UNDERSTANDING WORKING MEMORY

Summary
Working memory is essential for learning and academic success, but it is not the same as IQ. It plays a critical role in managing day-to-day learning tasks, especially during early education. Over time, long-term memory and expertise can reduce reliance on working memory, allowing children to perform complex tasks more efficiently in areas of expertise. This advice sheet aims to offer an understanding of working memory alongside effective strategies that can be used by parents and teachers to support High Learning Potential and Dual or Multiple Exceptional children.

Introduction

Working memory is the ability to hold and manipulate information over short periods and is crucial for learning, problem-solving, and academic achievement. Unlike Intelligence Quotient (IQ), which measures overall cognitive potential, working memory directly impacts daily learning tasks like following multi-step instructions and processing new information.

Parents can support their child's working memory by using memory aids and strategies, while teachers can support developing working memory by reducing cognitive load and providing structured support in the classroom. With effective scaffolding children can thrive academically and develop confidence in their abilities.

What is Working Memory?

Working memory refers to the brains capacity to temporarily store and actively work with information. This capacity is necessary for tasks like problem-solving, decision-making, and comprehension. Unlike short-term memory which passively holds information, like remembering a phone number, working memory is when the brain actively processes and manipulates information, such as when solving multi-step mental maths problems or answering reading comprehension questions.

As an individual's knowledge and expertise develops, their reliance on working memory decreases; their long-term memory can compensate for barriers in working memory and support them carrying out complex tasks. High Learning Potential (HLP) and Dual or Multiple Exceptional (DME, also known as twice exceptional or 2e) children, may face challenges with working memory that may be interpreted as attention barriers or camouflaged by their areas of strength.

Working memory is a core cognitive skill that supports thinking, problem-solving, and learning. Understanding how our brains use working memory, how it differs from IQ, and its role in academic achievement can help parents and teachers support gifted children effectively.

How Do Working Memory and IQ Support Academic Achievement?

Although both IQ and working memory contribute to a child's academic achievement, they each play different roles. A child's IQ reflects their overall cognitive potential and is strongly associated with their ability to understand complex concepts, abstract reasoning and their long-term

achievement when motivated. Working memory, can predict day-to-day learning outcomes and attainment in tasks that require a child to effectively process and apply new information.

Working memory is typically a better predictor of immediate learning outcomes because it directly impacts skills like reading comprehension, problem-solving, and writing. If a child has a high IQ but also barriers with working memory, they may struggle with completing certain tasks or following through on multi-step instructions, even if they are able to grasp complex ideas quickly.

How do Working Memory and Long-Term Memory Impact Academic Achievement?
Long-term memory, what a person knows, plays a critical role in reducing the demand on working memory. If tasks are well-practised or familiar, the brain can rely on long-term memory to find solutions based on previous experiences, this allows the brain's working memory to focus on other tasks. For example, a child would be able to answer a simple maths problem like 6 x 8 as they've previously memorised the answer, they will not need to calculate it mentally.

During the early years and stages of learning, working memory is essential because children must hold and process new information. However, as learners acquire knowledge and develop expertise, their reliance on working memory decreases. Knowledge and strategies are stored in their long-term memory, allowing them to perform complex tasks more efficiently. For instance, an experienced reader processes words automatically, rather than blending phonics and finding the meaning related to those combined sounds, this allows their working memory to be used for higher-level comprehension tasks.

This transition of knowledge from the working memory to the long-term memory, highlights how working memory barriers can create challenges in early years foundation stages and throughout formal education. As learners gain knowledge in a subject and draw on long-term memory and experience, the impact of working memory on their academic performance may decrease.

How does Working Memory Manifest in HLP and DME Children?
Many HLP children often excel in verbal or problem-solving tasks, but some may struggle with lengthy or multi-step activities when their working memory is overwhelmed. However, it is important to distinguish between true working memory challenges and barriers related to attention. Sometimes, what looks like a working memory barrier, may be an attention barrier; meaning the challenge isn't storing the information but in being able to absorb it in the first place. This inattention might stem from conditions such as ADHD or from a child's high learning potential itself, particularly if they feel bored due to lack of appropriate challenge or pace. Whilst disinterest in a topic can sometimes mimic working memory challenges, gifted children without an additional diagnosis would typically be expected to be able to focus, even when disinterested.

Additionally, a DME (2e) child, who experiences challenges with working memory differences or attention barriers, may show exceptional focus and performance when learning about areas of interest. In these children, their long-term memory, depth of knowledge, and high motivation can help compensate for barriers. It is also possible that younger DME children may be able to camouflage their barriers, particularly if they are not challenged enough as this may mean that barriers aren't evident at the level they are being provided with. It may only be in Key Stage 2 or secondary school, when academic demands increase, that working memory or attention

challenges fully manifest. Recognising these patterns and conducting careful holistic assessments are essential to establishing the cause of barriers and ensuring appropriate support is provided.

Supporting Working Memory at Home
As parents, you can use several strategies to strengthen and support your child's working memory at home:

- **Chunk Information**: Break tasks or instructions into smaller, manageable steps.
- **Use Visual Aids**: Provide diagrams, charts, physical prompts or written instructions to supplement verbal information and instructions.
- **Repetition and Practice**: Encourage rehearsal of information in engaging ways through games, flashcards, or repetition.
- **Allow Processing Time**: Give children time to think and process instructions before moving on or repeating the instructions.
- **Play Memory Games:** Activities like puzzles or memory games can help improve working memory skills.

Building long-term memory can also help compensate for working memory challenges. Encourage frequent practice of foundation skills, such as multiplication tables or sight words, and use mnemonic devices to link new information to existing knowledge. Organising information into categories or using a colour-coded system can further aid memory recall and help your child approach tasks with greater ease.

Helping Children to Support Their Own Working Memory
Helping children develop strategies they can use independently for their working memory is essential for their long-term success and well-being. Parents and teachers can guide children to:

- **Develop Personal Memory Aids**: Encourage them to create to-do lists, these can be handwritten or digitally but should include the steps required to complete a task.
- **Make Connections:** Help them link new information to prior knowledge, feelings, or emotions, which can create stronger retrieval pathways.
- **Use Mnemonics**: Support them in making information more memorable using rhymes, songs, acronyms, or phrases. For example, "Stalactites hold tight to the ceiling, while stalagmites might reach the top."
- **Visualise Tasks:** Teach children to use guided imagery, mental rehearsal, or visualisation techniques to retain information.
- **Engage in Active Reading:** Encourage highlighting or underlining key points, taking notes, using sticky notes, drawing or modelling the content.
- **Practise Verbal Rehearsal:** Teach them to say information aloud in their own words to reinforce understanding.
- **Become the Teacher:** Ask children to explain what they are learning to you, someone else or even a toy, this process helps them organise and cement the information in their memory.

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- **Use Multi-Sensory Approaches**: Incorporate activities that engage multiple senses, such as speaking, listening, writing, and physical movement, to strengthen memory connections.
- **Leverage Interests**: Encourage using personal interests, like imagining a task as a Lego build or creating rhymes or songs, to make learning more engaging and memorable.
- **Ask for Help:** Teach children to feel confident in seeking support when needed, fostering both academic progress and emotional well-being.
- **Prioritise Well-Being:** Emphasise the importance of reducing stress, managing anxiety, and ensuring adequate sleep, whilst providing strategies/support on how to do this as these factors significantly influence working memory.

How Teachers Can Support Working Memory in School

Teachers often play a critical role in identifying and supporting working memory challenges. By reducing the cognitive load of tasks during learning and in tasks required of students to show their learning, teachers can reduce the overwhelm a student may experience. Signs of working memory differences can include forgetting parts of multi-step instructions, struggling to complete tasks requiring mental processing, or losing focus during lengthy activities. Other signs might include worrying that they will miss something, such as frequently asking lots of questions or seeking reassurance about whether they are completing a task correctly. Inconsistent performance is another indicator, where a child may perform beyond expectations at times and below expectations at others.

Some effective classroom strategies include:

- Providing both written and verbal instructions with simple language.
- Modelling problem solving, step by step.
- Breaking assignments into smaller parts.
- Using visual schedules or checklists to support organisation.
- Allowing extra time for tasks with heavy cognitive demands.
- Regularly checking for understanding by asking students to repeat or paraphrase instructions.

Teachers can also leverage long-term memory by incorporating frequent reviews of key concepts, using group discussions to link new information to prior knowledge, and providing opportunities to practise foundational skills. These approaches not only support working memory but also build habits and automatic processes which reduces the cognitive load on students.

Additional Considerations for DME (2e) Learners

Supporting DME (2e) children requires patience and understanding. It is important to celebrate their strengths whilst addressing their challenges. Collaboration with school staff to develop personalised support plans, such as Individual Education Plans (IEPs), can ensure these children receive the help they need to thrive. Recognising that their gifts may be masked by difficulties is key to fostering their growth and potential in the long-term.

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Further Information

Understood-What is Working Memory https://www.understood.org/en/articles/working-memory-what-it-is-and-how-it-works	Article from understood.org summarising working memory and offering further information on related topics.
The Memory and Processing Guide for Neurodiverse Learners: Strategies for Success by Alison Patrick	Study guide aimed at children and teens to help them understand different ways to learn and looks at the theory behind strategies outlined.
How Can I Remember All That?: Simple Stuff to Improve Your Working Memory by Dr Tracy Packiam Alloway	This book looks at what working memory is and offers strategies to improve barriers caused by differences in working memory. Also includes a guide for parents to how barriers in working memory can be tested.
Working Memory and Learning: A Practical Guide for Teachers by Dr Tracy Packiam Alloway and Susan Gathercole	This book aimed at teachers, SENCOs, teaching assistants and other professionals; offers an overview of the role working memory plays in learning during a child's school years, it discusses how theory can be used to inform good practice.
Working Memory in the Primary Classroom: Practical and Inclusive Strategies for Curriculum Success in Maths and English by Catherine Routley	This book is a practical resource designed to support working memory and curriculum success in Key Stage 1 and Key Stage 2 classrooms. It includes resources teachers can use in the classroom to support working memory in their students.
Mind Maps For Kids: The Shortcut to Success at School. An essential workbook for improving memory, focus, and study skills in young learners by Tony Buzan	Aimed at children aged 7-14 years old, this is a full-colour workbook, which aims to make learning fun. This practical book includes step-by-step guides, tips for improving memory and concentration alongside cartoons, jokes and brainteasers.