

PART 2:

COGNITIVE CONSEQUENCES OF EPILEPSY



Cognitive issues present in the majority of children with epilepsy

Cognition refers to a variety of skills such as attention, processing speed, learning and remembering, intellectual reasoning abilities, expressing and understanding language as well as planning and problem solving.

Cognitive issues are often present early on in the course of epilepsy or may even predate the onset of seizures (Smith et al., 2013; Besag et al., 2016).

The most common issues affecting academic achievement are:

- Attention
- Processing speed
- Memory
- Intellectual Disabilities



Students with epilepsy may also have difficulties in executive, language, and motor functions, which may impact their performance in school.

The cognitive, psychological and social consequences of epilepsy play a major role in school success and in determining the educational and occupational outcomes of a student living with epilepsy.

Attention is readily impacted because attention networks are widely distributed throughout the brain.

Sustained attention, or the ability to remain focused for extended periods of time particularly if something feels boring or tedious, is a common issue for many students with epilepsy.

ADHD is significantly more common in children/youth with epilepsy than in the general population. Approximately 30 to 40% of children/youth with epilepsy meet criteria for ADHD (Besag et al., 2016). The inattentive subtype is most common. Males and females are equally represented.

Educational and behavioural supports used for any student with attention problems can be effective for children living with epilepsy.

Strategies to support students who have attention issues

Checklist:

- Set up the environment to reduce distractibility.
- Consider having the student sit at the front of the class, close to the teacher and away from doors and windows.
- Provide the opportunity for access to a quiet workspace.
- Consider the effect of the atmosphere: calm, music, colours.
- Provide notes in advance.
- Provide clear, explicit, concise instructions.
- Use engaging and varied activities, emphasizing the student's interests.
- Tailor appropriately paced/time activities.
- Use visual prompts: timetable or checklists.
- Gain attention before giving instructions: use eye contact/child's name.
- Provide prompts to attend (look, listen, respond).
- Modify/limit the task length (clear beginning/clear end).
- Have the student identify something to look forward to after the work is done.
- Encourage the student to participate actively in the classroom to maintain attention.
- Provide regular work breaks.
- Alternate intense working periods with periods of recreation.
- Assist in breaking down information into short pieces that are "do-able".
- Offer a lot of positive feedback and try to limit corrective feedback.
- Identify and encourage strengths.
- Use reward systems to boost self-esteem.
- Evaluate the student using short tests over a series of days.

Slow or inconsistent processing speed is common, resulting in:

- Variable responding
- Slower reaction time on tasks
- Difficulty in working quickly and methodically
- Difficulty learning a routine
- Difficulty keeping pace with lessons
- Gaps in learning
- Frustration



Strategies to support students who have slow processing speed

Checklist:

- Speak at a slower pace and provide concise information.
- Use sequential and clear language.
- Simplify tasks by dividing information into chunks.
- Use a multisensory approach - visual, auditory, kinesthetic.
- Recap and fill in the gaps in learning as much as possible.
- Give extra time.
- Use cueing mechanisms to prepare student for changes.
- Teach independent strategies (e.g. write lists, pack homework and class notes into knapsack after each subject to avoid rushing at the end of the day).
- Provide visual/written information to support verbal instructions.
- Use visual timetables and colour coding.
- Provide a note taker or audio or video record of lesson.
- Offer longer times for writing tests and exams.
- Avoid competitions (fastest first).

Memory is vulnerable to seizure activity

70% of children living with epilepsy report issues with memory in their daily lives (Smith et al., 2006) and over 50% of children with ongoing seizures display weakness in some aspect of memory when formally assessed (Reilly et al., 2014).

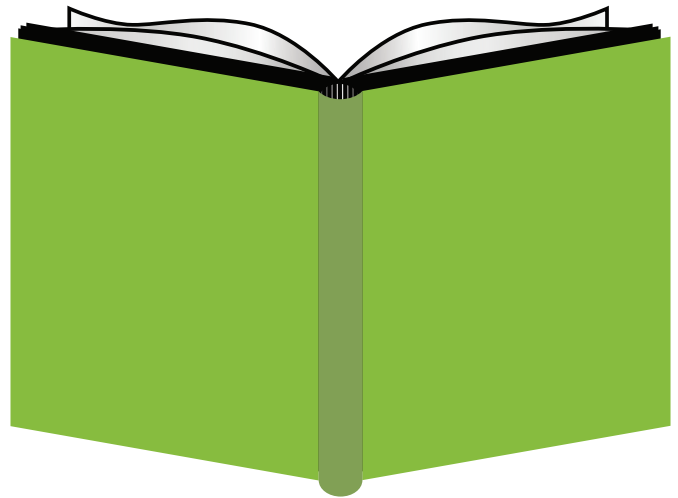
Memory is a complex operation which can be affected by other cognitive processes, such as attention, effort, self-monitoring, speed of information processing, the use of strategies, and organization.

For memory to work properly, the brain needs to continuously monitor itself. Seizures can interfere with the brain's self-monitoring process.

Memories before a seizure can be lost because the brain does not store them properly.

After a seizure, confusion and fatigue can stop memory processes from working correctly.

Interictal discharges (i.e. abnormal firing of neurons below a level that would cause a seizure) disrupt the formation and retrieval of memories.



Memory issues involve consolidating, retaining and transferring newly learned information.

The most common issues with memory experienced by students living with epilepsy include:

- Forgetting what they have just heard or read.
- Forgetting remote events such as special trips they went on.
- Retrieving words or information that are needed in the moment in order to express their ideas or to participate in class discussions.
- Abnormal rapid forgetting of information that they had previously learned.

Strategies to support students who have memory issues

Checklist:

- Activate learning by making topics meaningful to the student.
- Find ways to relate the content being discussed to the student's prior knowledge or interests.
- Use different learning styles (visual, auditory, kinesthetic).
- Teach information in clear, small chunks.
- Establish routines; keep things in the same order.
- Use hands-on activities.
- Repeat the important messages and information.
- Teach mnemonics, and use music cues, drills.
- Ask the student to generate their own memory cues.
- Use visual aids: photobooks, checklists, task cards, keywords, timetables, post it notes, pictures.
- Encourage the use of a journal to keep track.
- Allow the student time to review.
- Give students and parents review materials and lessons that the student can do at home or at a later date.
- Recognize that rote learning will require effort and support.
- Create an environment where students do not have to rely heavily on memory (open book, access to computer, access to notes).
- Focus less on information retrieval by recall and more on recognition.
- Avoid tests that emphasize memorization (e.g., fill-in-the-blank items).
- Provide students with a list of formulas for math and science, having them select and apply the appropriate one.
- Have the student practice retrieving the information to be learned (using cues, recognition, exercises).
- Communicate with parents via planners or online about class programs.

Intellectual reasoning abilities

Intellectual reasoning abilities refer to general mental abilities.

Compared to other individuals their age, a greater number of students with epilepsy will experience mild (Low Average), moderate, or significant weaknesses in their intellectual reasoning abilities (Prasad et al., 2014).

Those with significant weaknesses will meet criteria for an intellectual disability (i.e. at or below the 2nd percentile for their age).

Overall, approximately 15-25% of children with epilepsy meet criteria for an intellectual disability; however, rates are higher when only children with ongoing seizures are considered (Reilly et al., 2014).

Strategies to support students with weak reasoning abilities

Checklist:

- Check for understanding.
- Provide concrete examples.
- Teach reasoning overtly by talking out loud, modelling, and offering rehearsal.
- Be direct - express complex ideas as simply as possible.
- Provide opportunities for experiential learning.
- Set up opportunities for learning to be reinforced at home.

Executive functioning

Students with epilepsy, as well as those with ADHD and learning disabilities, can display problems with executive functioning.

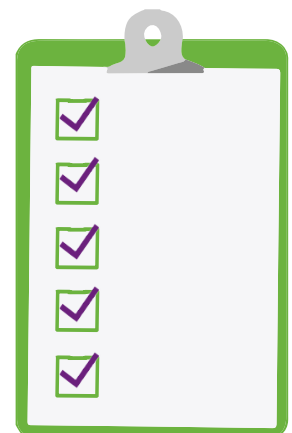
Executive functioning refers to a set of self-directed skills including:

- (1) Concentrating on things.
- (2) Planning and organizing problem solving approaches.
- (3) Regulating emotions, behaviour, and attention.
- (4) Cueing oneself to use previously learned information.
- (5) Initiating activities.

Strategies to support students with executive functioning and organization

Checklist:

- Change the environment to support skills.
- Set up and have the student follow routines; when activities become habitual they require less active processing and are less likely to be forgotten.
- Use short instructions and have students check off each step as it is completed.
- Use visual prompts.
- Use engaging, varied activities to meet the needs of students with different learning styles.
- Use eye contact.
- Modify the tasks to support development.
- Provide the student with more time.
- Tailor the pace and time of activities.
- Provide regular breaks, including those with physical exercises.
- Limit multi-tasking; focus the student on one activity at a time to reduce the demand on working memory and to limit distractions.



- Consider the effect of the class atmosphere on learning and remove distractions.
- Give warnings well ahead of time for changes in routine to aid with transitions.
- Proactively plan for changes in routine whenever possible.
- Check notebooks frequently.
- Have duplicate copies of worksheets for students who misplace items.
- Model problem-solving explicitly (thinking out loud).
- Use step-by-step problem-solving approaches and provide a template.
- Prior to initiating the task, teach the student to divide the activity into multiple steps.
- Model organizational strategies throughout the school day.
- Teach students how to use a planner.
- Break the planner into sections: a calendar with sufficient space for writing daily activities, address book, general to-do list, assignment due date.

Language and communication

Children living with epilepsy may experience language difficulties. Sometimes the disturbance relates to difficulty in a broad range of receptive and expressive skills. Some types of epilepsy may produce specific patterns of difficulty.

Strategies to support students who have language and communication difficulties

Checklist:

- Speak clearly, slowly and be specific.
- Use non-verbal communication to enhance verbal instructions.
- Allow more time and check for understanding.
- Repeat and rephrase instructions.
- Use open ended questions to promote dialogue.
- Use group work and role play.
- Teach key words.
- Use visual prompts (objects, photos, pictures, symbols).
- Classify and group objects and pictures together.
- Teach singing.
- Engage the student in conversation - include new words and explain their meaning.
- Encourage parents to read to the child every day.
- When the lesson contains a new or interesting word - pause and define the word.
- Play word games.
- Have a daily checklist of take home materials in the student's planner.
- Provide a daily schedule on the board or in the student's planner.



- Provide parents with important dates/reviews/tests.
- Support word retrieval.
 - Provide a phonemic and/or semantic cue.
 - Encourage visualization and gestures.
 - Encourage self-cueing.
- Consider consultation with or assessment by speech and language therapist.

Motor co-ordination

Children with epilepsy may experience problems in motor functioning, including both reduced fine-motor and gross-motor skills.

- Slow motor output
- Weakness in both sides or one side
- Gait and balance issues
- Difficulties with coordinated movement

These issues may have implications for handwriting and note-taking, and for moving between one class and another.

Strategies for fine motor issues

Checklist:

- Provide a note taker to scribe for the student.
- Provide hand-out of board work.
- Offer the opportunity to take tests orally to assess understanding.
- Provide extra time for assignments and tests.
- Consider key-boarding as an alternative to printing or cursive writing.
- Check to see if the student is eligible for Special Equipment (e.g., SEA claim for a computer).

References:

Besag, F., Gobbi, G., Caplan, R., Sillanpää, M., Aldenkamp, A., & Dunn, D. W. (2016). Psychiatric and behavioural disorders in children with epilepsy (ILAE Task Force Report): epilepsy and ADHD. *Epileptic Disorders*, 18(s1), S8-S15.

Prasad, A. N., Burneo, J. G., & Corbett, B. (2014). Epilepsy, comorbid conditions in Canadian children: analysis of cross-sectional data from cycle 3 of the National Longitudinal Study of Children and Youth. *Seizure*, 23(10), 869-873.

Reilly, C., Atkinson, P., Das, K. B., Chin, R. F., Aylett, S. E., Burch, V. & Neville, B. G. (2014). Neurobehavioral comorbidities in children with active epilepsy: a population-based study. *Pediatrics*, 133(6), e1586-e1593.

Smith, M L., Elliott, I. M., & Lach, L. (2006). Memory outcome after pediatric epilepsy surgery: objective and subjective perspectives. *Child Neuropsychology*, 12(3), 151-164.

Smith ML, Gallagher A, Lasonde, M. Cognitive Deficits in Children with Epilepsy. In Duchowny M, Cross H, Arzimanoglou A (Eds.). *Pediatric Epilepsy*, New York: McGraw-Hill, 2013, pp. 309-322.