

Module 8: Numeracy

This training aims to develop your understanding of Language Disorder in the context of numeracy development. You will investigate the 4 essential components of numeracy and increase your knowledge of effective strategies to support students with Language Disorder.

This module will explore numeracy skills typically developed by students in the early years of schooling. These skills form the building blocks for competency in mathematics. Development of these skills is often not linear and each student will be different. For some students with Language Disorder, numeracy skills can be significantly delayed despite having progressed to higher levels of schooling.

Students typically develop integrated knowledge in three areas – conceptual knowledge, such as the underlying concepts of more and add; procedural knowledge such as the awareness of counting rules and declarative knowledge, or memorized material, such as number names and sequences. Clearly language provides an important foundation for accessing numeracy, which results in students with Language Disorder struggling in one or more of these areas.

Numeracy difficulties often arise due to underlying weaknesses in:

- phonological memory and processing
- auditory and visual sequencing
- verbatim recall of sentences
- working memory capacity
- lexical storage and retrieval
- vocabulary and concept formulation

In the classroom these challenges can present in difficulties with:

- counting and ordering of numbers
- one-to-one correspondence
- number fact recall
- reading, writing and understanding symbols
- mathematical concepts, such as place value, operations, and magnitude

Inadequate numeracy skills in the early years of schooling can be detrimental to long term mathematical success.

There are four areas to developing effective numeracy skills, which include counting sequences, position and order, quantity, and place value. We will now step you through each of the areas to learn more and explore strategies to support students with Language Disorder.

Counting groups of objects is a complex skill. Students need to recall names of numbers then follow the procedure of saying them in the correct order. Students must also demonstrate one-to-one correspondence by pointing to each object while counting, while knowing the final number is the answer to 'how many' objects there are.

Students with Language Disorder will often demonstrate common counting errors, such as:
skipping, inserting or randomly reciting numbers
count, but not understanding how many the number represents
use random numbers when they run out of numbers they know
confuse concepts such as 'teen' and 'ty' numbers
count out of sequence
retrieve the wrong word

When exploring counting sequences, there are four further subskills we will address, including:

- one to one correspondence
- subitising
- number patterns and
- finger training

We will now explore each subskill, as well as support strategies.

One to one correspondence refers to the ability to match one object to another object, person or number. When counting, some students will have difficulties matching their gestures and verbal counting. This will result in repeating numbers, skipping objects, over counting or stopping too early.

Therefore, it is important to consider strategies to support one to one correspondence when addressing a student's numeracy difficulties. Consider how the following strategies could support students with Language Disorder within your school context:

Utilise multisensory experiences with the hands, ears and eyes to help develop coordination.

Engage the whole body by clapping or jumping when counting, then transition to smaller motions

Using visual supports, such as a five frames to support understanding and organise the counting task

Develop conceptual understanding through consistent use of language.

For more information on one to one correspondence, please see our SALDA handout at the end of the module.

Subitising refers to the ability to instantly recognise the number of objects in a small group without counting them. This helps students to count on from known patterns, combine numbers from sets and develop mathematical fluency. Students with Language Disorder may not link subitising to counting and the concept of number. They may also present with working memory or visual perceptual difficulties, which impact on accuracy.

Therefore, it is important to consider strategies to support subitising when addressing a student's numeracy difficulties. Consider how the following strategies could support students with Language Disorder within your school context:

Initially start by targeting quantities up to 3 before moving up to 6

Discourage mental counting, tapping or finger counting when subitising

Use manipulatives such as counters, before progressing to visual representations such as dots

If subitising is too challenging, use visual supports such as five frames and ten frames to organise

Play dice games to build up instant recognition of small quantities

For more information on subitising, please see our SALDA handout at the end of the module.

Number patterns refers to a sequence of numbers that follow an order based on a rule. These patterns are predictable and help counting strategies, problem solving, number generalisations and algebraic thinking. Before starting school, most students naturally recognise everyday patterns and routines. For students with Language Disorder, they may have difficulties with sequencing, memory, concepts of time and executive function, which impact their ability to easily identify these patterns and routines.

Therefore, it is important to consider strategies to support number patterns when addressing a student's numeracy difficulties. Consider how the following strategies could support students with Language Disorder within your school context:

Encourage students to discover visual patterns in their environment

Demonstrate repeating patterns of sound, such as loud, loud, soft, loud, loud, soft

Explicitly teach vocabulary related to the patterns.

Start with one or two variables when copying and creating patterns

Introduce simple skip patterns such as counting in 2s before progressing to larger numbers

Support skip counting with chants and songs

Use number lines and 100 boards as visual supports

Include whole body activities

For more information on patterning, please see our SALDA handout at the end of the module.

The ability to represent numbers by counting on our fingers is critical to future mathematical success, as students will be able to better subitise, count and order numbers. Some students with Language Disorder may have difficulties with finger isolation, dexterity or differentiation, which can affect their ability to accurately represent numbers using their fingers. Motor planning difficulties can also impact a student's ability to coordinate their fingers when counting. Through improving finger awareness, students will be able to better subitise, count raised fingers and order numbers.

Therefore, it is important to consider strategies to support finger training when addressing a student's numeracy difficulties. Consider how the following strategies could support students with Language Disorder within your school context:

Encourage fine motor activities, such as playdough and peg games to improve finger strength and dexterity

Use finger mazes to practice isolating specific fingers

Create colour coded finger games to press down to corresponding dots. Students move across each row pressing one dot a time using the matching finger

Engage students in verbal counting as they represent numbers with their fingers

Play games of representing numbers on fingers. This is great to do with a partner.

For more information on finger training and fine motor skills, please see our SALDA handout at the end of the module.

This section of the module will explore the concept of position and order in number sequences. Ordinal numbers describe the relative position of an object in an ordered sequence, such as first, second and third. Students with Language Disorder may have difficulties with ordinal numbers for a variety of reasons, including:

Poor conceptual understanding and matching of quantity to number

Lack of specific vocabulary

Sequential memory difficulties

Challenges counting backwards

Problems generalising skills, for example, coming second in a running race, versus a number being second in the pattern.

Therefore, it is important to consider strategies to support position and order when addressing a student's numeracy difficulties. Consider how the following strategies could support students with Language Disorder within your school context:

Reduce the pace of learning to consolidate concepts being taught

Utilise real life examples and explicit language

Progress from real life experiences to visual representations of scenarios

Use multiple representations of the same concept with different images

Introduce symbolic representation using numbers for example the difference between 3 and third

Explicitly teach position and order and follow up with frequent repetition.

For more information on position and order of numbers, please see our SALDA handout at the end of the module.

This section of the module will explore the concept of quantity, including aspects of cardinality and magnitude.

Cardinality, or number conservation, refers to the ability to retain and identify that the last number counted in a quantity is the total. For example, after counting a group of four objects, a student may respond with a number other than four.

Students with Language Disorder may have difficulties with cardinality for a variety of reasons, such as:

- Inability to subitise or count with one-to-one correspondence
- Lack of understanding of the meaning of a 'how many' question
- Poor understanding of "manyness", resulting in guessing the quantity
- Lack of understanding that a quantity remains static.

Therefore, it is important to consider strategies to support understanding of cardinality when addressing a student's numeracy difficulties. Consider how the following strategies could support students with Language Disorder within your school context:

- Model consistent language
- Reduce and simplify language when doing a total count
- Use non-verbal supports, such as accentuating the final number of the count
- Teach students to keep track of what is counted, such as moving the counted object away
- Use number lines to reinforce counting forwards and backwards.

Magnitude includes the ability to accurately compare quantities both in symbolic and non-symbolic form. It is sometimes called 'quantity discrimination' or 'comparison of numbers'. Successful numeracy development requires students to map numbers onto groups of objects. Students with Language Disorder may also have difficulty learning concepts such as more, less, greater than, less than, fewer, least and most.

Therefore, it is important to consider strategies to support understanding magnitude when addressing a student's numeracy difficulties. Consider how the following strategies could support students with Language Disorder within your school context:

- Explicitly teach concepts, such as more/less, bigger/smaller
- Use concrete materials to conceptualise quantities and connect with numerical representation
- Provide visual supports such as number lines and 100 boards
- Explore large collections of objects to visualise larger numbers, such as 100s and 1000s
- Play linear number board games to enhance numerical knowledge.

This section of the module will explore concepts of place value. Understanding of place value relies on successful integration of all skills presented in the module so far. A place value system indicates the position of a digit in a number determines its value. In the standard base ten number system, each place represents ten times the value of the place to its right.

When students learn place value, they understand:

The relationship between the places (for example ones, tens, hundreds, etc)

The position of a digit determines its value

0 indicates there is none of a particular place

The decimal point marks the distinction between whole numbers and parts of numbers

There is symmetry around any particular place value, with each place to the left being ten times greater, and each place to the right being ten times smaller.

Students with Language Disorder may demonstrate difficulties with place value for a variety of reasons, including:

Difficulty understanding quantities in groups of 10

Difficulties understanding the use of zero as a place holder

Syntactical errors, resulting in digits being placed out of sequence, especially in larger numbers

Attentional and/or memory weaknesses, which impact upon a student's ability to store and process numbers

Poor executive functioning skills

Visual perceptual difficulties

Cognitive demands required when working with numbers.

Therefore, it is important to consider strategies to support place value when addressing a student's numeracy difficulties. Consider how the following strategies could support students with Language Disorder within your school context:

Explicitly teach vocabulary associated with place value

Represent numbers using a variety of concrete materials

Frequently compare and order numbers

Use colour coding to help understand the base 10 principle

Practice counting forwards and backwards in place value chunks

For more information on place value and colour coding numbers, please see our SALDA handouts at the end of the module.

Now that we have reached the end of this module, consider the two following scenarios. Reflect upon the concepts that are causing difficulty for the student and the strategies that you might implement to support the student's understanding.

Scenario 1

Jimmy is practising the addition concept by rolling two dice. He rolls a 6 and a 2. When totalling the dice, Jimmy counts the dots one at a time, pointing to each dot; however, his verbal count is faster than his touch. Jimmy states that the answer is twelve. When asked to check his answer, Jimmy again counts the dots one at a time, to reach an answer of eleven.

Reflect upon the concepts contained within this module that might be causing difficulty for Jimmy. Identify five strategies you could implement for each concept.

Scenario 2

Jenny is asked to write some 3 and 4-digit numbers. The original numbers and Jenny's responses are recorded in the table below:

Original number	Jenny's number
313	330
4276	4000200706
5008	58

Identify three concepts that are causing difficulty for Jenny. Now, drag and drop three strategies to support each concept.

At this stage of the training I invite you to take a minute to reflect. Consider the content covered so far.

What are the 4 essential components of numeracy you have learnt about?

How might the numeracy skills of a student with Language Disorder present?

What strategies could you utilise to support numeracy development in the classroom?

When you're ready to move on click the next button.

We hope that you have a greater understanding of the numeracy needs of students with Language Disorder, as well as strategies to support them in the classroom.

For more information on the content covered in this module please view the following handouts.

We value your feedback so please complete the following survey to help us improve future learning experiences.

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