# 'Sounding it out' not so easy for children with dyslexia

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Credit: Julia Cameron (Pexels)

For years, competent and well-educated elementary school teachers and well-intentioned, if exasperated, parents have routinely repeated a mantra to struggling early readers: "Sound it out."

But what if a child can't? What if something in a child's brain is blocking their very efforts to achieve such a seemingly simple task?

As part of a multi-year project, partly funded by BrainsCAN, cognitive neuroscientists at Western's Brain and Mind Institute studied children's brains using magnetic resonance imaging (MRI). After a deep dive into the data, they discovered a biological deficit for some that impairs phonological decoding—the ability to sound words out.

The findings are published in the journal Developmental *Cognitive Neuroscience*.

"We now have a much better understanding of how the structure of a developing brain is mirrored in children's reading, language and math development," said Marc Joanisse, associate dean (research) in Western's Faculty of Social Science and senior author of the study.

Explicit training in phonological decoding is critical for reading development and the Western study shows that some children have a specific cognitive impairment in this ability that requires further steps to address, said Joanisse, a psychology professor.

"While it's true that each child is unique, we know what works in the vast majority of children with reading disability, and it's concentrated, one-on-one training in phonological decoding," he said. "Other tactics that involve 'blended approaches' or 'three-cueing' are ineffective in helping children learn to read and are even more unlikely to work in children with significant impairments."

Three-cueing, a widely used albeit controversial reading development method, is based on early readers using meaning, syntax and symbols to identify words. This method would be of limited use for some struggling readers.

The study emphasizes how children use a large network of brain regions to read successfully. There is no one region that is solely responsible for reading; instead, individuals break the task down into different processes including vision, attention, memory and language.

"Learning to read is distributed across many brain regions, and coordinating this requires a large network of connections among these regions," said Joanisse. "The actual processing in the brain happens in the brain's gray matter, which is primarily located in the outer surface of the brain. However, we're increasingly aware that complex abilities require us to coordinate among many gray-matter regions, and those connections are located in the brain's white matter."

After children's brains were scanned using an MRI technique called diffusion tensor imaging, which targets white-matter structure, Ph.D. student Chenglin Lou analyzed the complex network structure of the brain and quantified its topography

from one child to the next, leading to the discovery.

Understanding how the brain functions is critical to helping children with reading disabilities like dyslexia, said Joanisse, but there is still work to be done before new training methods can be developed.

"We understand these kids in terms of their overt reading deficits: they have specific difficulty learning to associate letters with sounds so they can sound out words," he said. "It's still too early to translate this [work] directly, but it gives us a much better idea of what kinds of connectedness in the brain is necessary for successful learning-to-read abilities."

**More information:** Chenglin Lou et al, Rich-club structure contributes to individual variance of reading skills via feeder connections in children with reading disabilities, *Developmental Cognitive Neuroscience* (2021). DOI: 10.1016/j.dcn.2021.100957

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