



**The Dyslexia Foundation**  
**EXTRAORDINARY BRAIN SYMPOSIUM XX**

Extending our Knowledge of Context, Theory,  
Neuroscience, and Learning Science to Improve  
Treatments for Students with Dyslexia

June 16-20, 2024

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*Hotel Corinthia  
Malta*

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# Acknowledgements

Since its inception, the Extraordinary Brain Symposium (EBS) has been made possible by the passion and commitment of dedicated individuals who strongly believe in advancing the science and our understanding of dyslexia. None of us, however, would be gathering in Malta this June had it not been for the late William "Will" Baker Jr., the visionary founder of The Dyslexia Foundation (TDF). In 1986, Will founded the National Dyslexia Research Foundation, now known as TDF. In 1987, he convened a scientific symposium in Florence, Italy, with top researchers from cognition, neuroscience, and education, and the concept of a dyslexia symposium series was born. In 1990, TDF sponsored a second symposium in Barcelona, Spain, permanently establishing the EBS, now a biennial research symposium. More than 150 researchers from neuroscience, cognitive science, genetics, and education research have participated in nineteen EBS symposia, and this meeting celebrates our 20th symposium.

It is fitting that Will selected the topic, organizer, and location for our 20th meeting. In 2019, he asked Sharon Vaughn, PhD to spearhead a symposium to consider how treatments for struggling readers, beyond beginning reading, might be improved. Knowing that we would be meeting this June in Malta to continue advancing TDF's mission – and his life's work – gave him strength and made him feel so optimistic about TDF's future.

Many people made this year's symposium possible, but several deserve special recognition. Sharon Vaughn, PhD, has channeled Will's spirit and championed his vision in organizing a meeting he would feel proud to attend. Peggy McCardle, PhD, and Astrid Zuckerman, MS, have worked tirelessly with Sharon to develop the meeting agenda and publication opportunities. Joan Mele-McCarthy, D.A., provided thoughtful feedback to shape our agenda and organized our one-day conference for Maltese educators. Likewise, our Scientific Advisory Board chair, Laurie Cutting, PhD, has offered valuable insights into the process. Colleen Reutebuch, PhD, helped with the initial site visit and, along with Barbara Wilson, shared her knowledge and expertise at the one-day conference. Lanier Sachs and Claire Millerick provided critical organizational and logistical support to make our gathering possible. Ruth Falzon, PhD, Victor Martinelli, PhD, and the Malta Dyslexia Association have been incredible local resources to help guide our planning and make the most of our time together.

We appreciate everyone's support for this special meeting that honors Will's memory, vision, and the 38 years that TDF has helped advance our understanding of dyslexia.

# Meeting Overview

**Goal:** To better understand how treatments for students with dyslexia might better reflect our knowledge of theory, neuroscience, and learning science to improve outcomes for students with dyslexia with consideration for: (a) how these treatments might be redesigned, (b) how teaching might be reconsidered, and (c) how malleable elements related to improved outcomes might be integrated. Designing a research agenda that advances knowledge, practice, and policy that reflects the range of students with dyslexia including children of color and children growing up in poverty.

**Overarching Questions:** We have the expectation that all participants at the conference will come ready to challenge common understandings about effective intervention practices for students with dyslexia and wonder with us about how to more effectively design, implement, and evaluate more impactful interventions.

Consider these guiding questions:

1. Why do we think interventions have not had the impact we would like – particularly after the very early grades?
2. What are some of the underlying assumptions that we need to challenge?

Over the past 30 years we have made significant strides in screening, identifying, and treating very young children with dyslexia largely through our improved understanding of phonemic awareness and the alphabetic principle and how to apply instructional practices to promote their acquisition in school and clinical settings. These significant findings have led to the promotion of science-based reading approaches necessary for all students with reading difficulties (RD). For many understood and not so well understood reasons, treatments for students with dyslexia have stalled. Despite significant work from a range of research teams, interventions aimed to improve reading outcomes beyond initial word reading in the early grades have yielded rather unimpressive outcomes. The IES funding under the umbrella of “Reading for Understanding” invested 100 million dollars to improve interventions accelerating reading comprehension, yielding few treatments that resulted in statistically significant effects and none with effect sizes greater than what would be considered small. Compton et al. (2013) argue that we may have “inadvertently diluted reading theory” in ways that inadequately promote “generative word reading” leading to weaker interventions that fail to integrate what we know about inductive learning mechanisms that characterize learning. While the majority of students with reading difficulties exhibit word, fluency, and comprehension level reading difficulties (Cirino et al., 2013), there are subgroups of students with only word or comprehension reading difficulties (Catts, Compton et al., 2011) requiring us to consider treatments that are both independent and overlapping. Further, our knowledge of treatments requires that we integrate our growing knowledge about learning and neuroscience into the ways in which we design and promote word reading and comprehension. We further propose that context matters considerably and has inadequately been considered in the design of our treatments for students with RD.

We propose that this symposium is an opportunity to reconsider how we design and implement treatments for students with RD with consideration for vulnerable populations. We think there is increasing knowledge theoretically, conceptually, and through neuro and learning sciences to guide this reconstruction in ways that could be profitable for students with RD. We recognize that this will require considerable redesign of how we currently develop and implement treatments. We also recognize that it will require considerable adjustments to both preservice and professional development for teachers providing these treatments.

With these considerations in mind, we propose a multi-disciplinary symposium aimed at addressing critical questions in the field regarding the development and implementation of treatments for students with RD. We propose that the critical questions for the field to address include the following: (1) What do we now know from neuro and learning sciences that needs to be integrated into the way in which we provide reading treatments for students with RD? (2) What are the malleable factors that are required for appropriate treatments for students with word reading, fluency and comprehension problems and how do they differ for students with either word reading or comprehension difficulties? (3) How can we consider the contextual issues that make students of color and/or poverty more vulnerable to RD and in what ways should the treatments for these students differ?

The 20th Extraordinary Brain Symposium, “**Extending our Knowledge of Context, Theory, Neuroscience, and Learning Science to Improve Treatments for Students with Dyslexia**”, will tackle these important issues by first considering the scientific research agenda necessary to substantiate meaningful change in treatment and instructional practices. We will consider some of the “accepted practices” critically (e.g., strategy instruction) and attempt to reconstruct these treatments with the range of student experiences in the foreground rather than the background.

We will also consider how our identified malleable elements are applied to students with dyslexia and other language-based disabilities that impair reading and writing achievement across the age range. Our work will be guided by two fundamental assumptions. First, although we know much about reading development, assessment, instruction, and disability, innovation is required to create conditions that ensure reading success for many children. Second, knowledge from multiple disciplines is required to advance the study of reading and reading disability in vulnerable student populations because their risks for reading difficulty are above and beyond the “usual suspects” typically considered in reading research.

Through rich interactions and the freedom to openly question and discuss, we hope to move the field forward with innovative ideas, new applications of standard research methods, and the forging of a

plan for research projects and collaborations that will uncover new and important knowledge about how best to not only identify and successfully intervene with all children with dyslexia, but also move this knowledge into treatment development and teacher practice.



Program Agenda  
for  
  
The Dyslexia Foundation  
EXTRAORDINARY BRAIN SYMPOSIUM XIX

June 16-20, 2024

Sunday, June 16  
Corinthia Hotel  
San Anton, Malta

*Meeting with Moderators and TDF Professionals*  
5 pm

*Welcoming Reception*  
6:00-8:00 pm  
Caprice Gardens, Hotel Corinthia

*Welcoming remarks*  
Welcome to Symposium  
Ben Powers, Sharon Vaughn

*Introductions of Local Dyslexia Association dignitaries, Embassy Representatives*

*Goals of the Meeting*  
Sharon Vaughn

# Monday, June 17, 2024

## Setting the Stage...

Moderator: Laurie Cutting, Vanderbilt University

8:30	<b>Ben Powers</b> <i>Introductory Remarks</i>
	<b>Sharon Vaughn, University of Texas at Austin</b> <i>Welcome, meeting goals and stage setting</i>
9:00	<b>Maggie Snowling, University of Oxford</b> <i>Risk factors for dyslexia: beyond phonological deficits</i>
9:40	<b>Q&amp;A</b>
10:00	<b>BREAK</b>
10:30	<b>Donald Compton, Florida Center for Reading Research</b> <i>Moving past sandpaper tracing and air writing: Making a case for spelling instruction as the key component to multisensory instruction to improve lexical quality of representations.</i>
11:10	<b>Q&amp;A</b>
11:30	<b>Jeanne Wanzek, Vanderbilt University</b> <i>Exploring intensity in reading interventions for upper elementary students</i>
12:10	<b>Q&amp;A</b>
12:30	<b>LUNCH</b>

## Using theory to improve word reading intervention efficiency

Moderator: Brett Miller, NICHD

1:30	<b>David Share, Haifa University</b> <i>Accuracy-disabled vs. rate-disabled subtypes of dyslexia: True double dissociation calls for different interventions for different subtypes of dyslexia.</i>
2:10	<b>Q&amp;A</b>
2:30	<b>Laura Steacy, Florida State University</b> <i>Increasing the efficiency of word reading interventions: Exploring theoretically relevant add-ons to boost the potency of existing programs.</i>
3:10	<b>Q&amp;A</b>
3:30	<b>BREAK</b>
4:00	<b>Integrative Discussion</b>
5:00	<b>ADJOURN</b>



# Tuesday, June 18, 2024

## Orthography and Dyslexia Moderator: Philip Capin, University of Texas at Austin

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8:30	<b>Nathan Clemens, University of Texas at Austin</b> <i>Three studies of word reading interventions influenced by statistical learning, lexical quality, and connectionist frameworks</i>
9:10	<b>Q&amp;A</b>
9:30	<b>Yusra Ahmed, University of Texas Health, Houston</b> <i>Capitalizing on reading-writing connections in the context of dyslexia</i>
10:10	<b>Q&amp;A</b>
10:30	<b>BREAK</b>
11:00	<b>Joanna Christodoulou, MGH Institute of Health Professions</b> <i>Summer reading outcomes: Cognitive neuroscience and education perspectives</i>
11:40	<b>Q&amp;A</b>
12:00	<b>Integrative Discussion</b>
12:30	<b>LUNCH</b>

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## Treating Children: Intervention in the Schools Moderator: Michael Coyne, University of Connecticut

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1:30	<b>Ron Gillam, Utah State University</b> <i>The wide-ranging effects of narrative intervention for children with language and literacy difficulties</i>
2:10	<b>Q&amp;A</b>
2:30	<b>BREAK</b>
3:00	<b>Brandy Gaitlin-Nash, University of California at Irvine</b> <i>Language differences and dyslexia</i>
3:40	<b>Q&amp;A</b>
4:00	<b>Hugh Catts, Florida Center for Reading Research</b> <i>Language and Dyslexia</i>
4:40	<b>Q&amp;A</b>
5:00	<b>Integrative Discussion</b>
5:30	<b>POSTER SESSION</b> Please view the posters and engage with the poster presenters: Andrew Chang, Vanderbilt University Eleni Chatzoglou, University of Texas at Austin Matthew Cooper Borkenhagen, Florida State University Sarah Fishstrom, University of Hawaii Natalie B. Huerta, Vanderbilt University Megan Israelson-Augestine, West Virginia University Anna Yi Leung, Ludwig-Maximilians-University of Munich Tatiana Logvinenko, Ludwig-Maximilians-University of Munich Adi Shechter, University of Haifa Emma Shanahan, University of Texas at Austin Na Young Yoon, University of Texas at Austin <b>ADJOURN</b>
7:00	



# Wednesday, June 19, 2024

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## Methodology and Treatment Effects

Moderator: Nicole Patton Terry, Florida Center for Reading Research

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8:00	<b>David Francis, University of Houston</b> <i>Methodological considerations and advances to promote understanding and interpreting treatment effects</i>
8:40	<b>Q&amp;A</b>
9:00	<b>Xenia Schmalz, Ludwig-Maximilians-Universität München</b> <i>Is reading and developmental dyslexia research affected by the replication crisis?</i>
9:40	<b>Q&amp;A</b>
10:00	<b>Elizabeth Tipton, Northwestern University</b> <i>Developing an evidence base when treatment effects vary</i>
10:40	<b>Q&amp;A</b>
11:00	<b>ADJOURN</b>

Lunch is on your own today. This is a half day free for local side trips/excursions, or just relaxing.

# Thursday, June 20, 2024

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## Accelerating Interventions Given Minimal Response

Moderator: Sandi Gillam, Utah State University

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8:30	<b>Garrett Roberts, University of Denver</b> <i>Integrating reading and behavior approaches</i>
9:10	<b>Q&amp;A</b>
9:30	<b>Jason Yeatman, Stanford University</b> <i>How does the brain learn to read, why do some children struggle, and what is the impact of intervention?</i>
10:10	<b>Q&amp;A</b>
10:30	<b>BREAK</b>
11:00	<b>Charles Hulme, Oxford University</b> <i>Integrating language and literacy</i>
11:40	<b>Q&amp;A</b>
12:00	<b>Integrative Discussion</b>
12:30	<b>LUNCH</b>

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## Integrating What We Know into Practice

Moderator: Joan Mele-McCarthy, Summit School

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1:30	<b>Panel Discussion: Models of Integrated Practice and Future Research</b> <b>Elizabeth Stevens, University of Kansas</b> <i>Models of comprehension and outcomes across the continuum of instruction and intervention</i> <b>Devin Kearns, University of Connecticut</b> <i>Aligning effective tiered intervention strategies (RTI and MTSS)</i> <b>Ruth Falzon, University of Malta</b> <i>Maltese models of intervention/school programming and future ideas</i>
2:30	<b>BREAK</b>
3:00	<b>Sharon Vaughn, University of Texas at Austin</b> <i>Emerging themes and next directions</i>
4:00	<b>Final Discussion</b>
4:30	<b>ADJOURN</b>
7:30	<b>Gala Dinner and Final Farewells</b>

## Timeline for Journal Articles Based on Presentations

As stated in your formal invitation and by agreeing to give a major presentation at this symposium, you have also committed to providing an article based on that presentation. Because you have already thought deeply about your topic, we assume that you have in mind much of what you would write. In addition, we hope that your article will also be updated/enhanced by the discussions throughout the meeting.

As the Special Issue Editors, we will be writing a final paper that will address 'next steps' and 'future directions' drawn from the week of discussions but primarily based on the final discussion at the end of the symposium. We will hold ourselves to the same deadlines given to you below. It is very important that you take these deadlines seriously and thank you in advance for doing that!

You are welcome to write with any coauthors you choose, but as the speaker you will be serving as corresponding author and will be the primary contact for working with us as the special issue editors.

For previous Extraordinary Brain Symposia, we had published edited volumes, but TDF has determined that having special issues as the product of the symposia is preferable. We appreciate the process of peer review as well as a wider distribution and readership for the information presented.

The symposium coordinators have already been in contact with the journal Mind, Brain, and Education, which has agreed to have our group submit for a special issue based on the symposium.

### Timeline for the June 2024 symposium

October 1, 2024: Draft Manuscript due to the special issue editors (Vaughn, Zuckerman, & McCardle)

November 15, 2024 (or before): Editors' feedback to authors

January 15, 2025: Submission deadline to the journal

Guidelines for manuscript preparation can be found at:

<https://onlinelibrary-wiley-com/page/journal/1751228x/homepage/forauthors.html>

## Monday, June 17, 2024

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### Setting the Stage...

Moderator: Laurie Cutting, Vanderbilt University

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8:30	<b>Ben Powers</b> <i>Introductory Remarks</i>
	<b>Sharon Vaughn, University of Texas at Austin</b> <i>Welcome, meeting goals and stage setting</i>
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11:10	<b>Q&amp;A</b>
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### Using theory to improve word reading intervention efficiency

Moderator: Brett Miller, NICHD

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2:30	<b>Laura Steacy, Florida State University</b> <i>Increasing the efficiency of word reading interventions: Exploring theoretically relevant add-ons to boost the potency of existing programs.</i>
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## Maggie Snowling

### *Risk factors for dyslexia: Beyond phonological deficits*

It is well-established that phonological skills are critical for learning to read and that individuals with dyslexia have phonological processing difficulties. However, there is also growing evidence that dyslexia is the outcome of multiple genes of small effect acting through the environment to produce individual differences in the manifestation of dyslexia. In this presentation, I will draw on findings from a longitudinal study of children at high-risk of dyslexia, either because they have a parent with dyslexia or preschool language difficulties, to consider a range of risk factors that are associated with poor reading. The paper will begin by reviewing findings from longitudinal studies assessing the role of speech and language skills in reading development. There will follow a series of analyses examining dyslexia outcomes which are either specific or associated with comorbid developmental language disorder. Retrospective analyses suggest that there is more than one pathway to poor reading; preschool phonological difficulties prior to reading instruction represent a significant risk and children who enter school with poor language are likely to experience deficits in word reading and reading comprehension as well as mathematics disorder. We will consider the role of 'protective' factors including the home literacy environment and implications for screening and intervention.

## Donald Compton

### *Moving past sandpaper tracing and air writing: Making a case for spelling instruction as the key component to multisensory instruction to improve lexical quality of representations*

Across individuals, words vary in the strength with which they are represented in the mind, which leads to variation in reading and writing skill. Perfetti and colleagues attribute this variation to word-level lexical quality, which refers to the extent to which the reader's knowledge of a given word represents the word's form (i.e., orthography and phonology) and meaning (i.e., semantics and morphology) constituents. A word's representation is considered of high quality to the extent that it has a fully specified and precise orthographic representation, redundant phonological representations, and provides meaning that is both specific and flexible. The development of high-quality representations is a gradual process that operates at the item level, with lexical quality differing across words for a given individual and across individuals for a given word. Perfetti and colleagues suggest that the key measure for gauging lexical quality is spelling. In this presentation, I will review the importance of lexical quality for the development of skilled word reading and spelling; present results from an adult spelling study examining the important role of lexical quality in explaining individual differences in spelling performance; and finally explore the importance of both assessing and teaching spelling to help typically developing and children with dyslexia improve the quality of store word representations.

## Jeanne Wanzek

### *Exploring intensity in reading interventions for upper elementary students*

The current research for upper elementary students demonstrates smaller effects than research on reading interventions for early elementary students with reading disability (RD; Donegan & Wanzek, 2021; Gersten et al., 2008; Wanzek et al., 2016). This research also indicates students who struggle with reading beyond the early elementary grades frequently demonstrate deficits in multiple areas of reading affecting their overall reading performance (e.g. Torgesen et al., 2007). Recommendations for intensifying interventions at the early elementary level include decreasing instructional group size or increasing amount of intervention (Gersten et al., 2008; Vaughn et al., 2012); however, individual studies (Vaughn et al., 2010) as well as the results of two meta-analyses of older students provide no evidence that intervention effectiveness differs by instructional group size, relative number of hours of intervention, or grade level of intervention (Flynn et al., 2012; Scammacca et al., 2015; Wanzek et al., 2013). Based on the research and needs of students, examination of intensive intervention efforts for students with RD beyond Grade 3 is needed (Kamil et al., 2007; Vaughn & Wanzek, 2014), including intensifications with a psychosocial aspect of learning (Cassidy, 2014; Fuchs & Fuchs, 2014).

This presentation will examine several recent studies of reading intervention for students with RD in fourth grade. These studies explore student learning after participation in less intensive and more intensive implementations of multi-component reading interventions, including interventions integrating psychosocial aspects of learning. In addition to overall effects on foundational reading skills and reading comprehension, each study investigated student characteristics that may be related to accelerated learning in reading. The immediate and long-term outcomes for students with RD in these interventions will be provided as well as the intervention techniques and implementation contexts related to these outcomes.

## David Share

### *Accuracy-disabled vs. rate-disabled subtypes of dyslexia: True double dissociation calls for different interventions for different subtypes of dyslexia.*

We present converging evidence for the validity of a subtyping approach developed by Michal Shany and colleagues at the University of Haifa based on the distinction between selective deficits in reading accuracy and reading rate. We report evidence of true or “hard” accuracy/rate subtypes in the strict double dissociation sense of selective impairment on only one dimension alongside normal levels of performance on the other dimension. In a series of cross-sectional and longitudinal studies with children and adults in two languages (Hebrew and Arabic), we repeatedly find a specific accuracy-disabled sub-group as well as an equally specific rate-disabled subgroup (in addition to a doubly impaired accuracy-and-rate-disabled subgroup).

Validating this subdivision, we show that (i) the double dissociation is also evident on reading variables other than the measures used to define the subgroups, (ii) the two selectively disabled subgroups have distinct and non-overlapping cognitive-linguistic profiles and (iii), biosocial, demographic, and instructional factors do not explain the subgroup differences. The accuracy-only subgroups in all our samples display a broad range of language weaknesses – primarily phonological and morphological awareness (but intact RAN), whereas the rate-only subgroups show impaired RAN alone (alongside intact language skills). Each of the three subtypes appears to account for around one third of the dyslexic population.

If our findings are not merely an idiosyncratic Semitic phenomenon, then they call for very different interventions for the two singly disabled subgroups who, together, constitute a majority of dyslexics.

# Monday Abstracts



## Selected References

Shany, M., & Share, D. L. (2011). Subtypes of reading disability in a shallow orthography: A double dissociation between accuracy-disabled and rate-disabled readers of Hebrew. *Annals of Dyslexia*, 61, 64-84.

Shany, M., & Breznitz, Z. (2011). Rate-and accuracy-disabled subtype profiles among adults with dyslexia in the Hebrew orthography. *Developmental neuropsychology*, 36(7), 889-913.

Shany, M., Asadi, I., & Share, D. L. (2023). Accuracy-disability versus rate-disability subtypes of dyslexia: A validation study in Arabic. *Scientific Studies of Reading*, 27(2), 136-159.

### Laura Steacy

*Increasing the efficiency of word reading interventions: Exploring theoretically relevant add-ons to boost the potency of existing programs.*

The English orthography contains many “complex words,” a large class of English words in which the relationships between orthography, phonology, morphology, and semantics are relatively opaque. As children matriculate through school, they increasingly encounter complex words in school texts from which they are expected to extract critical academic knowledge. For children to successfully make the transition from learning to read to reading to learn, they must learn to coordinate a complex set of skills that vary as a function of the text and purpose of reading. This requires children to develop a set of highly refined and flexible word reading and decoding skills that allows a large variety of words to be read accurately and fluently.

To date, our best attempts at developing potent interventions to treat children with reading disabilities, including dyslexia, can best be described as producing limited successes. Our most powerful researcher delivered code-based interventions aimed at ameliorating early word reading problems leave as much as 10-15% of the population of children emerging from treatment with inadequate word reading skills (O'Connor & Fuchs, 2013; Torgesen, 1998, 2000). In addition, our most powerful word reading interventions for struggling readers often yield effects sizes well below 1.0, which are necessary to “normalize” word reading skills (see Hall et al., 2023). Thus, further exploration of theoretically relevant instructional approaches to word reading instruction is warranted.

Theoretical models of skilled reading suggest that students who experience difficulties with word reading lack high quality lexical representations. The Lexical Quality Hypothesis (Perfetti, 1992, 2017; Perfetti & Hart, 2001, 2002) highlights the importance of developing high quality lexical representations containing relevant information about a given word, including knowledge of the orthographic, phonological, and semantic forms. Targeting skills relevant to increasing the specificity and redundancy of these representations may lead to better intervention outcomes. A process that has received recent attention is “set for variability (SfV),” a child’s ability to identify a word from a mispronounced attempt at decoding the word. Elbro et al. (2012) conceptualized SfV as a bridge between decoding and correct word pronunciations, suggesting that SfV could be an important second step in the decoding process for words that already existed in a child’s oral vocabulary. Promoting this process in poor readers may improve children’s lexical representations of words and may be particularly well suited for spelling instruction to help children to store specific words and spellings in their long-term memory.

# Monday Abstracts



Additionally, since English is considered a morphophonemic language, and as such its orthography represents both sound (phonemes) and meaning (morphemes), morphemes may be an especially important focus of instruction. Findings suggest that students may rely on and exploit these morphological units in reading morphologically complex words (e.g., Steacy et al., 2022) and that promoting knowledge of these orthographic units may lead to better word reading (e.g., Lovett et al., 2000).

This presentation will explore the role of SfV and morphology across three samples of students spanning Kindergarten to fifth grade. The presentation will focus on these processes as predictors of word reading outcomes, and their potential as components of interventions to target improved outcomes for students with and at-risk for dyslexia.



# Tuesday, June 18, 2024

## Orthography and Dyslexia Moderator: Philip Capin, University of Texas at Austin

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8:30	<b>Nathan Clemens, University of Texas at Austin</b> <i>Three studies of word reading interventions influenced by statistical learning, lexical quality, and connectionist frameworks</i>
9:10	<b>Q&amp;A</b>
9:30	<b>Yusra Ahmed, University of Texas Health, Houston</b> <i>Capitalizing on reading-writing connections in the context of dyslexia</i>
10:10	<b>Q&amp;A</b>
10:30	<b>BREAK</b>
11:00	<b>Joanna Christodoulou, MGH Institute of Health Professions</b> <i>Summer reading outcomes: Cognitive neuroscience and education perspectives</i>
11:40	<b>Q&amp;A</b>
12:00	<b>Integrative Discussion</b>
12:30	<b>LUNCH</b>

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## Treating Children: Intervention in the Schools Moderator: Michael Coyne, University of Connecticut

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1:30	<b>Ron Gillam, Utah State University</b> <i>The wide-ranging effects of narrative intervention for children with language and literacy difficulties</i>
2:10	<b>Q&amp;A</b>
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4:00	<b>Hugh Catts, Florida Center for Reading Research</b> <i>Language and Dyslexia</i>
4:40	<b>Q&amp;A</b>
5:00	<b>Integrative Discussion</b>
5:30	<b>POSTER SESSION</b> Please view the posters and engage with the poster presenters: Andrew Chang, Vanderbilt University Eleni Chatzoglou, University of Texas at Austin Matthew Cooper Borkenhagen, Florida State University Sarah Fishstrom, University of Hawaii Natalie B. Huerta, Vanderbilt University Megan Israelson-Augestine, West Virginia University Anna Yi Leung, Ludwig-Maximilians-University of Munich Tatiana Logvinenko, Ludwig-Maximilians-University of Munich Adi Shechter, University of Haifa Emma Shanahan, University of Texas at Austin Na Young Yoon, University of Texas at Austin
7:00	<b>ADJOURN</b>

# Tuesday Abstracts

## Nathan Clemens

*Three studies of word reading interventions influenced by statistical learning, lexical quality, and connectionist frameworks*

Interventions for students with word-level reading difficulties have been more successful in improving pseudoword reading compared to generalized ability to read real words. This presentation will report the results of three experiments conducted as part of the development of an intervention to improve generalized word reading efficiency for students in grades 2 through 4 with significant word reading difficulties. In Study 1, 58 students were randomly assigned to one of two small-group intervention conditions. The “Traditional” condition emphasized teaching individual letter sounds, standard pronunciations of letters and letter combinations, and high-frequency word instruction separate from decoding instruction. The “Complex” condition directed students’ attention to larger letter units, taught standard and alternative pronunciations of letters and letter combinations, interleaved regular and irregular words, and taught high-frequency words in the context of decoding instruction. Following 10 weeks, results indicated that both groups demonstrated progress and although not statistically significant, students assigned to the Complex condition outperformed students in the Traditional condition on standardized measures of word reading efficiency, silent word identification fluency, and sentence verification fluency ( $gs = 0.24$  to  $0.51$ ); and on intervention-aligned measures of word reading, including words that were not included in the intervention content ( $gs = 0.14$  to  $0.31$ ), and letter–sound correspondence ( $g = 0.39$ ). We discuss the possibility that the Complex condition may have offered an environment that promoted a greater recognition of statistical regularities in spelling patterns. Study 2 investigated the unique effect of integrating spelling practice with decoding instruction over decoding instruction alone on word reading skills. Seventy students were randomly assigned to one of two conditions, both of which used the Complex intervention from Study 1, however, the “Decoding+Spelling” condition included opportunities for students to spell all words targeted in decoding instruction. After 10 weeks, statistically significant differences favored students in the Spelling+Decoding group ( $g = 0.20$ ) on grade-level oral reading fluency compared to Decoding Only. Although not statistically significant, effect sizes favored Spelling+Decoding on measures of silent word identification ( $g = 0.40$ ) and handwriting fluency ( $g = 0.73$ ), with weaker effects on measures of word reading efficiency ( $g = 0.12$ ) and letter–sound correspondence ( $gs = 0.12$  and  $0.11$ ). Near-zero effect sizes were observed on measures of proximal word reading and spelling, and effects favored the Decoding Only group on sentence verification ( $g = -0.22$ ). We discuss the possibility that spelling practice may enhance word reading, but the small effects combined with the practical fact that students can read many words in the time it takes to spell one suggest that spelling should not significantly detract from abundant opportunities for students to read. Study 3 investigated the unique effect of integrating semantic information within decoding instruction. Students ( $N = 94$ ) were randomly assigned to one of two conditions; both involved identical decoding instruction and practice using the Complex+Spelling intervention from Study 2, but in the “Semantic+Decoding” condition, tutors referred to word meanings and used words in sentences each time they were read or spelled. Results of Study 3 will be presented in the session. More generally, the results of the three studies will be discussed regarding how perspectives on lexical quality, connectionism, and statistical learning may inform new interventions that promote stronger word reading acquisition and skill generalization for students with significant word reading difficulties.

## Yusra Ahmed

*Capitalizing on reading-writing connections in the context of dyslexia*

Writing difficulties often co-occur with reading challenges, yet comprehensive studies on their interrelation remain limited. This study consists of a secondary data analysis of two studies employing

structural equation modeling (SEM) to evaluate relations among reading and writing components skills independently, using the Direct and Inferential Mediation Model (DIME) of reading comprehension and Not-so- Simple View of Writing (NSVW) as theoretical frameworks.

We examine relations between reading and writing components from these models with a sample of upper elementary students with/at-risk for learning disabilities ( $n = 405$ ). Lower-order components included word reading, vocabulary, handwriting and spelling. Higher-order components included background knowledge, reading strategies, inferencing, planning, editing, and revision. The literacy outcomes were oral and silent reading fluency, reading comprehension, and writing quality and productivity. We systematically build a Reading-to-Writing Mediation (RWM) model by first merging the DIME and NSVW components in a direct effects model (Aim 1), expanding the joint model to include reading and writing fluency (Aim 2), evaluating indirect effects between DIME and NSVW component skills (Aim 3), and finally, evaluating indirect effects with reading and writing fluency (Aim 4).

The findings suggest that higher order fluency and comprehension skills are differentially related to writing activities and products. The results showed decoding, comprehension, fluency, and strategies directly contribute to writing quality and productivity. Further, background knowledge and inferencing indirectly influenced writing skills. Other findings include the impact of oral reading fluency on spelling and editing, silent reading fluency's influence on planning and reviewing, and the key role of writing quality on inferencing and knowledge, with editing skills also predicting inferencing.

The findings help elucidate the mechanisms of how various reading and writing skills transfer and relate. The results have implications for targeted and implicit instruction in multicomponent interventions and the use of screeners to identify areas of risk. The findings suggest the importance of integrated literacy interventions and the potential of oral reading fluency as an indicator for both reading and writing proficiency, underscoring the need for further research in this area.

### **Joanna Christodoulou**

*Summer reading outcomes: Cognitive neuroscience and education perspectives*

One of the most potentially impactful periods for children's reading acquisition is paradoxically not during the academic year, but rather during summer vacation. While learning during the summer is expected to slow compared to the school year (i.e., 'summer slump'), summer can unequivocally serve as a time to close achievement gaps in reading. In this presentation, we will discuss current knowledge regarding summer reading outcomes from education and cognitive neuroscience perspectives. From the education framework, we will consider the evidence base of summer slump (i.e., the expected trajectory of reading during summer months), school-based policies for addressing summer learning loss, and research on summer programming. From the cognitive neuroscience perspective, we will review brain plasticity associated with reading interventions broadly, as well as specifically in the context of summer programming. In discussing foundational and applied knowledge for summer reading outcomes, we will focus on the relevance for high-risk learners who could benefit from harnessing summer as a targeted opportunity for closing achievement gaps.

Christodoulou, J. A., Azor, A. M., & Marks, R. A. (2024). Reaching students with reading disabilities during the summer. *Policy Insights from the Behavioral and Brain Sciences*, 11(1), 67-75.  
<https://doi.org/10.1177/23727322231220636>

## Ron Gillam

*The wide-ranging effects of narrative intervention for children with language and literacy difficulties*

Narration is a foundational oral language skill for supporting literacy development in school-age children. We conducted a multi-site randomized controlled trial to rigorously evaluate the efficacy of the Supporting Knowledge of Language and Literacy (SKILL) program (Gillam, Gillam, & Rogers, 2017) for improving oral narrative comprehension and production. Three hundred fifty-seven students at-risk for language and literacy difficulties in Grades 1-4 in 13 schools across seven school districts were randomly assigned to the SKILL treatment condition or a business as usual (BAU) control condition. The manualized SKILL program consists of three phases: Teaching Story Structure and Causal Language, Teaching Strategies for Creating a Situation Model, and Teaching Strategies for Integration into Long-Term Memory. Treatment was provided to small groups of three or four children in 36, 30-minute lessons across a 3-month period.

The results of our multi-site RCT indicated that children randomized to the SKILL narrative treatment significantly outperformed the BAU controls on listening comprehension and spoken production of both macrostructure and microstructure aspects of narration; treatment generalized to written narration; and narration served as an important pathway for improving reading comprehension (controlling for decoding). These results held for monolingual and bilingual children as well as children with mild and/or moderate (but not severe) listening comprehension and reading decoding abilities prior to treatment. We will discuss the theoretical and practical ramifications of these findings.

## Brandy Gaitlin-Nash

*Language differences and dyslexia*

For several years, researchers have focused attention on opportunity, and resulting, achievement gaps between Black children from low-income backgrounds and their peers. Yet, these gaps continue to exist (and widen) despite efforts to improve reading performance among this group. Because of the predictive nature of oral language to reading achievement, oral language has recently received attention in research examining literacy performance specifically among this group (e.g., Gatlin & Wanzek, 2016; Terry et al., 2023). For one, children of color are more likely than their peers to grow up in poverty, which is a predictor of language exposure and use. In addition, many Black children speak a language variety that differs from standardized or General American English. Spoken language variation may be a factor to consider when examining reading outcomes among Black children because the nature of the relationship between general oral language skills and spoken language variation is unclear and because of an apparent negative association between dialect use and reading skills (Gatlin & Wanzek, 2015).

With few exceptions (e.g., Gatlin & Wanzek, 2017), students with language and learning disabilities have been omitted from studies examining language variation and literacy by design. However, various researchers have analyzed general spoken language in relation to reading performance and found significant differences for students with language and learning difficulties or disabilities (e.g., Dethorne et al., 2010; Scarborough, 1990). It is possible that the relationship between spoken language, specifically language variation, may be different for students with dyslexia or other language and learning difficulties. Additionally, language variation may play a role in the accurate identification of dyslexia. This session will discuss the potential implications of English language varieties on literacy acquisition, instruction, and assessment and dyslexia diagnosis among culturally and linguistically diverse students.

## Hugh Catts

### *Language and Dyslexia*

This presentation begins with a brief history of research on the early identification of dyslexia and what has been learned in the nearly 100 years of work in this area. Early studies examined a range of factors thought to be related to reading achievement. Some assessments were directed at the evaluation of “reading readiness,” while others were designed to specifically identify reading disabilities. Soon studies took more of a preventative approach, focusing on screening, diagnosis, and intervention. Recent extensions of this work will be discussed before considering a current program of research directed at early identification. This program has four main goals; (1) develop a cutting-edge set of screening assessments that accurately and efficiently identify risk for dyslexia, (2) design assessments for theme-based presentation to maintain student interest, (3) extend research on early identification to include a whole-child approach that examines biopsychosocial correlates of reading achievement, and (4) tie early identification directly to intervention. For the development of the screening assessments, a large sample of children were administered subsets of test items for multiple measures. This allowed for the calculation of item difficulty and discrimination needed for computer adaptive presentation. Questionnaires were also completed by teachers and parents. Initial validation compared participants’ performance on item-level data to end of year reading achievement. Further validation involved new samples of K-1st grade students who completed screening assessments in a computer adaptive format. Efforts are underway to combine screening with follow-up testing and intervention using developments in artificial intelligence.

**See the poster abstract after the daily agendas and abstracts**

# Wednesday, June 19, 2024

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## Methodology and Treatment Effects

Moderator: Nicole Patton Terry, Florida Center for Reading Research

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8:00	<b>David Francis, University of Houston</b> <i>Methodological considerations and advances to promote understanding and interpreting treatment effects</i>
8:40	<b>Q&amp;A</b>
9:00	<b>Xenia Schmalz, Ludwig-Maximilians-Universität München</b> <i>Is reading and developmental dyslexia research affected by the replication crisis?</i>
9:40	<b>Q&amp;A</b>
10:00	<b>Elizabeth Tipton, Northwestern University</b> <i>Developing an evidence base when treatment effects vary</i>
10:40	<b>Q&amp;A</b>
11:00	<b>ADJOURN</b>

# Wednesday Abstracts

## David Francis

*Methodological considerations and advances to promote understanding and interpreting treatment effects*

Intervention research is often criticized when treatment effects are found on experimenter-developed tests of reading but fail to obtain on standardized tests. This criticism is understandable when leveled at research that aligns tests to treatments in an unfair way, such that participants in the control condition lack opportunity to learn the to be tested material. However, sensitivity of experimenter developed assessments need not arise from alignment of the test to intervention, but from factors that affect test sensitivity and treatment effect heterogeneity. This talk examines the age-old question of why treatment effects appear harder to obtain on standardized tests of reading. We will employ modern psychometric models to understand the relationship between student ability, test-item difficulty, and the elements of test construction that affect their relationship. We hypothesize that a standardized test's insensitivity to treatment effects may stem in large measure from the limited number of items providing maximum discrimination in the ability range of students receiving intervention. We will discuss the implications of the findings for intervention research and the design of standardized tests for use in intervention research.

## Xenia Schmalz

*Is reading and developmental dyslexia research affected by the replication crisis?*

In 2015, a landmark study showed that about two-thirds of studies in psychological science yield unreplicable results: If we take a study and apply the same experimental methods and analyses to a different sample, we are likely to obtain different results (Open Science Collaboration, 2015). To date, no detailed investigation exists on the extent to which low replicability is problematic in reading and developmental dyslexia (hereafter: dyslexia) research. However, one can easily find examples of controversial topics and conflicting results: on the role of statistical learning and reading (Arciuli & Simpson, 2012; Gabay, Thiessen, & Holt, 2015; Schmalz, Altoè, & Mulatti, 2017; Schmalz, Moll, Mulatti, & Schulte-Körne, 2019), or using Action Video Gaming to improve reading ability in children with dyslexia (Franceschini et al., 2013; Łuniewska et al., 2018).

In this contribution, we first provide a theoretical discussion on the reasons why replicability might be low, with special consideration of issues in reading and dyslexia research. Low replication rates can occur due to a low number of replication studies, or when replication studies are being conducted, but yield different results than the studies they seek to replicate. The latter suggests low standardisation in research methods, sample selection, and statistical analysis (Elson, Hussey, Alsalti, & Arslan, 2023). While low standardisation can help to optimise research designs and establish generalisability of results, demonstrating replicability is desirable when applying outcomes of research studies in practice.

Second, we investigate the reasons for low replicability. Low standardisation can occur – intentionally or unintentionally – on different levels. Using a combination of systematic reviews and Natural Language Processing techniques, we examined standardisation of several aspects. First, when it comes to terminology, researchers may have different understanding of the same key words. This should lead to differences in theoretical models, as well as the operationalisation of constructs and subsequently the way they are measured in empirical studies. To demonstrate this, we selected keywords from dyslexia research and quantified the heterogeneity in the way that these words are defined across articles. We find high heterogeneity, partly due to the multidisciplinary nature of dyslexia and articles being

published in different fields (e.g., cognitive psychology versus educational sciences versus clinical psychology).

The second source of variability is on the methodological level. Studies differ in the selection of participants, as well as the implementation of experimental tasks. Sometimes, deviations from standard procedures are insufficiently described. Here, we present both a transparency rating scale, developed specifically for studies on dyslexia, and a quantification of differences between studies, when the relevant details are reported. In this work, we focus on the case study of the auditory frequency discrimination deficit in dyslexia (Witton, Swoboda, Shapiro, & Talcott, 2020). We found variability in the extent of methodological details described in the articles, as well as in the tasks. Due to the relatively small number of studies, we were unable to establish whether this variability affects the effect sizes obtained by the studies.

The third source of variability is on the analytical level. Different statistical methods can be used to answer the same research question: if children with dyslexia and a control group perform one task where we expect a deficit and a control task, for example, one can conduct a t-test on the critical task, an ANOVA with an interaction between task and group, or vary the constellation of covariates. We perform a meta-analysis on tasks used to test the Magnocellular/Dorsal theories of dyslexia (Stein, 2001; Vidyasagar & Pammer, 2010) and report substantial variability in the statistical models used to analyse one specific task, namely the Visual Search Task (Iles, Walsh, & Richardson, 2000).

The third aim of this contribution is to propose solutions. Many solutions have already been proposed and implemented for the field in psychology more generally, such as increasing transparency (Lindsay, 2020), pre-registration (Nosek & Lakens, 2014), and improving statistical expertise (Schmalz, Biurrun Manresa, & Zhang, 2023). We will discuss challenges that are specific to the field of reading and dyslexia research, such as the heterogeneity the samples of interest and the importance of examining generalisability, for example, across languages (Huettig & Ferreira, 2022). Overall, we argue that some variability is necessary to establish the optimal experimental procedures and generalisation, even if it comes at the cost of conducting replication studies. However, some level of standardisation is essential to improve replicability rate and to establish how to teach all children to read.

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### **Elizabeth Tipton**

*Developing an evidence base when treatment effects vary*

Dyslexia researchers often want to know if an intervention ‘works.’ These interventions can include policy changes, group-based curricula and teaching practices, or one-on-one treatments and interventions. Randomized control trials (RCTs) offer the ability to determine unambiguously if such interventions cause outcomes to change; these changes are summarized in terms of the average causal effect. But interventions may not improve outcomes to the same degree for every person or in every context or setting. Thus, when treatment effects vary, the average causal effect estimated in one sample may not generalize to another. Furthermore, the average causal effect may not be the parameter of interest; for example, we may instead be interested in understanding ‘for whom’ and ‘under what conditions’ such an intervention is effective. But what does this mean for how we plan studies? In this talk, I focus on how to best design RCTs when treatment effect heterogeneity is likely. I show that the optimal study designs for estimating average effects, subgroups effects, and person specific effects can differ substantially. Throughout I provide examples from education and social science experiments.

# Thursday, June 20, 2024

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## Accelerating Interventions Given Minimal Response

Moderator: Sandi Gillam, Utah State University

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8:30	<b>Garrett Roberts, University of Denver</b> <i>Integrating reading and behavior approaches</i>
9:10	<b>Q&amp;A</b>
9:30	<b>Jason Yeatman, Stanford University</b> <i>How does the brain learn to read, why do some children struggle, and what is the impact of intervention?</i>
10:10	<b>Q&amp;A</b>
10:30	<b>BREAK</b>
11:00	<b>Charles Hulme, Oxford University</b> <i>Integrating language and literacy</i>
11:40	<b>Q&amp;A</b>
12:00	<b>Integrative Discussion</b>
12:30	<b>LUNCH</b>

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## Integrating What We Know into Practice

Moderator: Joan Mele-McCarthy, Summit School

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1:30	<b>Panel Discussion: Models of Integrated Practice and Future Research</b> <b>Elizabeth Stevens, University of Kansas</b> <i>Models of comprehension and outcomes across the continuum of instruction and intervention</i> <b>Devin Kearns, University of Connecticut</b> <i>Aligning effective tiered intervention strategies (RTI and MTSS)</i> <b>Ruth Falzon, University of Malta</b> <i>Maltese models of intervention/school programming and future ideas</i>
2:30	<b>BREAK</b>
3:00	<b>Sharon Vaughn, University of Texas at Austin</b> <i>Emerging themes and next directions</i>
4:00	<b>Final Discussion</b>
4:30	<b>ADJOURN</b>
7:30	<b>Gala Dinner and Final Farewells</b>

# Thursday Abstracts

## Garrett Roberts

### *Integrating reading and behavior approaches*

A high proportion of students with reading difficulties experience elevated levels of inattention, which impedes their response to reading interventions. To enhance the effectiveness of reading interventions for this population of students, we investigated the impact of integrating a researcher-developed attention supports program titled, Engaged Learners, into an evidence-based reading intervention on reading and attention outcomes. Using a 3-arm randomized controlled trial with 159 Grade 3-5 students with co-occurring reading and attention difficulties, we randomized students 1:1:1 to one of three-conditions: Reading with Engaged Learners (READ+ENGAGE; n = 56), Reading-only (READ; n = 54), and a business-as-usual comparison (BaU; n = 49). Students in the READ+ENGAGE and the READ conditions received small group sessions for 30 minutes, three to five days per week for five months. The only variation between the READ+ENGAGE and READ conditions was the presence or absence of the Engaged Learners program, respectively. Outcomes suggested that students in the READ+ENGAGE condition displayed higher levels of attention (i.e., more attentive) as measured by teacher surveys ( $g = 0.43$ ,  $p < .05$ ) and observations ( $g = 1.15$ ,  $p < .01$ ) during the reading instruction than students in the READ condition. Additionally, pretest attention significantly moderated ( $p < .05$ ) these outcomes, suggesting that the intervention was most effective for students who were more inattentive at pretest. There were no statistically significant differences between READ+ENGAGE and the comparison conditions on word reading, fluency, or reading comprehension outcomes. The effect of READ+ENGAGE was largest, when compared to the BaU, on the primary outcome of reading comprehension ( $g = 0.23$ ), which suggests promise. Limitations and future research will be discussed.

## Jason Yeatman

### *How does the brain learn to read, why do some children struggle, and what is the impact of intervention?*

From the perspective of neuroscience, written language is an incredible feat. Prompted by reading instruction, the brain constructs specialized circuits to translate visual symbols into the sound and meaning. Indeed, since written language was invented by human societies only a few thousand years ago, it is unlikely that the brain evolved dedicated circuits for written language. Rather, the brain's capacity to change in response to new experiences - a principle known as "plasticity" - means that a child's experiences in the classroom sculpt the neural circuitry of literacy. However, this circuitry is not built from scratch. Literacy is grounded in circuits that evolved for component processes such as spoken language and visual recognition.

Reading begins in the eye where the retina transforms light reflected from a page of text into nerve impulses that are sent to the brain. Within a couple hundred milliseconds, the literate brain translates these patterns of light into sound and meaning. This is accomplished through rapid communication between brain regions that are specialized for processing visual, auditory and language information. Reading, like most complex cognitive functions, is not carried out by a single brain region but depends on coordinated activity among a network of regions, each with its own specialized role, but also dependent on the function of a broader brain network. Over the course of schooling, the brain's visual processing centers are plugged into language networks in a new way, allowing for a new form of communication: written language.

Children who struggle with reading and those with dyslexia show subtle differences in the way brain networks are wired together. Also referred to as “connectivity”, non-invasive diffusion MRI measurements of the brain’s white matter have revealed differences in the physical properties of brain connections between children with dyslexia and their peers with typical reading skills. These differences in brain structure have caused many scientists and educators to worry that these differences might be static traits that continually present a barrier to learning. Our research has shown the opposite: the developing brain has an incredible capacity for plasticity when provided high-quality, evidence-based educational intervention programs. Over the time-scale of weeks, we can measure changes in the physical structure of the brain connections that sub-serve reading. These findings highlight the importance of early identification and intervention: new precise and efficient assessment tools like the Rapid Online Assessment of Reading (ROAR; <https://roar.stanford.edu/>) can support schools in identifying children who are struggling, planning a personalized intervention program, and ensuring that learning difficulties are addressed early while the developing brain’s capacity for plasticity is at its peak.

### **Charles Hulme**

*Integrating language and literacy*

Mattingly famously proposed that ‘reading is parasitic on speech’. He was correct in the sense that a child’s ability to learn to recode print is critically dependent on their phonological, or speech sound, skills. However, I will argue that it would be more accurate to say that reading is parasitic on language. Recent longitudinal studies show that early language skills are highly predictive of both later decoding and reading comprehension skills. More broadly, language is the medium of instruction and forms a critical foundation for formal education. Many children, especially those from socially disadvantaged backgrounds, enter school with poor oral language skills which compromise their ability to benefit from education. Our work, developing and evaluating the Nuffield Early Language Intervention (NELI) programme, shows that an oral language intervention delivered in schools can produce meaningful improvements in children’s oral language skills, as well as resulting in improvements in decoding and reading comprehension. The NELI programme is now being delivered in circa 10,000 English primary schools. Our language assessment App (LanguageScreen.com) allows schools to identify children with language weaknesses and monitor their progress. I will conclude with a plea for the importance of embedding oral language enrichment work in early educational settings.

# Poster Abstracts

## Andrew Chang

### *Meta-Analysis on the Academic Outcomes of Cross-Age Tutoring*

Cross-age tutoring is an educational model where an older tutor is paired with a younger tutee. It is valued for its cost-effectiveness and capacity to engage participants, leading to improvements in both academic performance and behavior. Its effect is evidenced by Shenderovich et al.'s (2016) meta-analysis, which reported statistically significant positive effects in various educational settings and among different demographic groups. In this study, we sought to update this previous meta-analysis examining the research on cross-age tutoring. This presentation will provide a systematic examination of 32 studies of cross-age tutoring. We will provide overall effects of cross-age tutoring on academic outcomes for tutees and tutors as well as examination of intervention characteristics that moderate these effects.

## Eleni Chatzoglou

### *The Differential Impact of the COVID-19 Pandemic on Reading Outcomes Among Students With and Without Disabilities in the U.S.*

In March 2020, the COVID-19 pandemic prompted schools worldwide to shift to remote learning, causing immediate changes to teaching and exacerbating reading challenges for students. This study compared how the pandemic differentially affected the reading proficiency of U.S. students with and without disabilities. Using data from the National Assessment of Educational Progress, a descriptive analysis was conducted to answer the following research question: How do the NAEP reading outcome data for all students, as well as students with and without disabilities compare pre- and post-pandemic? A sample of 219,500 students from Grades 4 and 8, both with and without disabilities, was assessed at two distinct time points: pre-pandemic (2019) and post-pandemic (2022).

Results indicated statistically significant decreases ( $p < .001$ ) in reading proficiency of Grade 4 and 8 students in the United States. Subgroup analyses revealed that students without disabilities experienced a significant decline in reading performance from 2019 to 2022 ( $p < .001$ ), while those with disabilities did not ( $p = .58$  to  $.72$ ). The comparative analysis showed that the difference on performance between students with and without disabilities was statistically significant ( $p < .05$ ) across years. Therefore, the pandemic significantly impacted reading proficiency for students without disabilities, emphasizing the need for targeted interventions. Persistent reading disparities underscore the necessity for intensified support for students with disabilities. Further research is recommended to explore the pandemic's specific impact on reading performance among different disability categories. Prioritizing evidence-based interventions is essential for equitable access to quality education post-pandemic.

Chatzoglou, E., Fishstrom, S., Payne, S. B., Andress, T. T., & Vaughn, S. (2023). The footprint of the COVID-19 pandemic in reading performance of students in the US with and without disabilities. *Research in Developmental Disabilities*, 140, 104585. <https://doi.org/10.1016/j.ridd.2023.104585>

## Matthew Cooper Borkenhagen

*Computational models investigating the relative benefits of ensembles of words on early word recognition for learners of different levels of reading skill*

It is taken as a truism that the learning environment matters for early reading development. This fact bears out in a number of indirect ways, including treatment effects associated with experiments on different forms of reading instruction (Foorman et al., 1998) and differences in processing difficulty of words as measured in psycholinguistic megastudies (Balota et al., 2007), among others. This assumption also pervades code-based instructional programs that are designed to teach children how to develop word recognition skills. Words in these programs are carefully curated for various properties of print and speech, with special consideration of children with slow developing decoding skills.

However, identifying the learning benefits of specific words (and ensembles of them) for children's word recognition skills is difficult. This is due to several factors, including variability in children's language knowledge (including for print vocabulary), limited instructional time, and general challenges associated with behavioral experimentation with young children in the early elementary years. This study sought to investigate the issue using computational models within the triangle framework (Seidenberg & McClelland, 1989) in order to understand the extent to which specific sets of words can differentially effect outcomes for learners of different skill levels.

Using connectionist models that learn to name printed words, we constructed random training environments for a large number of simulated learners ( $N = 50,000$ ), each trained to produce named responses for all words in a learning environment of 300 words. In order to investigate the interaction of print environment and skill level, models varied in their capacity to learn print-speech mappings, which was accomplished by manipulating the number of interlevel units contained in the model from 20 to 100 units. Results indicate dramatic variation among learning environments constructed with different ensembles of words, and these differences are pronounced across levels of learner skill. For example, impaired models are associated with an average of 1.59 lower accuracy (in SD units) than their unimpaired counterparts across all 300 training words. Even more dramatic are the relative outcomes of the most and least successful learners across the two groups, where differences exceed 5 standard deviation units. These results have implications for the construction of print learning environments (including but not limited to instruction) for early developing readers across different levels of skill and help frame accounts of differential benefits of words and their structural properties on learning.

## Sarah Fishstrom

*Understanding the relation between reading and anxiety among upper elementary students with reading difficulties*

There is converging evidence to support a negative association between reading achievement and anxiety; however, there is still more to disentangle. Thus, the current study examined the strength of relationships for students whose reading difficulties differ in severity, as measured by differential quantiles, on specific reading outcomes. Using a sample of students with reading difficulties from the United States ( $n = 536$ ), unconditional quantile analysis was utilized to test if various domains of anxiety were differentially related to word reading accuracy and fluency, text reading fluency, or reading comprehension based on the severity of their reading difficulties. The results indicated that higher reading anxiety was negatively associated with word reading fluency, text reading fluency, and comprehension. Further analyses indicated that these relationships existed in students who fell in the middle and upper quantiles for reading but not the lowest quantile. Possible explanations for the findings are explored and may help to inform future efforts, since both lack of reading proficiency and anxiety in children are public health concerns and appear to be related.

Leaning on the additional results from recent meta-analyses in the field of integrated anxiety and intervention research, this study has implications for researchers, clinicians, and practitioners who work to break the cycle between anxiety and reading achievement.

### **Natalie B. Huerta**

#### *Reading Intervention and Executive Function (EF) Skills of First Grade Struggling Readers*

In addition to early reading skills, executive function (EF) skills such as inhibition and working memory are fundamental to later academic success. Therefore, it is important to consider how early EF skills may be associated with academic growth, as well as whether early EF skills may influence responsiveness to reading intervention. These research questions are being addressed in an ongoing longitudinal study that currently includes two cohorts of students (N=109) that are followed from kindergarten through first grade; kindergartners are oversampled for reading risk, and in the fall of 1st grade, the lowest scoring third of participants receive reading intervention. Participants are then randomly assigned to a tutoring condition or a waitlist control condition. Those in the tutoring condition receive 8 weeks (40 sessions) of one-to-one explicit reading instruction using University of Florida Literacy Intervention (UFLI) Foundations. The waitlist control participants continue business-as-usual instruction in their educational settings. All participants receive post-testing at the end of first grade once tutoring sessions are completed. Data collection and analyses are ongoing, but preliminary results suggest that children who received reading tutoring showed improvement in their word attack skills, with some possible interactions with EF abilities. The interaction between EF abilities and intervention response could provide information that supports future research on reading intervention intensity and duration based on non-cognitive correlates of reading such as EF.

### **Megan Israelson-Augestine**

#### *Comparing Narrative Abilities of Monolingual and Dual-Language-Learning Students at-risk for Language and Literacy Disability*

The purpose of this study was to assess the nature of oral narratives produced by monolingual and Spanish-English Dual-Language Learners (DLLs) who are at-risk for language and literacy disability (AR-LLD). Data from 337 participants between the ages of 6;0 and 10;5 who had taken part in a Randomized Control Trial were used in this study. Participants were 181 males and 156 females with slightly more than half ( $n = 199$ ) being monolingual English speakers. Oral narratives were transcribed verbatim and scored using the Monitoring Indicators of Scholarly Language rubric. This rubric yields scores for total narrative proficiency, narrative macrostructure, and narrative microstructure abilities. A multilevel model (MLM) approach, specifically linear mixed effects models, was used to answer each research question and examine the differences in narrative performance of each child while controlling for language status. The results indicated there were no significant differences in stories told by monolingual or DLLs who were at-risk for language and literacy difficulties. The theoretical, pedagogical, and clinical implications of the findings are discussed in terms of how narrative proficiency is measured, and how at-risk students are identified in the U.S.

## **Anna Yi Leung**

*Is it an issue that constructs are not measured as defined? An empirical evaluation of dyslexia research as a case study*

Recent reviews called for attention to construct validity issues in dyslexia and reading research (e.g., Andresen et al., 2022; Pamei et al., 2023). Ideally, empirical studies should use valid tests that can measure the intended constructs, such as “phonological awareness,” “morphological awareness,” and “statistical learning.” Often, the reported operationalization of constructs in academic articles might not match the conceptual definitions of those constructs. A question is how important it is to operationalize a construct as it is defined conceptually. We conducted an academic text analysis to compare the conceptual definitions and the tests or diagnoses used to define commonly studied constructs (e.g., developmental dyslexia, phonological awareness) in dyslexia research. In addition, we present an expert-survey-based protocol to examine whether the variability in conceptualization reflects inconsistencies in researchers’ understanding of a construct’s meaning. The survey also explores the roles of the experts’ degree of expertise, research subfields (e.g., clinical psychology vs. cognitive psychology vs. education), and the study participants’ language background in the observed mislinkage between conceptualization and operationalization. Additionally, the protocol examines researchers’ perceived heterogeneity in conceptual definitions and measures and their attitude towards its impact on theory building. This work suggests an empirical approach for re-examining the current practice in addressing the construct validity issues in dyslexia and reading research.

## **Tatiana Logvinenko**

*Perceptual deficits as an explanation for reading difficulties: Testing the tasks*

Dyslexia research encompasses many theories that focus on the cognitive and/or perceptual deficits that may underlie reading difficulties. For example, the Temporal Sampling Framework addresses low-level auditory deficits (Goswami, 2011) and the Sluggish Attentional Shifting Theory addresses visuospatial deficits (Facoetti et al., 2010). Among the studies testing the theories, the cross-sectional design is the most prevalent. This design tests a prediction that falls out of causal theories, that participants with reading difficulties should perform worse than the matched control group on a theory-specific task measuring the cause of poor reading ability. However, tasks pertaining to concurrent theories are rarely tested in a single study. Therefore, the aim of this study is to explore the relationship between reading ability and performance on various perceptual tasks that are used in dyslexia research commonly per se, but rarely together.

The sample consists of 250 German-speaking children in grades 3–5. The tasks include visual and auditory processing experiments, replicating previous studies: (1) rise time and frequency discrimination (Goswami et al., 2011, 2010), (2) auditory and visual temporal order judgement (Landerl & Willburger, 2010), (3) visual-spatial attention tasks (Bertoni et al., 2021), (4) coherent motion detection (Stein, 2014). To assess reading ability, we utilise the SLS 2-9 reading fluency screener ([Wimmer & Mayringer, 2019](#)). Furthermore, we employed control tasks, including phonological awareness and simple and choice reaction time tasks. Each child participated in two sessions: half of them did both sessions online, and the second half did the first session online and the second session in the lab. This work forms part of a larger study which aims to assess the reliability of visual and auditory processing tasks.

We report the preliminary results on the associations between the performance in the perceptual tasks and reading ability investigated using linear regression and path analyses. This allows us to conceptually replicate the effects reported in previous studies while also assessing the concurrent predictive ability of the tasks in relation to reading. In addition, we will share insights on the feasibility of the online dyslexia/reading studies with children as participants.

### **Emma Shanahan**

*Effects of writing instruction on the reading outcomes of students with literacy difficulties in pre-kindergarten to fifth grade: a meta-analysis*

Although writing instruction can positively impact reading for students across grades and levels of literacy, the extent to which these findings generalize to young students with literacy difficulties is unclear due to the dynamic nature of reading-writing relations. The purpose of this meta-analysis was to examine the effects of writing instruction on the reading outcomes of students in grades pre-K–5 who have reading, writing, or co-occurring reading and writing difficulties. Across 19 studies and 72 effects, writing instruction had a positive effect on reading outcomes ( $g = 0.27$ , 95% CI [0.13, 0.41],  $p < .01$ ). Descriptively different subset effects for higher-intensity instruction (small student group, greater total hours) could not be reliably estimated. Effects were moderated by the focus of instruction, with transcription instruction associated with larger effects. Percentage of instructional time spent writing and type of comparison condition (reading treatment or control) did not moderate effects. The effects of writing and reading instruction on reading outcomes did not differ significantly ( $g = 0.23$ , 95% CI [-0.07, 0.52],  $p = 0.19$ ,  $k = 44$ ). These findings suggest that writing interventions have the added benefit of supporting students' reading. Continued efforts to integrate reading and writing activities into efficient and effective early literacy interventions are needed.

### **Adi Shechter**

*Effort and Effortlessness in Word Recognition*

Perhaps the most distinctive characteristic of skilled reading is the sheer speed and effortlessness of the word recognition process. Among reading researchers, there is a broad consensus that fast, near-effortless recognition of printed words (often referred to as "automatic" or "fluent" word reading) is crucial to successful reading development because it frees the reader to devote limited processing resources to the meaning of text (LaBerge & Samuels, 1974; Perfetti, 1985). In contrast, there is little agreement on the definition or operationalization of the concepts of automaticity, fluency, or even effort (Moors & de Houwer, 2006; Stanovich, 1990).

Here, we report a study examining the applicability of pupillometry to the study of cognitive effort in word reading. We compared pupil dilation (as well as reading accuracy and pronunciation latencies) for naming familiar and unfamiliar letter strings as an indicator of the cognitive effort involved in both oral and silent word reading among adults (Experiment 1,  $N = 30$ ; Experiment 2,  $N = 20$ ) and children in grades 4–6 (Experiment 3,  $N = 30$ ; Experiment 4,  $N = 18$ ).

The findings from all four experiments were consistent in showing that readers, both young and old, are not only slower and less accurate but also allocate more cognitive resources when reading unfamiliar letter strings (i.e., pseudowords) compared with familiar (real) words. Furthermore, as predicted, we confirmed a significant familiarity-by-length interaction; length effects on behavioral and pupillometric measures were consistently stronger for pseudowords than for real words.

These findings not only open up new possibilities for studying the issue of effort and effortlessness in the field of visual word recognition, but also in clarifying the troublesome concepts of automaticity and fluency in word reading.

### **Na Young Yoon**

*The Differential Effects of a Reading Intervention With Anxiety Management Instruction for Students With and Without Disabilities*

Reading performance and anxiety are negatively associated with each other (Eum & Rice, 2011; Grills-Taquechel et al., 2012). In addition, students with disabilities often experience higher anxiety symptoms than their peers without disabilities (Nelson & Harwood, 2011). Prior reviews revealed promising effects of anxiety interventions on reducing anxiety and improving academic outcomes (Bicer et al., 2020; von der Embse et al., 2013), and Grills and Vaughn developed integrated reading and anxiety intervention to improve outcomes in both areas. This study presented the extended prior efficacy studies (Capin et al., 2024; Vaughn et al., 2022) to investigate whether the effects of integrated reading and anxiety intervention differed for students with and without disabilities. A total of 360 third to fifth grades students with ( $n = 81$ ) and without disabilities ( $n = 279$ ) who were experiencing reading comprehension difficulties were included in the analytic sample. Within our sample of students with disabilities, most of them were identified as Learning Disabilities (57%) and others include Speech Impairment or Other Health Impairment. Students were randomly assigned to one of three conditions: reading and anxiety intervention (RANX), reading and math intervention (RMATH), and business as usual (BaU). Students in two intervention conditions received 30-mins of small group instruction for approximately 15 to 20 weeks. To examine the moderating effects of disability status on reading and anxiety outcomes, we ran a two-level model using the mean-centered pretest and cohort as covariates. On the majority of standardized reading measures, intervention effects of RANX relative to RMATH and BaU did not significantly differ for students with and without disabilities. On the contrary, the effects of RANX did vary on proximal reading comprehension outcome. The effects of RANX relative to RMATH and BaU were positive for students without disabilities ( $ES = 0.2$  and  $ES = 0.68$ , respectively) but not for students with disabilities ( $ES = -0.54$  and  $ES = -0.15$ , respectively). On all anxiety outcomes, there was no statistically significant differential effect of RANX between students with and without disabilities. Findings did not support the evidence to suggest that the effects of RANX vary as a function of disability status. Findings will be discussed in relation to the promising effect of integrating reading and anxiety interventions, as well as the limitations of the sample size.

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