Place the objects into the containers one at a time For the first few times make sure you do not have a remainder Then plan to have some left over Show how you cannot put that object into a container because the rule is that each container must have the same number of objects

2 Arrays This is the opposite process that you used to teach multiplication concepts Show how you can divide an array into equal size groups You can make a number family to show the operation For example an array of 12 objects can be displayed as three rows of four Let s see how many sets of three we can make from twelve Rearrange the same objects into two rows of six Let s see how many sets of two we can make from twelve

o	o	o	o	o	o
o	o	o	o	o	o

Process Knowledge

1 Teach the number sentence Division sentences come in three forms your child should understand that each sentence has the same meaning Use arrays to show number sentences

$6 \div 2 = 3$

$$\begin{array}{r} 3 \\ 2\,\overline{)\,6} \end{array} \qquad \frac{6}{2} = 3$$

Make up a chart with missing information for your child to complete

$12 \div 3 = 4$		
	$\begin{array}{r} 6 \\ 3\,\overline{)\,18} \end{array}$	
		$\frac{16}{4} = 4$
$6 \div 2 = 3$		

2 Teach the names of numerals in division problems It will be easier to explain and teach more complicated processes if your child knows the names of the numerals in division problems Post this diagram on the wall

$$\begin{array}{r} \text{Quotient} \\ \text{divisor}\,\overline{)\,\text{dividend}} \end{array}$$

3 Divide a two-digit dividend by a one-digit divisor with no remainder Teach your child to use the multiplication chart to solve this type of problem

Step 1 Find the divisor on the multiplication chart

Step 2 Follow across the row until you find the dividend

Step 3 Go to the top of the column and read off the number That number is the quotient

4 Divide a two-digit dividend by a one-digit divisor with remainder Start by following the same process described above

Step 1 Find the divisor on the multiplication chart

Step 2 Follow that row across until you come to a number that is as close to the dividend as possible but not over it

Step 3 Find the column number Write that number in the quotient space

Step 4 Write the actual number from the chart under the dividend

Step 5. Subtract that number from the dividend Write the difference as the remainder

5 Divide a three- or four-digit dividend by a one-digit divisor with regrouping Build on the previous process Repeat steps 1 through 5 Then

Step 6 Bring down the next number

Step 7 Read the new difference Check Is the difference more or less than the divisor? If more the quotient is too low The new difference becomes the new dividend

Step 8 Repeat the whole process from step 1

Now teach the four main steps for the process

1 **Divide**

2 **Multiply** the quotient and the divisor

3 **Subtract**

4 **Bring Down**

5 Repeat until there are no more numbers to bring down

DIVIDE

MULTIPLY

SUBTRACT

BRING DOWN

6 Divide a four-digit dividend by a two-digit divisor Before you teach this process make sure your child can round to the nearest ten Follow the same process as above However this time tell your child to read the first two digits of the dividend Is that number more or less than the divisor? If it is more you can divide if it is less you cannot divide you must use three numbers Determine how many times the divisor can go into that part of the dividend by rounding the divisor and estimating the quotient Check by multiplying the divisor by that number Now repeat the process for dividing by one digit with regrouping

Mathematics Processes — Fractions

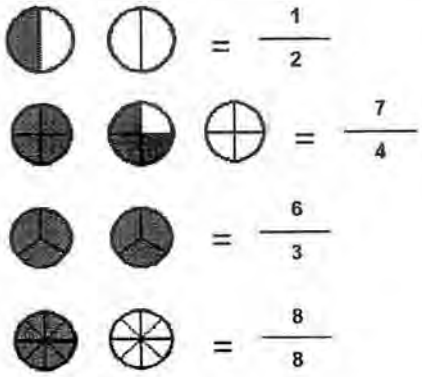
1 GRAPHIC REPRESENTATION OF FRACTIONS AND MIXED NUMBERS

Start with shapes that represent wholes (e g circles squares) Show your child how to divide each whole into equal parts Use sets of more than one whole to avoid teaching the misrule that fractions are numbers that are less than one Fractions may be less than one more than one or equal to one Show three types

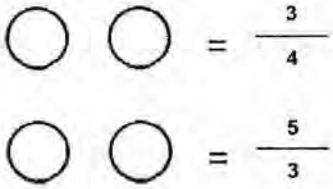
	Less than one	Proper fraction
	Equal to one	Fraction of one
	More than one	Improper fraction

2 WRITING FRACTIONS

Fractions have three parts a denominator a numerator and a fraction bar The denominator tells how many parts each whole is divided into The numerator tells how many parts are used Teach your child to recite these rules by heart Now present diagrams and show how to write the fractions that describe the diagrams Present a mixture of diagrams that represent the three types For example



Now present empty circles and have your child draw shapes to correspond to fractions



3 ADDING FRACTIONS WITH LIKE DENOMINATORS

Introduce the rule You can add fractions if the denominators are the same Don t try to teach adding with unlike denominators yet that will come later Next have your child match a picture to the written numeral and translate the picture to a

number problem

$$\frac{3}{4} + \frac{5}{4} = \frac{8}{4}$$

Explain that these fractions **can be added because the denominator is the same** First find the denominator and write it in the correct space (under the fraction bar) Now count how many parts are used altogether, and write that number in the numerator space Now you can introduce examples without the diagrams Include some problems with unlike denominators Don t try to teach this process yet just have your child recognize that you can t do it

4 SUBTRACTING FRACTIONS WITH LIKE DENOMINATORS

Start by reminding your child that you can only add fractions if they have the same denominator It s the same for subtracting fractions You shouldn t need to go back over the diagram stage Introduce examples of subtraction operations with like denominators and some without Have your child identify the ones that can be completed and do those items Skip items that cannot be completed because the denominator is not the same

5 MULTIPLYING FRACTIONS

Next students need to know how to multiply fractions This is an easy operation to learn but it is a critical prerequisite to more complex fraction processes Teach your child to multiply across the top first then multiply across the bottom Don t worry about reducing the product to lowest terms yet just concentrate on accurate multiplication Include some examples with the same denominators Explain that you can multiply whether the denominators are same or not

$$\frac{3}{4} \times \frac{2}{3} = \_\_\_$$

$$\frac{2}{5} \times \frac{3}{5} = \_\_\_$$

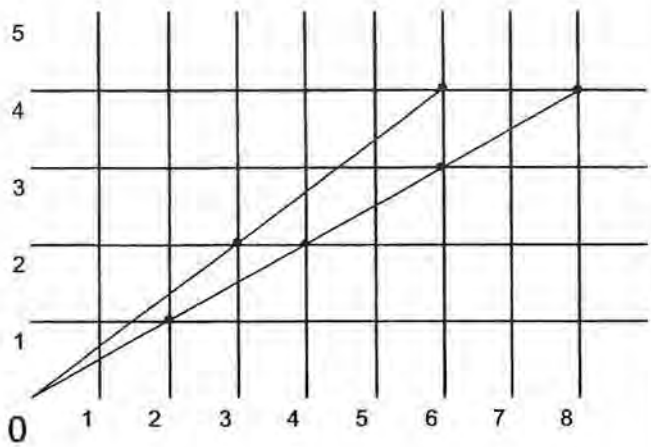
When you feel your child can complete these operations accurately without manipulatives mix multiplication items with some addition and subtraction problems (include some addition and subtraction examples with unlike denominators)

6 FINDING EQUIVALENT FRACTIONS

There are two methods to show for finding equivalent fractions The first shows the concept of equivalency The second is the short form process

a The equivalency grid Use graph paper to show a grid and map a fraction onto that grid The denominator always

goes on the horizontal axis the numerator is shown on the vertical axis Find the intersection of 1 and 2 (½) Now draw a line connecting that intersection to zero Extend your line Each intersecting point is an equivalent fraction Try a new fraction (say $^2/_3$) on the same grid The line will intersect at $^4/_6$



b The short-form In this process you are going to multiply the fraction by 1 however 1 may be in a different form Remind your child that a fraction that has the same number on the top and the bottom is equal to 1 no matter how large those numbers may be To find an equivalent fraction you multiply by a fraction of 1 (e g 3/3 10/10 123/123) Any number multiplied by 1 is the same number you started with Three-eighths times 1 is still three-eighths. However it may look different

If you want to find an equivalent fraction for 2/3 we could multiply the fraction by a fraction of 1 (say 3/3) Six-ninths is the same as (equals) two-thirds it just looks different The fraction two-thirds can have many different looks depending on what fraction of 1 we choose to multiply it by Try several with your child Remind your child that no matter what disguise it is wearing it is still two-thirds

$$\frac{2}{3} \times \left(\frac{3}{3}\right) = \frac{6}{9}$$

7 FINDING MISSING NUMBERS IN EQUIVALENT FRACTIONS

If your child has understood how to write equivalent fractions the next step will be easy

$$\frac{3}{4} = \frac{\square}{12}$$

Start with what you know 4 multiplied by something equals 12 We know from our multiplication facts that 4 times 3 equals 12 So we can re-write the problem this way

$$\frac{3}{4} \times \left(\frac{\quad}{3}\right) = \frac{\square}{12}$$

Remember we are multiplying by a fraction of 1 so if we know the bottom we know the top or vice versa If we multiply one part of the fraction by a number we must multiply the other part by the

same number So 3 times 3 equals 9 Show how this process works whether the missing number is on the top or the bottom

$$\frac{3}{4} \times \left(\frac{3}{3}\right) = \frac{\boxed{9}}{12}$$

8 REDUCING FRACTIONS

When we reduce fractions we undo what we did when we found equivalent fractions To undo multiplication we divide So to reduce a fraction to lowest terms (the way it first looked) we divide be a fraction of one

$$\frac{6}{8} \div \left(\frac{2}{2}\right) = \frac{3}{4}$$

To find the fraction of one that we must divide by we need to find a number that can be a divisor for both numbers in the fraction Your child must know the rules for dividing

9 CONVERTING IMPROPER FRACTIONS TO WHOLE OR MIXED NUMBERS

In number 1, you taught that there were three types of fractions proper fractions, improper fractions, and fractions of one When calculating fraction problems, answers should be converted or re-written as mixed numbers The procedure involves turning the whole number into a fraction form with the same denominator as the fraction part of the mixed number For example

$$\frac{8}{3} = \frac{3}{3} + \frac{3}{3} + \frac{2}{3} = 2\ \frac{2}{3}$$

The denominator of the fraction (3) tells how to make fractions of one If the bottom number is 3 the top must be the same

When your child understands this concept (fractions of one) you can show the

Table 6 2 Rules for Dividing

Number can be divided by	If	Examples
2	The last digit is an even number or zero	2, 14, 26, 58, 270
3	The sum of the digits is a multiple of three	354 (3+5+4=12)
5	The last digit is five or zero.	25, 2005
10	The last digit is zero	100, 2110

short way which is to divide the bottom number into the top The remainder of course is a fraction of the divisor

$$\div \frac{10}{3} = \begin{array}{r} 3 \text{ R1} \\ 3\overline{)10} \\ -9 \\ \hline 1 \end{array} = \quad = 3\frac{1}{3}$$

10 CONVERTING MIXED NUMBERS TO IMPROPER FRACTIONS

If you have been following the sequence indicated here your child should have by this stage understood the important concept that one of the things that makes fractions special is that you can show the same value with many faces This is not so for whole numbers one is one and sixty is six tens and no ones For whole numbers there is always a close family resemblance but fractions can wear many disguises e g ¾ is the same as $^{6}/_{8}$ $^{21}/_{28}$ $^{27}/_{36}$ and so on Sometimes we need to convert a mixed number to an improper fraction so we can calculate more easily The conversion or re-writing does not change the value, it s just wearing a new look

$$2\frac{2}{5} \longrightarrow 2\frac{2}{5} \quad (+,\ \times) \qquad = \frac{12}{5}$$

To change this mixed number into a fraction, we must convert the whole number to its fraction form We can do this by multiplying the whole number by the denominator of the fraction We are asking how many fifths are there in 2? Ten Next we must add the fraction That makes 12 So the answer is $^{12}/_{5}$

11 ADDING AND SUBTRACTING MIXED NUMBERS WITH LIKE DENOMINATORS

If you have followed the previous steps you shouldn t need to review the concept by using pictures or manipulatives If you run into trouble however it s probably because one of those previous steps isn t firm you ll need to go back

$$1\frac{3}{5} + 2\frac{4}{5} = 3\frac{7}{5} \quad (1)\ (2)$$

$$= 3 + 1\frac{2}{5} = 4\frac{2}{5} \quad (3)\ (4)$$

This is best taught as a four-step process Use four steps for addition but only the first three steps are needed for subtraction

Step 1 Add or subtract the whole numbers
Step 2 Add or subtract the fractions
Step 3 (if necessary) Re-write the improper fraction as a mixed number
Step 4 (for addition only) Add that mixed number to the sum

12 SUBTRACTING MIXED NUMBERS FROM WHOLE NUMBERS

To subtract a fraction or a mixed number from a whole number you must re-write the whole number as fraction Then you can complete the operation

$$3 - \frac{1}{4} = \frac{12}{4} - \frac{1}{4} = \frac{11}{4}$$

13 MULTIPLYING FRACTIONS AND MIXED NUMBERS

Before you multiply mixed numbers you must convert them to improper fractions

$$3\frac{1}{2} \times 1\frac{1}{8} = \frac{7}{2} \times \frac{9}{8} = \frac{63}{16} = 3\frac{15}{16}$$

14 FINDING THE LEAST COMMON DENOMINATOR (LCD)

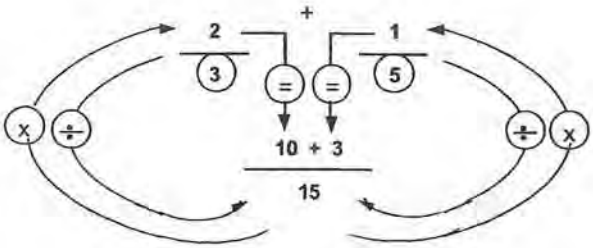
You need to teach this skill in preparation for the next skill (#15) The lowest common denominator (LCD) is the smallest number that is a multiple of two or more numbers or in plain terms the lowest number that two or more numbers will divide into evenly Find your multiplication chart Choose two numbers and find the numbers that appear in both columns

	1	2	3	4	5	6	7	8	9
2	2	4	6	8	10	12	14	16	18
3	3	6	9	12	15	18	21	24	27

The common multiples of 2 and 3 are 6 12 18 but the lowest common multiple of 2 and 3 is 6

15 ADDING AND SUBTRACTING FRACTIONS WITH UNLIKE DENOMINATORS

In numbers 3 and 4 above, you taught your child that you can not add or subtract fractions unless the denominators are the same So, before you can add or subtract fractions with unlike denominators you must make the denominators the same

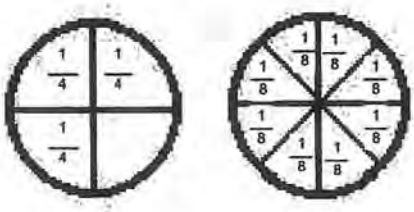


$$= \frac{13}{15}$$

Step 1	Find the low est common multiple	The LCM for 3 and 5 equals 15
Step 2	Divide the SCM by the first denominator.	15 divided by 3 equals 5.
Step 3	Multiply the quotient by the numerator	5 times 2 equals 10
Step 4	Repeat Steps 2 and 3 for the other fraction.	15 divided by 5 equals 3; 3 times 1 is 3.
Step 5	Add the nu merators	10 plus 3 equals 13

16A DIVIDING FRACTIONS USING MANIPULATIVES

This is a hard concept to grasp Use manipulatives to introduce the concept You will need two equal size circles one divided into fourths and the other into eighths Cut each circle into sections



$$\frac{3}{4} \div \frac{1}{8}$$

When we divide fractions such as the example above we are really saying How many one-eighths are in three-fourths? Place three-fourths on the table and cover them with your eighths pieces How many eighths did it take to cover three-fourths? It took six So there are six eighths in three-fourths So three-fourths divided by one-eighth is six

16B DIVIDING FRACTIONS USING RECIPROCALS*

We can use the reciprocal of the divisor to calculate the quotient In a reciprocal of a fraction the position of the numerator and denominator is reversed or inverted The reciprocal of one half is 2 ones (2)

$$\frac{3}{4} \div \frac{1}{2}$$

In this problem we are asking How many halves are in three quarters?

<u>Step 1</u> Find how many halves in one

$$1 \div \frac{1}{2} = 2$$

The number of $^1/_2$ s in 1 is 2 which is the reciprocal of $^1/_2$ So the number of $^1/_2$ s in $^3/_4$ should be $^3/_4$ of 2

Step 2 We find $^3/_4$ of 2 by multiplying

$$\frac{3}{4} \text{ x (of) } \frac{2}{1} = \frac{6}{4} = 1\frac{1}{2}$$

The process for dividing fractions is to find the reciprocal of the divisor and multiply the dividend by that number, or invert and multiply

Hake S and Saxon J (1997) *Math 76* Norman OK Saxon Publishers

Mathematics Word Problems

Some students have trouble figuring out story problems in math despite being able to read the problem without difficulty These students need instruction in how to solve math word problems Students can improve their ability to solve word problems in math when they master certain skills This resource guide sets out a suggested sequence of skills that teachers or parents should introduce Parents or teachers could use this outline to develop a series of lessons that will lead the student to better understand how to solve math word problems

The most basic skill is translating the word problem into a number sentence that the student can solve by doing the arithmetic Consequently the initial emphasis should be on sound knowledge of math facts and basic algorithms for whole-number operations However this does not mean that students must know all the algorithms for all the operations before learning how to solve problems but basic fact knowledge is a prerequisite

1 OPPOSITE OPERATIONS AND NUMBER FAMILIES

First teach about number families Number families are groups of three numbers that are related by an operation There are addition/subtraction families for example the numbers 4 5 and 9 are a fact family Four facts can be derived from this family

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

There are also multiplication/division families For example the numbers 3 5 and 15 form a family from which four facts can be derived

3 x 5 =15 5 x 3 =15 15 ? 5 =3 15 ? 3 =5

2 FINDING MISSING RELATIVES IN NUMBER FAMILIES

The important principle for the student to learn here is that if you know any two members of the family you can figure out the third member If you know 4 plus something equals 9 you can use the opposite operation to figure out the something 9 - 4 = 5 If you know 3 times something equals 15 you can use the

opposite operation to find the something 15÷3 = 5 Clearly before reaching this stage the student must know that addition and subtraction are reciprocal operations and division and multiplication are reciprocal operations

3 STORY PROBLEM PLOTS*

Hake and Saxon (1997) found that most story problems follow one of six plots The student must learn these stories using simple language that will be useful for translating stories into numbers and that will be used in the word problems The steps for solving word problems are the same regardless of the type of problem

Figure 6–4: Steps to Solve Word Problems

Step 1	Figure out what kind of story it is
Step 2	Write the pattern for the story.
Step 3	Write the problem in numbers Fill the numbers you know in their correct spaces
Step 4	Find the missing number that completes the pattern.
Step 5	Answer the question

Hake S and Saxon J (1997) *Math 76* Norman OK: Saxon Publishers

STORY PLOTS

Have Some, Get Some More Stories (SSM)

Have some get some more stories are addition problems In this story somebody has something and they get some more We have to figure out how much they have at the end of the story For example *Bob had 3 bags of chips He got another 2 more on his way home from school How many bags of chips did he have altogether?*

The number pattern for this story is

Pattern	Problem
some	3
+ some more	+2
total	5 Bags of chips

Larger-Smaller-Difference Stories (L-S-D)

Larger-smaller-difference stories are subtraction problems that compare two numbers For example There were 300 boys at camp and 200 girls How many fewer girls were there at camp?

Pattern	Problem
larger	300
- smaller	-200
difference	100 fewer girls

Later-Earlier Difference Stories (L-E-D)

Later-earlier-difference stories are subtraction problems that compare times For example Sue was born in 1989 How old was she in 2000?

Pattern	Problem
later	2000
- earlier	-1989
difference	11 years old

Have Some, Lost Some Stories (SLS)

These stories are subtraction problems In this story someone has some quantity and some of it goes away or is lost For example Jen went to the store with $5 00 She came back with $2 00 How much did she spend?

Pattern	Problem
some	$5 00
- lost some	- lost some
what is left	$2 00

In have some lost some stories we usually have to find out how much was lost From our knowledge of number families we know that we can find the missing number by subtracting $2 00 from $5 00 So the answer is $3 00

Equal-Groups Stories

Equal-groups stories have a multiplication pattern Any one of the numbers may be missing For example

At Montcrest School there were 15 students in each class If there were 10 classes how many students were there?

Pattern	Problem
number in each group	15
x number of groups	x10
number in all the groups	150

To find the missing number we multiply the number in each group by the number of groups Here s another equal-groups problem Montcrest School has 150 pu pils and 10 classes If they have the same number of students in each class how many students are in each class?

Pattern	Problem
number in each group	?
x number of groups	x10
number in all the groups	150

To find the bottom number in an equal-groups problem we multiply To find the first or second number we divide This problem can be solved by division (the reciprocal operation for multiplication number families) $150/10 = 15$

Rate Problems

Rate problems have the same pattern that equal-groups problems have Example Kate drove a car 80 kilometers per hour for 5 hours How far did Kate drive?

Pattern	Problem	
number in time groups	80	kms each hour
number of time groups	x 5	hours
total	400	kms

Kate drove 400 kms in 5 hours

To find the bottom number we multiply Like equal group problems we can use the reciprocal operation (division) to find the first or second number Example Sally can do 20 math fact problems in a minute How long will it take her to do 60 problems?

Pattern	Problem	
number in time	20	facts each minute
number of time groups	x N	minutes
total	60	facts

60 ÷ 20 = 3 It will take Sally 3 minutes to complete 60 facts

TEACHING SEQUENCE

To teach students to solve word problems

1 Teach the concept of number families

2 Teach the student to use reciprocal operations to find missing numbers in number families

3 Teach the first of the story-problem types *Have Some Get Some More*

4 Teach the student to work through the steps for solving word problems

5 Introduce the remaining stories one at a time

6 Provide practice in identifying which pattern to use and following the five steps to solution

When the student can work out the pattern, solving the problem is easy because the problem can be translated into a number sentence

Time and Money

TIME

1 Teach analog first Start by teaching your child to tell time on an analog clock not a digital clock When your child has mastered telling time on the analog clock you can introduce the digital clock and teach how to express analog time in digital format

2 Use a toy clock You will need a good-sized toy clock with two movable hands The clock-face should include all the numbers (one through twelve) and indicators for minutes Preferably the minute indicators will be slightly shorter than the five-minute indicators

3 Teach your child the direction the hands move Have your child touch and count the numbers starting at 1 and moving around the clock-face until you reach 12

4 Name the hands Teach your child the names of the hands Use terms such as big-hand and small-hand Pair these terms with minute hand and hour hand

5 Teach your child to read ' o clock Place the minute hand on the twelve Have your child repeat When the big hand is on twelve it s something o clock Practice this rule until perfect

6 Teach half-past Place the big hand on the six and teach the following rule When the big hand is on the six it s half past something Practice this by placing the big hand on the six and asking Is it half past something? Place the big hand on other numbers such as the twelve five nine or seven and ask the same question

7 Teach the placement of the small, or hour hand If you can remove the minute hand from your toy clock Teach your child that the small hand the hour hand tells the hour Move the hand to several positions pointing straight at the number and ask your child to tell you the hour Ask what hour is it? and What o clock is it? Replace the minute hand

8 Teach your child to read both hands Place the big hand on the twelve and say The big hand is on the twelve so what do you know? Your child should answer 'When the big hand is on the twelve it s something o clock [If not go back to step five and practice some more] Say 'Yes the big hand tells us it's *something* o clock The small hand tells us *what* o clock Place the small hand on 2 (or any number except 6) and say The small hand is on the two so it must be *two* o clock '

9 Teach your child to read half-past times Use the procedure described above to teach your child to read o clock times and half-past times until he or she makes no errors consistently Then give your child times and ask him or her to move the hands to correct positions Correct as necessary

10 Make sure your child can count by fives to sixty Practice until this skill is established firmly as an automatic sequence Now teach your child to touch each number starting with the number one say five and count by fives for each number through to sixty Practice this until your child can tell you the correct multiple of five for any number you point to on the clock

11 Teach after (past) Teach your child that if the minute hand has not past the six we say after Place the minute hand in various places between twelve and six and each time ask Do we say after? Your child should answer yes Make sure that sometimes you put the hand *on* 6 Now place the minute hand in various places between six and twelve (but never *on* twelve) Ask the same question The answer is no

12 Teach before (to) Teach your child that if the minute hand has past the six we say before Place the minute hand in various places between six and twelve *but not on either number* and each time ask Do we say before?' Your child should answer yes Now place the minute hand in various places between twelve and six (but never *on* twelve) Ask the same question The answer is no

13 Mix up the examples When you get several correct answers in a row for each example of before and after present mixed examples and ask your child to tell before or after Practice until firmly established

14 Tell time to five minutes Teach your child that when the time is 'before' we can count by fives starting with eleven Place the minute hand on the eight Say that the minute hand is in the before position so we count by fives starting at eleven 5 10 15 20 The minute hand is on 20 so it must be 20 before something Check the hour hand to see what hour it is twenty minutes before Repeat the same procedure for the after' side of the clock-face

15 Tell time to single minutes After several weeks practice with Step 14 your child can learn to tell time to single minutes Show your child how to count by fives first then count by ones For example with the minute hand on twenty-four minutes past count by fives to twenty then by ones to twenty-four

16 Convert analog time to digital Only after you are convinced that your child has mastered all these steps should you show your child how to write time in digits If the preceding steps are firm no elaborate teaching format will be necessary Make sure that your child includes the colon between hours and minutes

MONEY

1 Make sure your child has the following pre-skills can count by ones fives tens and twenty-fives Model and practice these oral sequences until your child can say the sequences quickly without hesitation and can start at a number other than five, ten, one or twenty-five

2 Introduce the penny Teach your child to name the coin and say its value For example This is a penny What is this? A penny is worth one cent How much is a penny worth?'

3 Introduce the nickel, dime, and quarter in that order Only after you have practiced this first step for several weeks or until you are sure that the knowledge has become automatic should you introduce the next coin name and value Use the same wording as the penny

4 Count groups of coins of the same denomination Start with groups of pennies, then nickels dimes followed by quarters Teach the following rules so that your child can recite each rule perfectly

1 When you count pennies you count by ones

2 When you count nickels you count by fives

3 When you count dimes you count by tens

4 When you count quarters you count by twenty-fives

5 Count groups of two different denominations Start with quarters and pennies Lay one quarter and two pennies on the table with the quarter on the left Model the sequence say twenty-five then count by ones (twenty-six twenty-seven) You ended with twenty-seven so that must be the number of cents Next use dimes and pennies then nickels and pennies When these skills are established move the coins around so you make groups that begin with pennies

6 Count groups of three or more denominations After several weeks practice with counting two denominations introduce groups of three denominations Model several examples before asking your child to go through the sequence

Start by counting left to right When that is established, teach your child to group larger denomination coins first then proceed down Have your child count aloud you should correct as soon as you hear a mistake

PART III

RESOURCES

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Having a child with a disability in your classroom can be a challenge With the proper knowledge and preparation you can meet the challenge head on

There are many resources available that will help you prepare for a child with spina bifida and/or hydrocephalus

The Spina Bifida and Hydrocephalus Association of Canada has knowledgeable personnel You ll find a list of provincial spina bifida and hydrocephalus associations in this section as well as information that has been provided by your local spina bifida and hydrocephalus association

Publications videotapes and other resources are also available from your spina bifida and hydrocephalus association and other specialty book distributors Included in the front and back pockets of this binder are publica tion lists and ordering information publications available in French and other languages are indicated

Your local library may also be a source for information on spina bifida and/or hydrocephalus The children s department can also provide books for children about living with a disability

Education libraries affiliated with provincial departments and university faculties of education can provide specific information about the learning disabilities that often accompany the condition

Who's Who in Spina Bifida and/or Hydrocephalus Care Programs

Classroom teacher Educator responsible for delivering education program to the child for observing and assessing a child s progress and for consulting with parents and other members of the school team about a child s progress at school

Gastroenterologist A medical doctor who has specialized training in diseases of the gastrointestinal tract (stomach intestines and so on)

Geneticist A physician trained to assess the risks of passing on or inheriting a congenital disorder

Neurologist A physician who specializes in the physiological functions of the brain and nervous system

Neurosurgeon A physician who specializes in surgery of the central and peripheral nervous system

Occupational therapist A therapist specializing in child development trained to assess children s skill levels especially in the areas of fine motor skill and eye hand coordination

Ophthalmologist A physician who specializes in the treatment of eye disorders

Optometrist A doctor who examines eyes to determine whether or not there is vision impairment and who prescribes corrective lenses

Orthopedist A physician who specializes in the treatment of bones joints and muscles surgically or otherwise

Orthotist An individual within the health care team who makes and fits braces and other orthopedic appliances

Paraprofessional (Teacher s assistant) Individual who assists the child with physical care and school work

Pediatrician A physician who specializes in the care of infants and children

Physiatrist A physician who specializes in treating disabilities and in rehabilitation

Physiotherapist An individual who provides treatment and instruction to build strength and range of motion that increases mobility

Plastic surgeon A physician who specializes in the surgical repair and reconstruction of deformed tissues

Primary care physician A physician usually a general practitioner or pediatrician who provides the majority of initial health care and who coordinates treatment by specialists

Principal School administrator responsible for ensuring that all appropriate resources are in place to deliver the education program for the child

Psychologist An individual trained in the functions of the mind i e thought memory and the behaviour of individuals in relation to their environment Assesses learning disabilities and areas of difficulty

Public health nurse A registered nurse who provides nursing and health care education and evaluation in the community

Resource teacher A teacher specially trained to teach children who have disabilities that affect learning

School counsellor/advisor Teacher with special training in the areas of counselling and resource gathering and assists school age children with social emotional educational, and developmental challenges

Social worker An individual who provides counselling to children and families about emotional and social problems In the hospital setting a member of the health care team

Special education coordinator An individual employed by an education facility to ensure that programming personnel and facilities are provided for children with special needs

Speech and language pathologist An individual who evaluates the ability to speak and to understand speech and written language and who provides assessment and appropriate therapy

Urologist A physician who specializes in problems and surgery of the urinary tract

Glossary of Terms

Arnold Chiari malformation An abnormal development of the brain in which the back of the brain gets pulled down into the neck It occurs in many children who have spina bifida and/or hydrocephalus

Attention deficit disorder (ADD) A physiological condition that causes attention and distractibility problems in students In recent years ADHD (Attention Deficit Hyperactivity Disorder) has been used in place of ADD to describe this disorder

Catheter A tube which allows fluid to flow in or out Catheters are used to drain urine from the bladder for example

Cerebrospinal fluid (CSF) The fluid produced by the brain that circulates throughout the central nervous system and protects the brain and the spinal cord

Clean intermittent catheterization (CIC) A method of emptying the bladder by inserting a catheter at intermittent intervals The urine passes out of the body through the catheter

Corpus callosum Mass of fibers that connects the hemispheres of the brain

Hydrocephalus A condition in which cerebrospinal fluid builds up in the ventricles (spaces) in the brain

Individual Education Plan (IEP) A written plan that outlines a child s level of educational performance annual goals and short term objectives statement of specific services to be provided to the child and evaluation procedures

Learning disability Any of several conditions that interferes with information processing especially language and visual spatial processing caused by abnormalities to the nervous system

Meningocele A rare type of spina bifida which primarily affects the coverings around the spinal cord

Myelomeningocele The most severe form of spina bifida It affects the spinal cord and its coverings as well as certain nerve functions and the growth of bones and skin

Neural tube defect (NTD) Any variation in the normal development of the neural tube There are three types of NTD They are spina bifida encephalocele and anencephaly

Neural tube The tissue in a developing fetus which eventually forms into the brain and spinal cord

Occulta The mildest form of spina bifida Occulta means hidden

Orthotics The science of orthopedic appliances and their use

Seizure A violent involuntary contraction or series of contractions of the voluntary muscles

Shunt A plastic tube surgically inserted in the brain that drains cerebro spinal fluid

Spina bifida. A congenital malformation of the spine characterized by failure of the vertebrae to fuse or close The three main types of spina bifida are myelomeningocele meningocele and occulta

Provincial Spina Bifida and Hydrocephalus Associations

Spina Bifida and Hydrocephalus Association of Canada (SBHAC)
Suite 647, 167 Lombard Avenue
Winnipeg, Manitoba, R3B 0V3

Phone: 800-565-9488
204-925-3650
Fax: 204-925-3654
Email: info@sbhac.ca
Website: www.sbhac.ca

In order to obtain contact information for any of the following associations in Canada, call the SBHAC toll number, 1-800-565-9488:

- Spina Bifida and Hydrocephalus Association of British Columbia
- Spina Bifida and Hydrocephalus Association of Southern Alberta
- Spina Bifida and Hydrocephalus Association of Northern Alberta
- Spina Bifida and Hydrocephalus Association of Saskatchewan South
- Spina Bifida and Hydrocephalus Association of Saskatchewan North
- Spina Bifida and Hydrocephalus Association of Manitoba
- Spina Bifida and Hydrocephalus Association of Ontario
- L'Association de spina-bifida et d'hydrocephalie du Quebec
- Spina Bifida and Hydrocephalus Association of New Brunswick
- Spina Bifida and Hydrocephalus Association of Nova Scotia
- Spina Bifida and Hydrocephalus Association of Prince Edward Island
- Newfound and Labrador Association for Spina Bifida and Hydrocephalus

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