# Children's Vision & Learning - Understanding Visual Processing Skills for Academic Success


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Wave 2026 + Optical Dispensers Australia

The University of Melbourne

# Learning Objectives

**By the end of this lecture, attendees will**

- Gain a deeper understanding of their role in supporting children's overall learning and development through comprehensive visual assessments.

# Visual Processing Matters

**Normal Visual Acuity ≠ Normal Visual Cognition**

**Learning Places Complex Demands on Vision**

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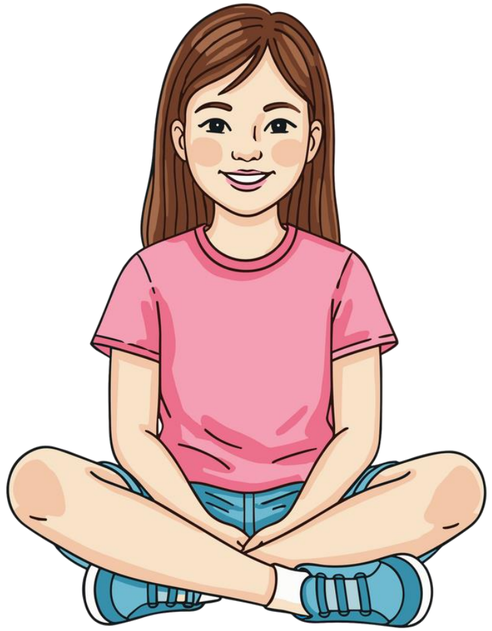
**A seven-year-old female presents with parental concerns of difficulties with reading and writing at school.**

# Sound familiar?



1. How would you work up your patient in order of priority?
2. How would you justify your plan to your peers, the parents and your inter-professional colleagues?
3. What would your overall assessment & management plan of this case include?

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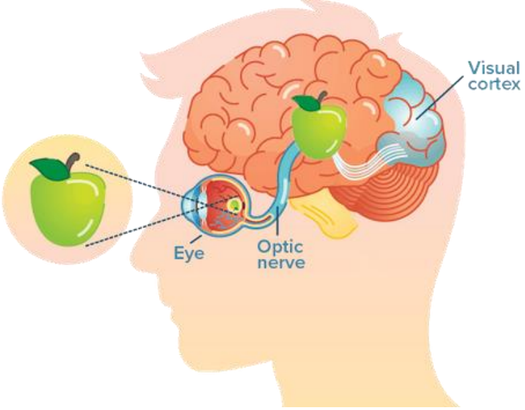


# What is Visual Processing?

How the brain interprets visual input beyond seeing clearly

# What is a Visual Processing Disorder(VPD)?

A learning challenge affecting how students process and understand **visual-spatial information**

**Not due to attention deficits,** oppositional behaviour, or low intelligence

Often **masked by strong verbal skills,** making it harder to identify in the classroom

Fisher, P. W., Litwin, H. D., Riddle, M. A., & Margolis, A. E. (2025). Report of a Work Group on Nonverbal Learning Disability: Consensus Criteria for Developmental Visual-Spatial Disorder: Reconceptualizing Nonverbal Learning Disability for DSM Consideration. J Am Acad Child Adolesc Psychiatry, 64(8), 882–896. https://doi.org/10.1016/j.jaac.2025.01.007

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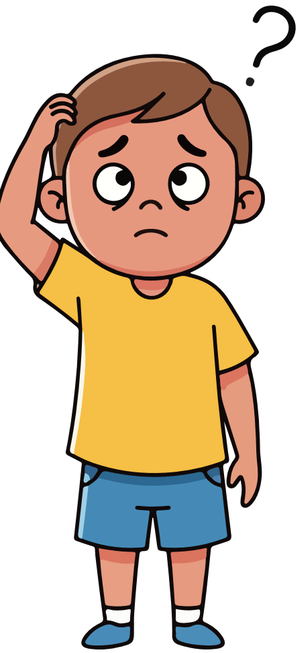
# Definition Conundrum?



Visual Processing Disorder (VPD)
Non-Verbal Learning Disability (NVLD)
Developmental Visual Spatial Disorder (DVSD)

**Same Neuro-developmental Profile**
**Different Professional Lens**
(Psychology | Education | Vision Science)
**Visual–Spatial Processing Weakness**

Fisher, P. W., Litwin, H. D., Riddle, M. A., & Margolis, A. E. (2025). Report of a Work Group on Nonverbal Learning Disability: Consensus Criteria for Developmental Visual-Spatial Disorder: Reconceptualizing Nonverbal Learning Disability for DSM Consideration. J Am Acad Child Adolesc Psychiatry, 64(8), 882–896. https://doi.org/10.1016/j.jaac.2025.01.007

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Optometrists WILL be consulting with families who have children in this sub-group!

# Why Does it Matter?

- **Learning difficulties are common**
  - 16–20% of students experience general learning difficulties
- **Reading disability/dyslexia affects ~10% of Australian children**
- **Visual deficits are prevalent**
  - ~20% referral rate for visual problems in Australian children
- **Uncorrected vision impacts academic performance**
  - Including lower reading and achievement scores
- **Early detection and treatment improves reading outcomes**

(Organisation for Economic Co-operation and Development, 2008; Westwood, 2008) (Skues & Cunningham, 2011).(Junghans & Kiely, 2002).(Atkinson, 2002; Williams, 2005)..Roch-Levecq, 2008; Mathers & Keys, 2010)

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# Relevance to Community

## Life-long Ramifications - Low Literacy

- Negative academic learning experience
- Anxiety, depression, low self esteem, suicide, crime
- Impaired socio emotional development
- Limited independence day to day tasks
- Reading signs, filling forms, communication
- Community/public – prison, crime, financial burden

KPMG Foundation, (2006). The long term costs of literacy difficulties. Retrieved from http://www.dyslexia-international.org/wp-content/uploads/2014/08/KPMG_ecr_costs-2006.pdf

# Visual Processing vs Visual Efficiency?

## Modern Classrooms = High Visual Efficiency Load

- Most near classroom work occurs at **20-25 cm**
- **High vergence demand** from short WD
- Constant board-desk shifts means **high accommodative load**
- VA: **D 6/12 N 6/30**
- **70%** School Day - Visual Tasks

**Modern classrooms need more than just good eyesight — they require optimal visual efficiency**

**(Alignment | Focus | Adaptability)**

Narayanasamy, S., Vincent, S. J., Sampson, G. P., & Wood, J. M. (2016). Visual demands in modern Australian primary school classrooms. *Clinical & Experimental Optometry, 99*(3), 233–240.

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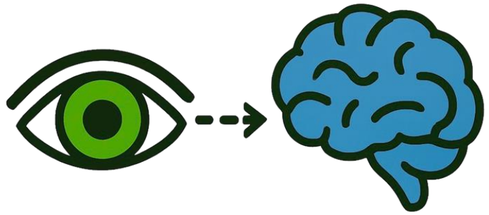

# Visual Cognition and Learning

**Eye Movements *(Rayner) - A Reflection of Visual Attention***

- Saccades – length
- Regression Saccades - frequency
- Fixations – quality & duration
- Reading Eye Movements - DEM | King Devick

**Visual Spatial Attention *(Facoetti, Vidyasagar, Lawton)***

- Visual Search Tasks (feature & conjunction)
- Visual Span
- Direction Discrimination
- Visual Information Processing (TVPS)

**Research Largely Centred Around Dyslexia & ADHD**

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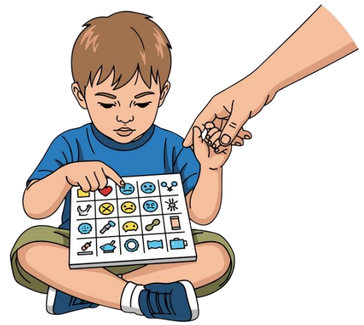
# Visual Spatial Attention

***(Tasks directed at evaluating level of visual cognition)***

## Visual Search



- Visual search skills in reading disability worse than typical readers - **primary years and pre-literate years**
- Visual search efficiency correlates with reading ability in children & left/right visual cortical size asymmetry relates to reading ability in children. Findings suggest a **deficit in visuo-spatial attention in dyslexia.**

## Visual Sequential Memory

- Visual sequential memory **poorer in children with poor reading** in elementary years - **worse with coexisting ADHD**

- **72.7%** of children with **Dyslexia or Reading Disability** have **a Visual Processing Disorder.**

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# Effect of Visual Perceptual Training on Reading Fluency?

58 Dyslexic Children (grade 2)
Standardised testing before and after intervention
Compared 3 Interventions:

a. Visual attention (Motion Direction Discrimination Training)
b. Phonological (Fast For Word Program)
c. Auditory training (Linguistic Word Building Intervention - Control)

| | |
|---|---|
| Reading fluency | Attention |
| Phonological processing | Working memory |

Visual activites focused on dorsal stream function
Each intervention - 20 weeks long

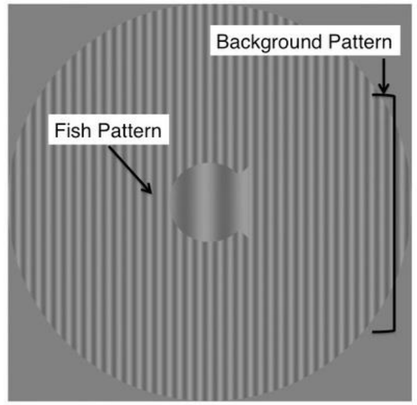

Figure 1. Sample PATH pattern

**Visual Intervention Group - Most Improvement**
**Attention | Reading fluency | Working memory**

**Dyslexia - Dorsal Stream Deficit + Phonological Processing**

**Recommend Interventions Include Visual Pathway Tasks**

Lawton, T. (2016). Improving Dorsal Stream Function in Dyslexics by Training Figure/Ground Motion Discrimination Improves Attention, Reading Fluency, and Working Memory. Front Hum Neurosci, 10, 397.

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# Visual Processing Deficits - Impact

- Visual Processing Problems impact skills beyond reading, including **following instructions & understanding mathematics**
- Collaboration needed between **teachers and families** to identify challenges early and **develop tailored strategies**
- Consistent communication to foster a **supportive network** & boost children's confidence to enhance their educational experience

https://www.insightcollective.net/current-news/2021/09/07/the-elephant-in-the-room-impact-of-visual-spatial-deficits-in-children-with-learning-disabilities-and-why-it-goes-untreated

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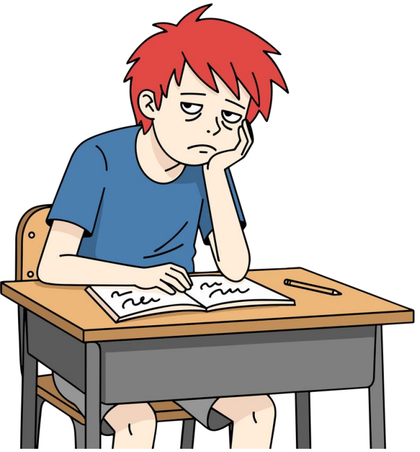

# Common Classroom Challenges

- **Writing & Drawing**

Poor spacing, inconsistent letter sizes, difficulty copying from the board

- **Math & Geometry**

Trouble visualising shapes, estimating sizes, and understanding spatial relationships

- **Organisation & Navigation**

Difficulty keeping desks tidy, finding belongings, or remembering classroom layouts

- **Following Instructions**

Struggles with diagrams, maps, or assembly tasks like puzzles or crafts

- **Sports & Physical Awareness**

Awkward movements, difficulty tracking fast-moving objects, poor sense of direction

- **Reading & Scanning**

Losing place in text, trouble filling out worksheets with designated spaces

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# Learning & Behaviour

- Students may appear **disorganised, forgetful,** or struggle with multi-step tasks
- They might **avoid certain activities** (e.g., drawing, team sports) due to frustration
- Can lead to **anxiety or low confidence** in academic settings

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# Cortical Visual Impairment (CVI)

- Most commonly identified in children with **Cerebral Palsy** BUT poorly understood
- Children with CVI have more visual problems than ADHD, Dyslexia and typically developing children
- Level of VA and severity of CVI DO NOT correlate **(not acuity dependent)**
- CVI often **mistaken for behavioural or learning disabilities** highlighting a need for **more concise screening tools**
- **Visual Search** is impaired **(slower and less accurate)** in children with CVI, ADHD & Dyslexia relative to typically developing children

Hokken, M. J., van der Zee, Y. J., van der Geest, J. N., & Kooiker, M. J. G. Parent-reported problems in children with Cerebral Visual Impairment: Improving the discriminative ability from ADHD and dyslexia using screening inventories. Neuropsychological Rehabilitation, 1-21. https://doi.org/10.1080/09602011.2024.2328875

Hokken, M. J., et al. (2023). "Visual selective attention and visual search performance in children with CVI, ADHD, and Dyslexia: a scoping review." CHILD NEUROPSYCHOLOGY 29(3): 357-390.

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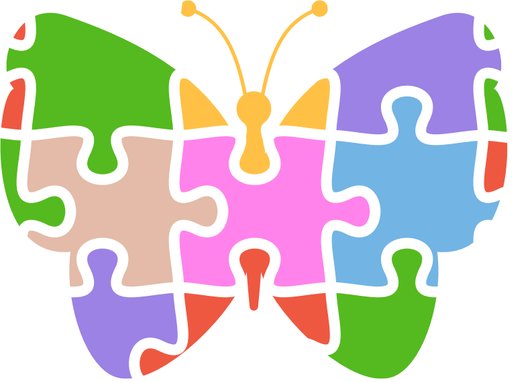

# Autism

- Children with Autism suffer a **variety of visual problems** such as refraction, eye movements, binocular vision, refractive errors

- They also demonstrate **visual cognition challenges such as visual attention, crowding, and higher order visual functions**

- Not well understood - more research needed but review emphasises need for **comprehensive vision care** for individuals with Autism

Little, J. a. (2018). "Vision in children with autism spectrum disorder: a critical review." Clinical and Experimental Optometry 101(4): 504-513.

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# Visual Processing Skills

**Visual Discrimination:**

- Recognising differences between visual stimuli

**Visual Memory:**

- Recalling visual details

**Visual Closure:**

- Identifying incomplete images

**Visual Sequencing:**

- Remembering sequences of images

**Visual-Spatial Skills:**

- Understanding spatial relationships

**Visual Motor Integration:**

- Coordinating visual input with motor actions

# Testing Visual Processing Skills in Children

## Why test visual processing?

1. What is the indication?
2. How will this help my patient?
3. What can I do with the information obtained?
4. What is my goal?

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# Why Assess Visual Processing Skills?

Early Detection
Support for Learning Challenges
Behavioural Concerns

# Intervention Approaches

Vision Therapy
Occupational Therapy
Educational Strategies
Classroom Accommodations
Remedial Reading Programs
Environmental Modifications

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**Table 1: General visual perceptual difficulties***

The child/student:

- Exhibits poor motor coordination
- Uncoordinated–frequent tripping, stumbling, bumping into things, having trouble skipping and jumping
- Communicates infrequently with gestures or through physical “acting”
- Does not enjoy books or pictures, perhaps does not enjoy video games
- Demonstrates restlessness, short attention span, perseveration
- Plays games poorly; cannot imitate children in games
- Exhibits poor handwriting, artwork, drawing
- Exhibits reversals of the letters b, d, p, q, u, n when writing [beyond age 7]
- Inverts numbers or reverses numbers
- Requires auditory cues
- Gives correct answers when teacher reads test but cannot put answer on paper
- Fails to understand what is read
- Exhibits poor performance on group achievement tests
- Appears brighter than test scores indicate
- Has poor perception of time and space

# Indications for Testing Visual Processing Skills

Piquet and Boulet, Visual Impediments to Learning, Optometry and Visual Performance, Vol 1 Issue 4 2013

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# Why Early Identification of Visual Processing Matters

- **Impacts how children access and process learning**
  - Without early identification & intervention, difficulties compound and impact educational progress.
- **Learning and sensory challenges are common**
  - Children may appear inattentive, easily distracted, or fatigued.
  - Often hypersensitive to movement and noise — masking underlying visual issues.
- **Validated tools are urgently needed**
  - Accessible, percentile-based assessments can track progress over time.
  - Tools must accommodate diverse learners, including those with communication challenges.

McDowell, N., St Clair Tracy, H., Blaikie, A., Ravenscroft, J., & Dutton, G. N. (2024). Hiding in plain sight: children with visual perceptual difficulties in schools. Frontiers in Human Neuroscience, 18, 1496730.

# How Educators Can Help

## Use Verbal Cues

Provide step-by-step spoken instructions rather than relying on diagrams

## Give Extra Time

Allow more time for copying, writing, and organizing work

## Break Down Tasks

Use checklists and color-coded materials to aid organisation

## Provide Hands-On Learning

Incorporate physical movement and manipulatives (e.g., blocks, models) in lessons

## Seat Strategically

Place students where they have clear visual access to the board and teacher

## Encourage Self-Advocacy

Teach students to ask for help and use strategies that work for them

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# Visual Information Processing Evaluation

**How will this help my patient?**

**What can I do with the information obtained?**

**What is my goal?**

1. Help decide whether a child will benefit from intervention or requires referral
2. Help support education professionals with classroom accommodations
3. Help decide which aspects should be emphasised during therapy/intervention
4. Provide a baseline from which to measure progress for comparison after therapy
5. Identify areas where further assessment may be indicated and appropriate referral made to colleagues or other education or health professionals

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# Visual Information Processing Test Protocol

| TEST | DESCRIPTION |
|---|---|
| **DEM** (Developmental Eye Movement Test) | Evaluation of **reading eye movement** skills & **Naming Speed** |
| **TVPS** (test of visual perceptual skills) | visual cognition **non-motor visual information processing** skills |
| **TVAS** (test of visual analysis skills) | **visually driven analysis & motor integration skills** |
| **DOT PATTERN TEST (NDPA)** | **visually driven analysis visualisation & sequencing skills** |
| **Incomplete Man Test** | **visually driven motor integration skills** |
| Wold **Visuo-Motor Test** | **visually driven motor integration skills** |
| Wold **Sentence Copy Test** | **visually driven motor integration skills** |
| **TAAS** (test of auditory analysis skills) | **Phonological skills** screening tool |
| **GRFT** (Gardner's reversals frequency sub-test II | Visually driven **directionality skills** |
| **Piaget** left-right awareness test | Visually driven **directionality skills** |

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# What Tests Screen Visual Cognition?

| Feature | Traditional Standardised Tests (e.g. TVPS-4, MVPT-4, DTVP-3) | Neuropsych Subtests (e.g. WISC-V, NEPSY-II) | Oculomotor Screeners (e.g. DEM, King-Devick) | Vis-CAT® (In Development)* |
|---|---|---|---|---|
| **Primary Focus** | Visual perception skills | Broader cognitive ability | Eye movements / rapid naming | **Visual cognition (processing & interpretation)** |
| **Motor Demands** | Often mixed (some motor-free) | Yes (construction tasks) | Verbal output | **Motor-minimised digital response** |
| **Administration Context** | Clinic-based | Psychologist setting | Clinic / sideline | **School-based, scalable** |
| **Time Required** | 30–60+ mins | Part of full battery | 2–5 mins | **Brief digital screener** |
| **Designed for Universal Screening?** | No | No | No | **Yes** |
| **Output for Teachers** | Clinical scores | Cognitive index scores | Speed scores | **Classroom-relevant profile** |

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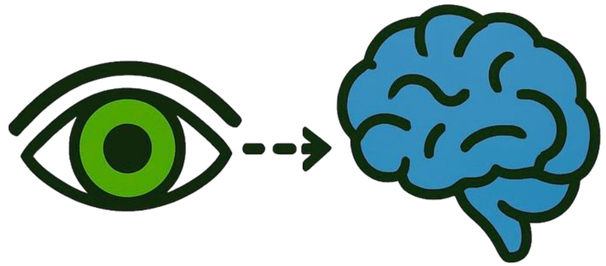
**Declaration of Interest:**
The presenter is the inventor of the Novel Dot Pattern Assessment and the founder and CEO of Area V1 Pty Ltd, the company commercialising the Vis-CAT® digital assessment tool.



# Vis-CAT®

## Online Test

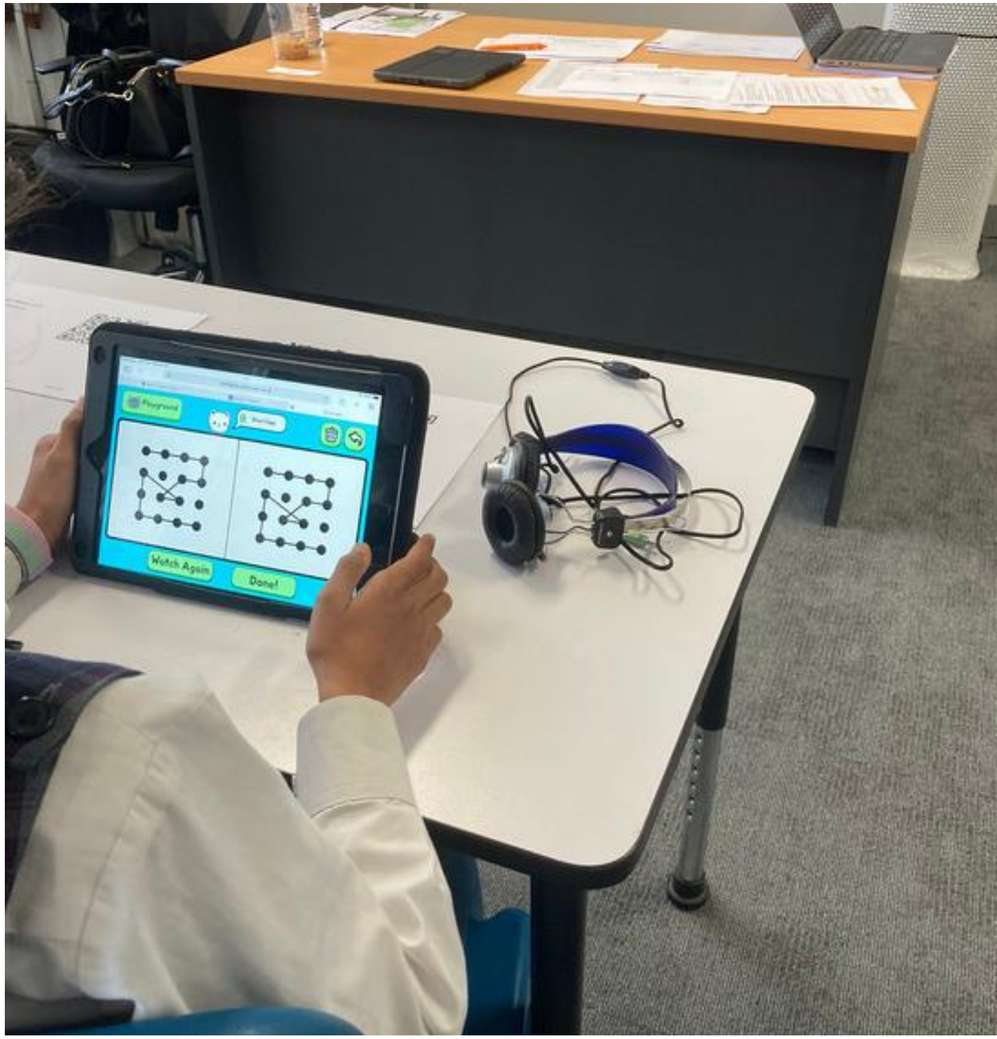
## Game-Based

## Any Touch Screen Device

## Minimal Training

## Tests In Minutes

## Instant Report




Based on a Novel Dot Pattern Methodology1

1Nearchou, C. (2022). A Novel Test for Visual Cognition in Children [journal]. Visual Development and Rehabilitation, 8(4)

**A seven-year-old female presents with parental concerns of difficulties with reading and writing at school.**

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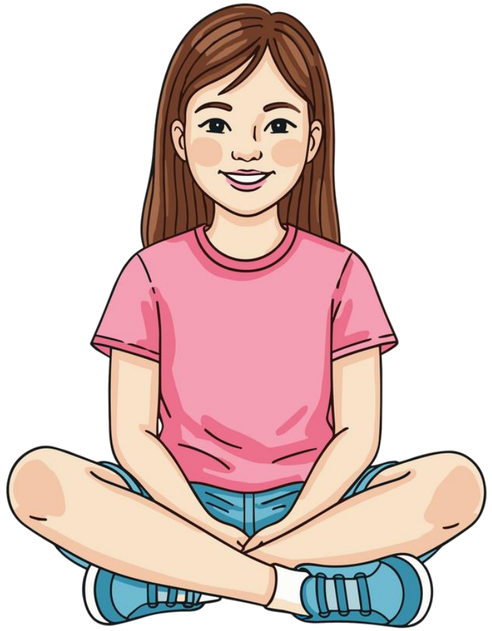

1. How would you work up your patient in order of priority?
2. How would you justify your plan to your peers, the parents and your inter-professional colleagues?
3. What would your overall assessment & management plan of this case include?

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# Enhancing Awareness of Current Opinions and Research

- Has your perspective on this case shifted?
- Do you feel the need to rethink your existing strategies?
- Are you able to present an evidence-based plan for discussing this case with your colleagues, both within and outside optometry?

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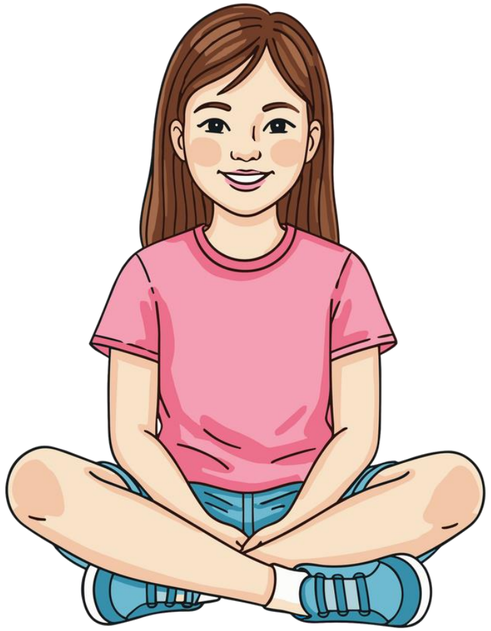
# Seven Year Old Female?

1. **History** – what is the problem exactly?
2. **Visual Integrity** - RE, Anterior, Posterior Eye
3. **Visual Efficiency -** Needs to be thorough (*vision for purpose)*
4. **Manage** 2 & 3
5. **Still an issue?**
6. **Visual Information Processing Assessment -** directed, clear plan, evidence based, standardised tests
7. Plan and propose a **management plan**
8. **Share** your expertise (not just an optometry issue)!
9. **Educate/liaise** with family, inter-professional collaboration (education, allied health, medical, psychology)



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# Take Home Points

- **Vision underpins learning:** vision shapes attention, language, and how information is accessed — not just what is seen
- **Functional vision matters:** acuity alone misses how children use vision to attend, discriminate, and integrate information
- **Visual Processing matters:** Early action improves outcomes
- **Visual barriers are often misattributed:** difficulties may appear as language, attention, or learning issues
- **Early identification prevents secondary impacts:** subtle, context-dependent visual challenges can compound over time
- **Vision is an equity issue:** identifying visual-cognitive access supports educational participation and inclusion

Perez, A., & Perez, A. (2026). Vision, Language and Learning Early Visual Experience as a Foundation for Language and Learning: A Developmental Framework for Educational Access in Young Children with Disabilities.

# Thank you!


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