

# Language, Reading & Math in Children

*A study of the skills that support children's learning*

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## THANKS TO YOU!!

Over the last 2 years, we've had nearly 400 children in Kindergarten participate in our study, 'Early Screening of Children's Learning'! By studying learning in a large group of children like this, we can develop a better understanding of how children learn. Thanks for helping us with this important work!



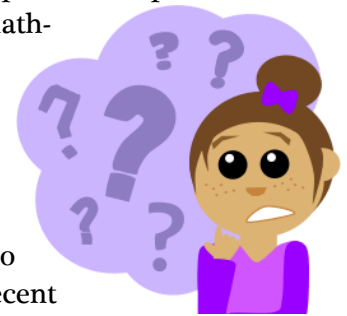
## UPDATE: EARLY SCREENING OF CHILDREN'S LEARNING!

Our research group is interested in understanding young children's learning even before they have learned to read and do math in school. The children in this study complete measures of foundational skills related to language, reading, and math. Then, we examine how these measures relate to reading and math development in grades 1 and 2. This use of our screening tool will help us identify how best to develop these early skills, in order to help all children be the best learners they can be!

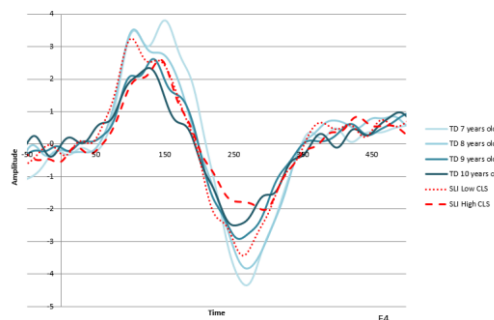


## HOW MATH ANXIETY AFFECTS US

Math anxiety refers to feelings of apprehension when faced with math or math-related situations. Around 20-40% of people have moderate to high math anxiety. High math anxiety is related to poor math performance, and, perhaps most worrying, to avoidance of math-related situations. Math is a skill like any other, so if a person avoids practicing it, how can they hope to improve? When teachers and parents exhibit math anxiety, this can have negative effects on a child's math learning. So, it is important to stay positive about math – to convey that it can be both fun and useful. Recent research has demonstrated that a short creative-writing exercise can help alleviate math anxiety. Through writing about your feelings about math for 5-10 minutes, you can help calm your nerves, reduce math anxiety, and stay focused. – Ian Lyons, PhD.



## BRAIN RESPONSES AND LANGUAGE LEARNING



We're interested in why some children struggle with learning language. We use Electroencephalography (EEG) to see how these children's brains respond to sounds. EEG is a powerful tool that records the electric waves generated by our brain in response to our surroundings. EEG lets us capture very fast brain responses that occur in a fraction of a second! During our study, children sit in a comfortable chair and watch a soundless movie while listening to tones through earphones. We have found that children who struggle with learning language have brain responses similar to what younger children's responses look like. These immature responses may explain their difficulties with learning language.



– Elaine Kwok, MSc.

## LANGUAGE AND PROCESSING

Our brains have to process sounds very quickly to gain all the information that we need, to learn language. Children who are having trouble learning language may have difficulty processing sounds quickly enough. In our bird task, we asked children to decide which of two birds paused between chirps. We kept changing how quickly the two chirps were made to find the smallest gap that the children could detect. Now we want to investigate whether this gap detection skill is related to language, thinking, and processing abilities. It may be that processing sounds more slowly makes it harder to learn basic speech sounds. Alternatively, processing sounds slowly may just be one part of the overall system processing information more slowly.

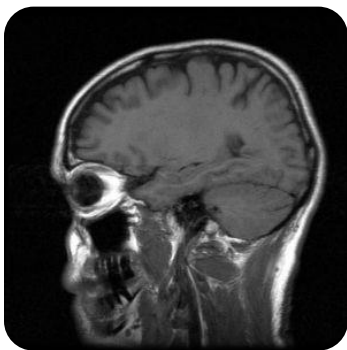
- Rachael Smyth, MSc. Student



## ASSESSING MATH DIFFICULTIES WITH fMRI

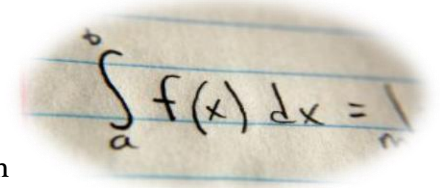
Basic numeracy skills (understanding how many items are in a set, e.g. 3 = three items) are the building blocks for learning more complex math problems, such as adding and subtracting. Learning these skills are important for children to succeed in school and their everyday lives. However, for some children, learning basic arithmetic is difficult. It is important to understand why children have difficulties learning math, in order to develop techniques to help them. We investigated how children with low and high math abilities perform number and math activities differently.

We used functional magnetic resonance imaging (fMRI) to take pictures of their brains while performing different number tasks. For example, children were asked to make number comparisons by selecting



which number is bigger. fMRI is a safe technique that can tell us what brain regions are active during math tasks in children with difficulties compared to those without difficulties. We found that children with math difficulties not only make more errors when performing number comparisons, but they use different brain regions as well. We hope that these findings can help us understand why children have math difficulties. That way, we can try to create ways to identify children who are at risk for developing arithmetic problems. This would also help us design better instructional tools for the classroom.

- Stephanie Bugden, PhD.



## HOW DO WE ACQUIRE LANGUAGE?

How does a newborn infant come into the world and learn to speak our language without a single lesson? One way in which an infant might learn language is by learning the patterns of sounds that naturally occur within speech. The process of learning these patterns is



known as *statistical language learning*. We're interested in what skills might support statistical language learning. One possible underlying skill is a learner's working

memory, the ability to hold information you're thinking about in mind. We have found that when we do a working memory task with words, we struggle to learn other speech sound patterns. It may be that our working memory abilities are essential in helping us to learn new words. So far, we have only studied adults, but we are looking forward to testing this idea in children and infants too!

- Nicolette Noonan, PhD. Candidate

## THE IMPORTANCE OF SPEECH PERCEPTION

Last year, our screening of reading, math, and language in kindergarten students told us about different profiles of learning abilities. One of our



projects this year looks at how these learning profiles relate to speech perception, the process of hearing and understanding speech sounds. Children who have trouble with language and reading also have difficulties processing information that helps identify sounds in the

speech they hear. This difficulty could lead to problems with language and/or reading. To study speech processing, we use a special computer that can track eye movements. Children look at pictures on the computer screen and listen to words through headphones. Some words in our study are recorded with the wrong speech information or cues. By observing what picture the children look at when they hear the wrong speech cue, we can tell whether children are sensitive to these speech cues or not. We're interested in whether children can process speech cues to the same degree as adults can, and whether this ability relates to their reading and language abilities. - Alex Cross, MSc. Student

## THE CHALLENGE OF LEARNING MORE THAN ONE LANGUAGE

Lots of children speak a different language at home from the one they speak at school or in the community in which they live. It takes time to learn a new language. But even with lots of time, some children still struggle to learn the new language. It's hard to know which children need extra help to learn the new language, and which ones just need more time. In this study, we're trying to find the best



measures for identifying children who are struggling to learn the language spoken at their school or in their community, when it's different from the language they learned at home. We want to identify these children as early as possible – even before they know many words in the new language – so we can help them as soon as possible too! The children in our study speak Arabic. Did you know that there are almost 300 million Arabic speakers making up about 4.5% of the world's population? Some of the sounds used in the Arabic language are different from English. There are 28 letters in Arabic writing, and words are written from right to left. Here is what writing looks like in Arabic:

أتمنى لك نهارا سعيدا

Do you  
know what  
this says?



It says:  
Have a nice  
day!

In our study, more than 400 children in Saudi Arabia who speak only Arabic did lots of activities for us. They named pictures, repeated sentences, pointed to matching shapes, and remembered locations of objects. Another group of children in Canada who spoke both Arabic and English did the same tasks, and some other ones in English too. From this data, we'll be able to find the best measures for identifying those who may be struggling to learn both languages.

- Areej Balilah, PhD. Candidate

## EARLY IDENTIFICATION AND INTERVENTION PILOT PROJECT

A multidisciplinary team at Thames Valley District School Board (TVDSB) is currently revising the Early Identification and Intervention procedure for students in Kindergarten through to Grade 3. We are excited to begin this new process for identifying a student's level of development, learning abilities, and needs. This procedure is mandated by the Ministry of Education's Policy/Program Memorandum 11. Our Early Identification and Intervention procedure is being designed to help educators identify students who will need targeted, supplemental programming and also to provide specific strategies to foster skill development in



each of four domains: Self and Social Development; Communication, Language and Literacy; Cognitive and Conceptual Development; and Physical Development. TVDSB is currently piloting the new procedure in 10 schools.

– Dr. Chris Stager, TVDSB

### A SPECIAL THANK YOU

Thank you to all of the school personnel, parents, and children who make our studies possible. Thank you also, to the talented graduate students working on these research projects!

### FIND OUT MORE ABOUT OUR RESEARCH!

Follow the links to find out more about our work:

Our past newsletters:

<http://www.uwo.ca/fhs/lwm/newsletters.html>

Podcasts about our research:

<http://www.uwo.ca/fhs/lwm/index.html>

Lists of our published papers can be found at the lab websites listed below



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