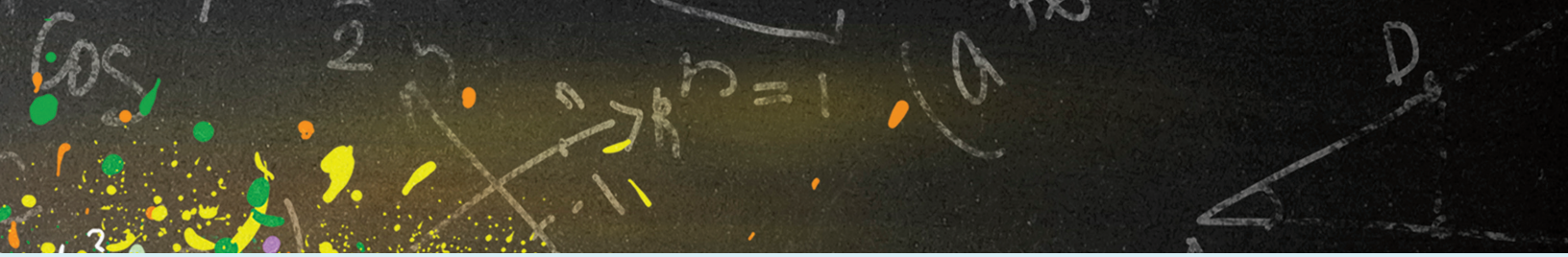

# 2018 International Mind, Brain and Education Society Conference

**SEPTEMBER 27–29**

RONALD TUTOR CAMPUS CENTER, UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES



MIND, BRAIN, AND EDUCATION

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## OVERVIEW

Mind, Brain, and Education (MBE) provides a forum for the scholarly communication of basic and applied research on learning and development, including analyses from biology, neuroscience, cognitive science, and education.

The journal is part of the effort of the International Mind, Brain, and Education Society to be a scholarly source for the accurate translation of the science of biology, brain, and behavior into applications that will impact education efforts internationally and across ages and contexts. The journal also has a goal of stimulating collaboration across disciplines and between researchers and practitioners with different perspectives informing each other to advance the science of mind, brain and education. Thus, the journal has a goal of supporting the development of a framework for new ideas to advance research efforts at the intersection of biology, brain, cognition, and education, and the practical innovations these research efforts inform. The broad target audience is researchers who wish to report basic, high quality research as well as practice-based evaluation relevant to education.

## AIMS AND SCOPE

Mind, Brain, and Education (MBE) publishes peer-reviewed articles addressing biological, brain, cognitive and behavioral questions that are relevant to the broad field of education. The journal operates through an open submission process. In addition, researchers are encouraged to contact the editorial board with ideas for reviews, commentaries and special issues. Short and full-length empirical reports, reviews and commentaries on specific topics broadly relevant to MBE readership, including to practitioners, will be considered.

MBE has an editorial board of internationally recognized scholars and practitioners from a variety of disciplines. MBE provides a forum for highest quality presentation of basic and applied research on learning and development across the ages, in typically developing and special needs populations, including analyses of biology, neuroscience, cognitive and social-emotional sciences, and education. Research in mind, brain, and education emphasizes the reciprocal relationship in which education informs biological and behavioral and cognitive research as much as these inform educational research and practice. MBE original research articles report novel discoveries from laboratory-based experiments or research in the settings of practice. MBE articles also may consider the biological, cultural and intergenerational factors that influence life-long learning and plasticity.

MBE strives to be a highly respected resource for reporting basic and translational data that provide a framework for developing a critical understanding of advancing educational practices and curricula. The journal is thus a venue for scientifically reliable, educationally relevant research that connects mind, brain and education, catalyzing the kinds of research across disciplines that are essential to promote research-based practices in education.

# IMBES

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# Thursday, September 27

| TIME | EVENT | LOCATION |
|---|---|---|
| 9:00 AM–5:00 PM | IMBES Conference Registration | **Trojan D** |
| 5:00 PM–5:30 PM | Welcome and Conference Overview – Mary Helen Immordino-Yang, EdD | **Trojan Ballroom** |
| 5:30 PM–6:30 PM<br>**Keynote Address** | **"Developmental Population Neuroscience: Where is the Classroom?"**<br>**Terry Jernigan,** PhD<br>Introduction by Pat Levitt, PhD, USC; UCLA, The Saban Research Institute | **Trojan Ballroom** |

# Friday, September 28

| TIME | EVENT | LOCATION |
|---|---|---|
| 7:30 AM–8:30 AM | Breakfast | **Trojan Ballroom** |
| 8:30 AM–9:30 AM<br>**Keynote Address** | **"Supporting Conceptual Growth and Life Change: From Digital Games to Empowered Ecosystems to Connected Individuals"**<br>**Sasha Barab**, PhD<br>Introduction by Rebecca Gotlieb, Rossier School of Education, USC | **Trojan Ballroom** |
| 9:30 AM–9:50 AM | Break | |
| 9:50 AM–11:50 AM | **Beyond Deficits in Struggling Learners:** Promoting Resilience, Remediation, and Compensation (p.9) | **Franklin** |
| | **Executive Function Development:** Bridging Psychological, Neurological, and Educational Perspectives (p. 9) | **Trojan AB** |
| | **Learning and Remembering in Real World Contexts** (p.10) | **Forum** |
| | **Math Anxiety:** Mechanisms and Implications for Interventions (p.11) | **Trojan D** |
| | **Domain-general Skills in Education:** Psychology, Education, and Neuroscience Perspectives (p.12) | **Trojan C** |
| 11:50 AM–1:15 PM | Lunch and Award Presentations | **Trojan Ballroom** |
| 1:15 AM–1:45 PM | Poster Set-Up | **Trojan Ballroom** |
| 1:45 PM–3:45 PM | **Applying Science:** Translating and Brokering Science of Adolescent Learning Research for School Improvement (p.12) | **Forum** |
| | **Social Emotional Skills in Education:** Perspective-taking, Empathy and Imitation in Learning (p.13) | **Trojan D** |
| | **Proportional Reasoning:** Insights from Development, Neuroimaging and Educational Intervention Studies (p.14) | **Trojan C** |
| | **Investigating the Impact of MBE Research-informed Teaching** (p.15) | **Trojan AB** |
| | **Associated Domains of Learning:** On the Overlap Between Reading and Arithmetic (p.16) | **Franklin** |
| 3:45 PM–4:00 PM | Break | |
| 4:00 PM–5:00 PM<br>**Keynote Address** | **"Bilingualism: Changing Minds and Brains"**<br>**Ellen Bialystok**, PhD<br>Introduction by Judith Kroll, PhD, University of California Riverside | **Trojan Ballroom** |
| 5:00 PM–7:00 PM | Poster Presentations (pp. 25–28) and Reception | **Trojan Ballroom** |

# Saturday, September 29

| TIME | EVENT | LOCATION |
|---|---|---|
| 7:30 AM–8:30 AM | Breakfast | **Trojan Ballroom** |
| 8:30 AM–10:00 AM<br>**Keynote Address and Panel Discussion** | **"How the Brain and Learning Sciences Can Re-shape Education Practice and Policy"**<br>**Linda Darling-Hammond**, PhD<br>Introduction by Marcelo Suarez-Orozco, PhD, UCLA School of Education and Information Studies<br><br>**Panelists:** Marcelo Suarez-Orozco, PhD (Chair), Claude Steele, PhD and Terry Jernigan, PhD | **Trojan Ballroom** |
| 10:00 AM–10:30 AM | Break and Poster Set-Up | **Trojan Ballroom** |
| 10:30 AM–12:30 PM | **Innovative Uses of Game-Based Learning and Data Analytics in Educational Neuroscience** (p.17) | **Forum** |
| | **Neuropsychology in the Classroom:** Executive Function in the Context of Learning and Development (p.17) | **Franklin** |
| | **Relational Learning in Mind, Brain, and Education** (p.18) | **Trojan C** |
| | **Emotional Learners:** The Effects of Stress and Emotion on Education, Learning and Cognition (p.19) | **Trojan AB** |
| | **The Elephant in the (Class)room:** Learning Occurs in Multisensory Environments (p.20) | **Trojan D** |
| 12:30 PM–2:30 PM | Poster Presentations (pp. 29–32) & Boxed Lunch | **Trojan Ballroom** |
| 2:00 PM–4:00 PM | **Creating Connections Between Researchers and Educators:** The Intersection of Cognitive Neuroscience and Education (p.20) | **Franklin** |
| | **What are the Barriers to MBE? Insights From Conversations and Collaborations with Early Maths Educators and Researchers** (p.21) | **Trojan C** |
| | **Multi-disciplinary Approaches to Understanding Reading Ability in Minority Populations** (p.22) | **Trojan AB** |
| | **Bridging Knowledge from Education and Neuroscience for Personalized Learning:** UCSD–VUSD Partnership (p.23) | **Forum** |
| | **Psychophysiological Approaches to Understanding Children's Learning in Educational Media Contexts** (p.24) | **Trojan D** |
| 4:00 PM–4:20 PM | Break | |
| 4:20 PM–5:20 PM<br>**Keynote Address** | **"Adaptive Environments or Rewiring Children? Poverty, Adversity and the Brain"**<br>**Sarah Watamura**, PhD<br>Introduction by Rodrigo Riverios Miranda, PhD Student, Psychology, USC | **Trojan Ballroom** |
| 5:20 PM | Poster Award Presentations and Closing Remarks | **Trojan Ballroom** |

KEYNOTES

SYMPOSIA

# Keynote Speakers

**Terry Jernigan, PhD** is Professor of Cognitive Science, Psychiatry, and Radiology and Director, Center for Human Development at UC San Diego. For over 30 years she has studied the human brain using noninvasive imaging. This work has focused on brain development and aging, neurodevelopmental disorders, neuropsychiatric and substance use disorders, and neurodegenerative disorders. For the last fifteen years her central research interest has been the developing human mind and brain, with a focus on the dynamic neurodevelopmental processes that give rise to human individuality – and on how these processes are impacted by experience, genetic variation, substance exposure, and other factors. She is Co-Director of the Coordinating Center for the national Adolescent Brain Cognitive Development (ABCD) Study. She also serves on the Council of Councils of the National Institutes of Health, and on the scientific advisory boards of several research organizations in the United States and Europe.

**Sasha Barab, PhD** is an internationally recognized Learning Scientist who has researched, designed, and published extensively on the challenges and opportunities of using innovation for impact, with a particular focus on the power of games. He is a professor in the School for the Future of Innovation in Society and serves as the Executive Director of the Center for Games and Impact. His research has resulted in numerous grants, over 100 published manuscripts, and multiple game-based innovations that have been engaged by over 200,000 players to support learning and transformation. His current work extends the design boundaries from the bits and bytes of the game world to complex real-world ecosystems with the goal of helping all learners thrive in a complex, rapidly changing, digitally connected world. One recent project, My Lifelabs, is based on an invite, enable, and release learning methodology and focused on cultivating growth and impact journeys so that more people can realize their potential. Across all work is a sensitivity to factors such as ecosystem integration, stakeholder alignment, enacted agency, and achieving sustainable and scalable outcomes.

**Ellen Bialystok, PhD** is a Distinguished Research Professor of Psychology and Walter Gordon Research Chair of Lifespan Cognitive Development at York University, and Associate Scientist at the Rotman Research Institute of the Baycrest Centre for Geriatric Care. Her research uses behavioral and neuroimaging methods to examine the effect of experience on cognitive

processes across the lifespan. The primary experience studied is bilingualism, and she has discovered significant effects of bilingualism at all ages, including postponement of systems of dementia in older adults. Among her awards are the Canadian Society for Brain Behaviour and Cognitive Science Hebb Award (2011), Killam Prize for the Social Sciences (2010), York University President's Research Award of Merit (2009), Donald T. Stuss Award for Research Excellence at the Baycrest Geriatric Centre (2005), Dean's Award for Outstanding Research (2002), Killam Research Fellowship (2001), and the Walter Gordon Research Fellowship (1999). In 2016, she was named an Officer of the Order of Canada and in 2017 she was granted an honorary doctorate from the University of Oslo for her contributions to research.

**Linda Darling-Hammond, PhD** is the Charles E. Ducommun Professor of Education Emeritus at Stanford University where she founded the Stanford Center for Opportunity Policy in Education and served as the faculty sponsor of the Stanford Teacher Education Program, which she helped to redesign. Darling-Hammond is past president of the American Educational Research Association and recipient of its awards for Distinguished Contributions to Research, Lifetime Achievement, and Research-to-Policy. She is also a member of the American Association of Arts and Sciences and of the National Academy of Education. From 1994–2001, she was executive director of the National Commission on Teaching and America's Future, whose 1996 report What Matters Most: Teaching for America's Future was named one of the most influential reports affecting U.S. education in that decade. In 2006, Darling-Hammond was named one of the nation's ten most influential people affecting educational policy. In 2008, she served as the leader of President Barack Obama's education policy transition team.

Darling-Hammond began her career as a public school teacher and co-founded both a preschool and a public high school. She served as Director of the RAND Corporation's education program and as an endowed professor at Columbia University, Teachers College. She has consulted widely with federal, state and local officials and educators on strategies for improving education policies and practices. Among her more than 500 publications are a number of award-winning books, including The Right to Learn, Teaching as the Learning Profession, Preparing Teachers for a Changing World and The Flat World and Education. She received an Ed.D. from Temple University (with highest distinction) and a B.A. from Yale University (magna cum laude).

**Sarah Enos Watamura, PhD** is an Associate Professor of Psychology at the University of Denver where she directs the Child Health & Development Lab and co-directs the Stress, Early Experience and Development (SEED) Research Center. After training with Megan Gunnar, PhD, at the University of Minnesota's Institute of Child Development, she received her PhD from the Department of Human Development at Cornell University in 2005. She has longstanding interests in children¹s physiologic regulation, their development within caregiving contexts, and in understanding mechanisms and trajectories from early life experiences to later physical health, mental health, cognitive/educational, and socio-emotional outcomes. Her work focuses on the role of adverse, protective and promotive factors in families experiencing poverty and among newly immigrated and refugee families, and includes testing promising intervention approaches.

# Keynote Abstracts

**Terry Jernigan, PhD**

## Developmental Population Neuroscience: Where is the Classroom?

In the last decade, several large-scale studies with a focus on the developing mind and brain have been launched in an effort to improve the depth and scope of observational data resources available to the research community. Such high-dimensional, longitudinal studies, especially those attempting to meet epidemiological criteria in enrollment, and producing genetic and multimodality imaging data, are lately referred to as population neuroscience studies. One of the largest of these is the Adolescent Brain and Cognitive Development (ABCD) Study; which as the name suggests focuses on the adolescent brain, enrolling children at ages 9 and 10 for a ten-year study. I will describe this study, its rationale and aims, structure, and protocols; and will highlight its open science model. I will focus on attempts in ABCD to identify and assess relevant environmental and experiential factors that are likely to impact important health and mental health outcomes. Finally, I will describe the challenges that we face in acquiring and integrating information about critically important classroom experiences and academic outcomes into these studies, in spite of widespread acknowledgement of the value of doing so, and what we should do about it.

**Sasha Barab, PhD**

## Supporting Conceptual Growth and Life Change: From Digital Games to Empowered Ecosystems to Connected Individuals

Barab will share experiences as a game designer and learning scientist moving from a focus on knowledge transactions to empowered ecosystems. Rather than a focus on games as products, and change as something one does to another, the work positions growth as a shared accomplishment distributed among the designers, the service providers, and, especially, those being impacted … all in relation to local ecosystems. For too long, designers have looked inwards to the bits and bytes of that which they are designing as the innovation. Or, they focused on leveraging gamification techniques to engage what are seemingly unmotivated learners. When one adopts an ecosystem perspective, there is a shift from treating impact as bound up in the product or in the learning theory to instead placing it squarely in the head, hands, and heart of the learner and the ecosystem in which learning is occurring. After all, to do meaningful work in the world, it is the learner and the implementation ecosystem, not the designer, who have the responsibility to integrate the ideas being learned.

**Ellen Bialystok, PhD**

## Bilingualism: Changing Minds and Brains

All our experiences contribute to the way our minds and brains develop, but intense experiences have a special role in shaping our cognitive systems. As humans, no experience is more intense or pervasive than our use of language, so a lifetime of learning and using (at least) two languages has the potential to leave a profound mark on human cognition. Research with infants shows that those exposed to two languages from birth demonstrate more control over attention than do infants in monolingual environments, and young children learning two languages show precocious development of essential cognitive processes. Thus, development through childhood is shaped by the linguistic environment. The most dramatic findings, however, are found in older age where lifelong bilingualism protects cognitive function in healthy aging and postpones symptoms of dementia and other neurodegenerative diseases. This talk will review the evidence from these studies and propose an explanation for how exposure to and use of two languages leads to these cognitive and brain consequences.

**Linda Darling-Hammond, PhD**

## How the Brain and Learning Sciences can Re-shape Education Practice and Policy

Education policy and practice have been shaped in recent years by strong, consequences associated with increases in standardized test scores, which have focused school studies on a particularly narrow set of outcomes and teaching on a particularly narrow set of strategies that ignore much of what we know about human development and learning. This keynote will describe how recent insights from neuroscience, the developmental and learning sciences, anthropology and sociology should inform changes in educational policy and practice – and will draw upon educational research illustrating the effects of these changes in schools in the US and abroad.

**Sarah Enos Watamura, PhD**

## Adaptive Environments or Rewiring Children? Poverty, Adversity and the Brain

This session will review the literature on the effects of poverty on brain development with a focus on time periods and opportunities to support resilience. Because experiencing poverty is frequently compounded with experienced adversity, we will also review the literature on the effects of stress and trauma on the brain, connecting these findings to possible individual differences relevant for educational settings. Without directly training teachers in this literature, we risk two sides of a problematic application of implicit bias around brain development and adversity: overgeneralization and stereotype on the one hand, and a one-size-fits-all model on the other. Contrasting theoretical approaches that recommend retraining the brain versus working from its strengths will also be discussed.

# Symposia

## Beyond Deficits in Struggling Learners: Promoting Resilience, Remediation, and Compensation

**Fri., Sept. 28, 9:50am–11:50am: Franklin**

**Chair:** **Robert Ochsendorf**, National Science Foundation
**Speakers:** **Fumiko Hoeft**, UCSF; **Ben Clarke**, University of Oregon; **Joanna Christodoulou**, MGH Institute of Health Professions; **Claudia Koocheck**, Westmark School

This symposium will highlight opportunities to promote resilience and skill improvement for students with learning disabilities. The session will be chaired by Dr. Rob Ochsendorf (National Science Foundation), who is the Program Director in the Education and Human Resources Directorate, Division of Research on Learning, and Program Lead for the Discovery Research Pre-K-12 Program. Dr. Fumiko Hoeft (University of California, San Francisco) will present a comprehensive model of protective factors that promote success in struggling learners. This model defines protective factors, both cognitive and socio-emotional, that promote resilience, as well as cognitive and linguistic factors that promote compensation. Dr. Ben Clarke (University of Oregon) will share cutting-edge research on effective math intervention practices for struggling math learners in elementary school. In particular, the work will focus on students who demonstrate non-responsiveness to generally efficacious intervention approaches. Dr. Joanna Christodoulou (MGH Institute of Health Professions) will discuss insights from cognitive neuroscience on reading intervention, highlighting the plasticity of the brain and the importance of individual variability in response to intervention. The speakers will discuss implications for practice and provide recommendations for educators and parents whenever possible. The session will conclude with an interactive discussion on next steps for research and practice, led by Claudia Koochek (Head of School at Westmark School, Encino, CA) who has served as a dedicated educator and administrator with a focus on students with disabilities for over 20 years.

## Executive Function Development: Bridging Psychological, Neurological, and Educational Perspectives

**Fri., Sept. 28, 9:50am–11:50am: Trojan AB**

**Chair:** **Frederick Morrison**, University of Michigan
**Speakers:** **Jennie Grammer**, University of California Los Angeles; **Elif Isbell**, University of North Carolina Greensboro; **Sarah Jo Torgrimson**, University of California Los Angeles; **Amira Ibrahim**, University of Michigan; **Sammy Ahmed**, University of Michigan

The early development of executive function (EF) has and continues to be a focal point of research given its relevance for school readiness and early academic outcomes. The burgeoning area of EF research has drawn the interest of scientists from different disciplines, all of whom have contributed to our understanding of the nature, sources and growth of these foundational skills. However, much of this work relies on different techniques, tools, and measurement traditions, highly specific to academic discipline. As a result, less is known about the degree to which research from distinct disciplines inform one another and the extent to which findings from different fields can improve learning and educational practices.

This symposium will focus on four studies that employ methods from neuroscience, experimental cognitive science and educational psychology to understand the development of EF and its relations to academic achievement in young children. Each presentation has been designed to address the following questions: 1) how can findings from different disciplines improve our understanding of the link between executive function and academic achievement? and 2) how this work may be used to inform us of learning processes and improve educational practice? Specifically, the first presentation will explore relations between executive function student motivation, and academic skill acquisition, using laboratory-based assessments and teacher reports (Torgrimson, et al.). Next, examinations of longitudinal associations between a neural

index of conflict monitoring and emergent math skills from preschool through first grade (Isbell, et al.) will be explored. Finally, in two separate talks drawing from a related data set, the neural correlates of response inhibition and early mathematics skills will be described (Ibrahim, et al.), as well as the development and validation of a set of new group-based EF tasks that assess classroom-like behaviors (Ahmed, et al.).

Frederick Morrison is a Professor of Psychology and the Combined Program in Education and Psychology at the University of Michigan. Dr. Morrison's work examines the impact of child, family and schooling factors in shaping children's cognitive growth and academic achievement. His most recent work involves collaborations with cognitive neurophysiologists to examine the impact of schooling on brain and behavioral measures of executive function and academic achievement. These experiences provide the knowledge and skills to contribute significantly to the cross-disciplinary nature of the current project.

Jennie Grammer is an Assistant Professor in Human Development and Psychology in the Graduate School of Education and Information Studies at UCLA. Motivated by an interest in the individual differences observed in children's school success, Dr. Grammer draws upon Psychology, Education, and Neuroscience to examine the impact of the elementary school context on developmental changes in children's cognition and academic achievement.

Dr. Elif Isbell is a postdoctoral fellow at the University of North Carolina at Greensboro.

Sarah Jo Torgrimson is a Ph.D. student in Human Development and Psychology at UCLA.

Amira Inbrahim is a Ph.D. Candidate in the Combined Program in Education and Psychology at the University of Michigan.

Sammy Ahmed is a Ph.D. Candidate in Developmental Psychology at the University of Michigan.

## Learning and Remembering in Real-World Contexts

**Fri., Sept. 28, 9:50am–11:50am: The Forum**

**Chair:** **Lisa Fazio**, Vanderbilt University
**Speakers:** **Catherine Haden,** Loyola University Chicago; **Jennifer Coffman,** University of North Carolina at Greensboro; **Haley Vlach**, University of Wisconsin, Madison

Children learn about the world both at home and in schools, but also in informal educational contexts such as museums. The current symposium examines how children's experiences and interactions in these contexts affect their learning and memory. The symposium has two goals: first, to examine how our knowledge of children's memory can be used to improve learning outcomes and second, to expand our understanding of the memory processes underlying learning. The speakers will bring together perspectives from educational, developmental and cognitive psychology to discuss how new insights from memory research can inform educational practices in all contexts.

First, Dr. Catherine Haden will discuss the conversations children and their parents have after an experience in a museum exhibit, and the ways these interactions advance learning opportunities for children. Engineering talk was greatest when families engaged in an engineering design challenge in the exhibit, told their narrative collaboratively, and gestured towards the exhibit while talking about the experience. Dr. Haden is a Professor of Psychology at Loyola University Chicago and is an expert on how parent-child interactions affect what children learn and remember.

Next, Dr. Jennifer Coffman will discuss how teacher talk affects children's memory development and content knowledge. Recent longitudinal and experimental research has shown that exposure to teacher language in the early elementary school years that is rich in references to metacognition, cognitive processes, and requests for remembering is important for long-lasting student gains in strategic memory and study skills. Dr. Coffman is an Associate Professor of Human Development and Family Studies at The University of North Carolina at Greensboro. A former elementary school teacher, Dr. Coffman's research focuses on the socialization of cognitive and affective functioning in young children.

Continuing with the theme of how metacognition can play an important role in children's learning, Dr. Haley Vlach will present on children's beliefs about massed

versus spaced practice. In general, adults believe that massed practice is more effective than spaced, but similar biases were not found in young children. Thus, teaching children about the benefits of spaced learning early on, before they acquire incorrect biases, may be optimal. Dr. Haley Vlach is an Associate Professor of Educational Psychology at the University of Wisconsin, Madison and studies how young children learn from the world around them.

Finally, Dr. Lisa Fazio will discuss the positive and negative effects of multiple-choice testing on learning in elementary school. Both younger and older students benefited from a prior multiple-choice test, but older children were more likely to learn incorrect answers from the test. Interestingly, this age difference was due to increases in knowledge rather than increasing memory abilities. Dr. Fazio is an Assistant Professor of Psychology at Vanderbilt University and studies how children and adults learn new information.

The symposium will feature a brief 5-minute introduction of the topic and presenters, 20 minute talks by each of the presenters, along with 5 minutes for questions (100 min total), and a 15 minute discussion with the attendees about the implications of the research.

## Math Anxiety: Mechanisms and Implications for Interventions

**Fri., Sept. 28, 9:50am–11:50pm: Trojan D**

**Chair:** **David Kraemer**, Dartmouth College
**Speakers:** **Lindsey Richland**; **Kelly Trezise**, University of Chicago; **Rachel Pizzie**, Georgetown University; **Stacy Shaw**, UCLA

How does math anxiety impact learning and achievement? What can be done to mitigate the negative impacts of math anxiety on learning and testing environments? Talks in this symposium sample a range of methods and age groups to investigate the impact of math anxiety on real-world educational outcomes. Decades of research have highlighted key cognitive and neural components implicated in performance decrements associated with math anxiety. Building on this prior work, recent insights from laboratory- and classroom-based research shed new light on the links between anxiety, stereotype threat, negative emotion, and academic achievement. Classroom-based studies reveal important factors related to early learning trajectories, including how changes in the difficulty of the material differentially affects elementary students who experience math anxiety. Further research on elementary math education highlights the impact of stereotype threat – the idea that individuals who identify as members of a stereotyped group are negatively influenced by the stereotype, especially in high-pressure situations such as math tests. Results indicate that both stereotype threat and responses to evaluative pressure can impact math test performance, and also math learning. In moving towards effective interventions, reappraisal of negative emotion is revealed to be an effective moderator of the negative effects of physiological arousal on test performance in the lab, and these effects are examined both in terms of neural systems and in terms of classroom achievement at the high school and college levels. Overall, these findings illustrate clearly that math anxiety and stereotype threat play a large role in math learning across the educational experience of many students. Fortunately, this research also highlights key ways in which we might be able to increase each student's potential for academic success.

Four speakers will present recent research related to the mechanisms of math anxiety and possible interventions. Dr. Richland's research examines stereotype threat and evaluative pressure. While previous research has focused on the effects of stereotype threat on math test performance, this research extends to examine how these stressors impact students' math learning. Her talk will examine how stereotype threat and evaluative pressure experienced alone or simultaneously, during cognitively demanding mathematics instruction, impact 5th graders' learning. Dr. Trezise's research investigates how math anxiety changes in classroom contexts. Specifically, her talk will focus on several aspects of classroom learning, including problem complexity (arithmetic to algebra problems in an adolescent sample), and throughout the learning trajectory before, during, and after a lesson on ratio (in a grade 5 sample). Dr. Pizzie's research examines interventions aimed at remediating math anxiety. Across several lab-based and classroom-based studies her work examined physiological indices of negative emotion, neural substrates of affect and math computation, and academic performance in high school math classes. Her talk will discuss the potential for cognitive reappraisal as a promising method for remediation of the deficits caused by math anxiety. Finally, in her research, Shaw focuses on understanding the mechanisms and factors that contribute to math anxiety, and also examines ways to reduce it. Her talk will discuss research that explores the relationship between math anxiety and flexible thinking in mathematics, including research that investigates how math anxiety relates to "aha" moments in math.

## Domain-general Skills in Education: Psychology, Education, and Neuroscience Perspectives

**Fri., Sept. 28, 9:50am–11:50am: Trojan C**

**Chair:** **Jamie Jirout**, University of Virginia
**Speakers:** **Katerina Schenke**, University of California, Los Angeles; **Sharon Zumbrunn**, Virginia Commonwealth University; **Tanya Evans**, University of Virginia

Domain general skills include school enjoyment, self-regulation, curiosity, self-efficacy, and mindset, and are sometimes referred to as "non-cognitive", "soft", or "21st Century" skills (Duckworth & Yeager, 2015; Heckman & Koutz, 2012; Martin, Sargrad, & Batel, 2016). Substantial research supports the importance of these skills in promoting academic well-being across the school years (Farrington et al., 2012), and measuring their development is becoming a higher priority in schools as the Every Student Succeeds Act (ESSA) supports a broader conceptualization of school quality and student success beyond traditional academic content knowledge. This symposium will discuss how research from can be applied to understanding and enhancing student learning by targeting domain-general skills, including multidisciplinary research spanning from preschool through high school.

In the first talk, Schenke will describe the development and implementation of brief survey measures of preschool children's academic orientations (growth mindset, academic self-concept, and school enjoyment), including the process of assessing the instrument using modern psychometric approaches (item factor analysis, invariance testing, and concurrent validity analyses) and results with over 1,100 students from a majority non-white public preschool sample. Jirout will then present an overview of research on students' curiosity in schools, including a qualitative analysis of the literature on behavioral indicators of curiosity, and quantitative analyses of both classroom instruction and associated student outcomes and an experimental test of the indicators identified. In the third talk, Zumbrunn will present an accelerated growth model with mixed membership to highlight individual differences in the development of student self-regulation from a longitudinal study of self-regulation in students from 3rd- through 11th-grade. Finally, Evans will describe a quasi-experimental elementary curriculum intervention based on foundational knowledge, focusing on discussion of the putative brain mechanisms driving the effects that will be collaboratively tested with a follow up neuroimaging study.

## Applying Science: Translating and Brokering Science of Adolescent Learning Research for School Improvement

**Fri., Sept. 28, 1:45pm–3:45pm: The Forum**

**Chair:** **Claude Steele,** Stanford Graduate School of Education, Stanford University
**Co-Chair:** **Winsome Waite,** The Alliance for Excellent Education
**Speakers:** **Jay Giedd**, University of California–San Diego, Johns Hopkins Bloomberg School of Public Health; **Dorainne Green**, Indiana University; **Bob Wise**, All4Ed, Former Governor of West Virginia; **Mary Sieu**, ABC Unified School District, California

Adolescence is a time of transition characterized by rapid physical, cognitive, emotional, social, and psychological development. As students move toward adulthood, their bodies and minds change and those changes affect how they learn, and likewise, should affect how educators work.

Fortunately, knowledge about how students learn, particularly during the adolescent years, has grown during the last thirty years. Furthermore, there is increasing interest in aligning education policies and practices with scientific research on adolescent learning and development. By aligning instructional practices with this scientific research, educators can create learning experiences that capitalize on unique opportunities that adolescence offers.

Research must be made useable and accessible if it's to influence education decisions. Consequently, the Alliance for Excellent Education's (All4Ed's) science of adolescent learning initiative focuses on translating, communicating, and disseminating adolescent learning and development research for policymakers and practitioners. All4Ed serves as a broker for researchers, policymakers, and practitioners to have deep discussion on how to best apply this research to school improvement policy and practice, especially for secondary schools serving historically underserved students such as students of color and students from economically disadvantaged backgrounds.

Building from the FrameWorks Institute's session on communicating scholarly research to non-scientific

audiences, All4Ed will discuss translating adolescent learning and development research to support efforts in improving U.S. middle and high schools. The symposium will build on All4Ed's series of reports for practitioners and policymakers on key SAL consensus statements developed from research from multiple disciplines of science of learning and development, to which panel members have contributed and reviewed. Researchers, education practitioners, and policy experts will provide insight into how practice and policy can be used to effectively incorporate well-supported research into actionable recommendations for education leaders seeking to improve low-performing schools and underperforming subgroups of students. A panel of researchers will discuss key findings from their research that have strong implications for schools, featured in All4ed's translated series of reports. Confirmed for the first panel are the following researchers:

- Claude Steele, PhD, I. James Quillen Endowed Dean, Emeritus, Stanford Graduate School of Education; Lucie Stern Professor in the Social Sciences, Emeritus, & Professor of Psychology at Stanford University

  *Research focus: Stereotype threat and its application to minority students' academic performance*

- Jay Giedd, PhD, Director, Child and Adolescent Psychiatry, University of California–San Diego; Professor at Johns Hopkins Bloomberg School of Public Health

  *Research focus: Adolescent brain development*

- Dorainne Green, PhD, Postdoctoral Fellow, Department of Psychological and Brain Sciences, Indiana University

  *Research focus: How discrimination shapes affective, cognitive, behavioral, and physiological outcomes*

The panel will be followed by a townhall-style discussion led by Bob Wise, president of All4Ed and former governor of West Virginia and Mary Sieu, PhD, superintendent of ABC Unified School District, California, who will share their knowledge and insight into how research can be applied purposefully and systemically to bring about substantive change in teaching and learning for the adolescent learner through policy and practice.

## Social-Emotional Skills in Education: Perspective-taking, Empathy, and Imitation in Learning

**Fri., Sept. 28, 1:45pm–3:45pm: Trojan D**

**Chair:** **Rebecca Gotlieb**, University of Southern California
**Speakers:** **Henricke Moll**, University of Southern California; **Hunter Gehlbach**, University of California; **Vanessa Rodriguez**, New York University

Education research, policy, and practice have seen dramatically increasing interest in social-emotional learning (SEL)—culturally sensitive skills and attitudes shaping how students understand and capitalize on their own and others' thoughts and feelings to guide action. Mounting interest in SEL is warranted; today's students will enter a workforce that values social-emotional skills that facilitate collaboration with diverse individuals. Further, social-emotional skills may promote students' learning, as learning is a social process. Of concern, some evidence suggests that students' social-emotional abilities may be lower than in preceding decades (e.g., Konrath, O'Brien, & Hsing, 2011). Thus, an urgent need exists to understand how to support students' development of SEL required for success in both school and the workforce. This symposium will highlight interdisciplinary evidence of social-emotional skills' role in learning and how to capitalize on these skills to promote learning.

Hunter Gehlbach, UCSB Associate Professor of Education and expert in adolescent social-emotional learning, will begin the session by proposing a new theory of social perspective-taking and its relation to learning. Social perspective-taking, Gehlbach argues, allows us to understand others' intentions, imagine their feelings, and respect their values. It can be taught by motivating perspective-taking, selecting appropriate perspective-taking strategies, gathering information to inform perspective-taking, and evaluating the perspective-taking attempt. Given that social perspective-taking is teachable and improves other social-emotional skills, it can unlock the potential of SEL in schools. Henrike Moll, USC Associate Professor of Psychology and expert in social-cognitive development, will discuss her recent research into children's reliance on testimony, demonstration, and imitation to build their understanding of the world. Moll finds that young children understand when others intend to teach them and transfer information obtained during such encounters. She argues from a comparative-

evolutionary and developmental perspective that children's physical cognition is culturally mediated and develops through understanding other's thoughts. Rebecca Gotlieb will present about the association between perspective-taking and long-term memory in adolescents and neurobiological moderators of this relation. Gotlieb will conclude by suggesting both that it may be possible to develop biological markers of social skills and that creating opportunities for adolescents to exercise these skills may support their memory for social and academic content. Vanessa Rodriguez, Assistant Professor of Population Health at NYU and expert in teacher-student relationships, will highlight the role of teachers' social-emotional skill and systems thinking in the dynamic interaction between teacher and students. Rodriguez will present evidence of the importance for students' learning of teacher-student behavioral and psychophysiological synchrony. She will conclude with implications for improving teacher professional development by focusing on cultivating teachers' social-emotional skills. Presenters will invite open discussion covering implications of social-emotional skills for learning and recommendations for practice.

Speakers range from junior to mid-career scholars and are trained educational and developmental researchers with experience in MBE. This symposium will address the nascent understanding of SEL within MBE. It will offer new interdisciplinary evidence from human development, comparative psychology, and social neuroscience to inform theories of social-emotional learning and educational practice for enhancement of SEL to support students' learning and workforce preparation.learning and recommendations for practice.

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## Proportional Reasoning: Insights from Development, Neuroimaging and Educational Intervention Studies

**Fri., Sept. 28, 1:45pm–3:45pm: Trojan C**

**Chair:** **Reuven Babai,** Tel Aviv University
**Speakers:** **Edward M. Hubbard**, University of Wisconsin-Madison; **David M. Gómez**, Universidad de O'Higgins; **Korbinian Moeller**, Leibniz-Institut für Wissensmedien/University of Tuebingen; **Ruth Stavy**, Tel Aviv University

Proportional reasoning is important in school and in everyday life. It involves the comparison of ratios, such as fractions, and is known to be difficult for schoolchildren and adults. Our symposium will combine insights regarding proportional reasoning, and their implications for the learning of fractions, that stem from different perspectives. The presenters are experts in allied neuroscience fields of Developmental Cognitive, Educational Neuroscience and Cognitive Neuroscience, Developmental Psychology, and Science and Mathematics Education. The presentations examine the role that non-symbolic ratio processing plays in understanding fractions, and attempts to leverage these insights in training and intervention studies, using behavioral and neuroimaging measures with school-aged children and adults.

Presentation 1 will focus on developmental neuroimaging investigations testing the prediction that symbolic fractions sensitivity builds on non-symbolic ratio sensitivity. 2nd-graders, 5th-graders and adults compared the magnitudes of two fractions presented as symbolic fractions, line ratios, or mixed pairs during fMRI scanning. Behavioral distance effects were observed in all conditions and groups. In adults, all three notations activated a common frontoparietal network. In 2nd-graders a right parietal specialization was observed only for non-symbolic ratios while 5th-graders showed evidence for emerging specializations for symbolic fractions in bilateral frontoparietal regions partially overlapping with non-symbolic ratio processing.

Presentation 2 will focus on the sources of difficulties with symbolic fractions. People tend to use the magnitudes of the components as proxies for the magnitude of the fraction itself, leading to difficulties when larger fractions have smaller components. Mathematically proficient undergraduates were presented with a fraction comparison task using carefully selected fractions pairs. Participants were slower to

compare numerically closer fractions, suggesting they compared fractions based on their magnitudes. However, results also revealed a strategy of choosing as larger those fractions with a smaller "gap" between their components. These findings point to the complexity of competence with symbolic fractions.

Presentation 3 will focus on a neurofunctional examination of fraction learning. Behavioral performance and fMRI responses were measured before and after a five-day number line estimation training aimed at improving participants' understanding of fraction magnitude. Measures included symbolic and non-symbolic fraction magnitude comparison tasks and a task in which symbolic fraction magnitudes were matched with non-symbolic line ratios. Pre-post improvements were found for all three tasks. Changes in activation patterns were observed in frontoparietal regions commonly associated with number magnitude processing. Importantly, distance related neural activation for symbolic fraction processing became significantly stronger after training, indicating neurofunctional plasticity in fraction learning.

Presentation 4 will focus on a neuroscience-inspired educational intervention. In the Drops test, 10th graders compared ratios in the context of mixtures. The Juice test directed students to calculate "rate per unit," thereby reducing the interference from automatic comparison of the salient natural numbers. Success in the Juice test was higher than in the Drops test and success in the Drops test was higher when it was performed after the Juice test. These findings suggest that using pedagogical approaches that direct students to use appropriate solution strategies aids them in overcoming difficulties and could serve as a tool to promote proportional reasoning.

## Investigating the Impact of MBE Research-informed Teaching

**Fri., Sept. 28, 1:45pm–3:45pm: Trojan AB**

**Chair:** **Lia Commissar**, Wellcome Trust
**Speakers:** **Marc Schwartz**, University of Texas at Arlington; **Janet M Dubinsky**; University of Minnesota; **Paul Howard-Jones**, University of Bristol; **Fran Dainty**, National STEM Learning Centre; **Richard Churches**, Education Development Trust; **Daria Makarova**, Star Academies

This symposium will present a range of work where neuroscience has been integrated into classroom practice and policy. The presenters will give an overview of their projects and research, focusing on what has worked well and what has been learnt along the way. This is intended to be a highly interactive session with plenty of time for questions and discussion about the key issues and how to address them.

Marc directed the Southwest Center for Mind, Brain and Education from 2007 to 2018. He will discuss the impact of teaching basic neuroscience concepts to teachers in a Masters program in MBE centered on models of learning from the cognitive sciences, as measured by revisions to their own lesson plans.

Janet directs the BrainU program in neuroscience for K-12 teachers and writes curriculum for their classrooms, www.Brainu.org. She will discuss teachers' classroom applications of the neuroscience knowledge from analysis of teacher interviews following classroom observations in the short term and long term perceived impacts on practice.

Having completed a IBRO/IBE-UNESCO Science of Learning Fellowship, Paul will be able to share his views on how key neuroscience research on learning has relevance to educators, policymakers and governments on a global scale. In addition, he will share findings from a recent project integrating neuroscience into an initial teacher training course in the UK.

Fran is an expert in designing and leading teacher professional development at the National STEM Learning Centre in the UK. She will share insight into the collaborative development process of an online course on the 'Science of Learning' and provide feedback from the first cohort of teachers who took part.

Richard Churches will describe a project in which he has supported teachers to run their own randomised controlled trials based on the best MBE evidence. He

will present some of the teachers' findings and discuss this as an alternative methodology for context specific knowledge creation. Daria Makarova is a teacher who led one of these randomised controlled trials and will co-present with Richard on the findings.

## Associated Domains of Learning: On the Overlap Between Reading and Arithmetic

**Fri., Sept. 28, 1:45pm–3:45pm: Franklin**

**Chair:** **Daniel Ansari**, University of Western Ontario
**Speakers:** **Bert De Smedt**, KU Leuven; **Marc Joanisse**; **Lien Peters**, University of Western Ontario; **Joe Bathelt,** University of Cambridge; **Kaili Rimfeld,** King's College London

Reading and arithmetic constitute two of the most important building blocks of children's education (Duncan et al., 2007) and are quintessential to children's academic and life success (Ritchie & Bates, 2013). Traditionally, neurocognitive research has mostly focused on identifying domain-specific correlates to explain individual differences in separate domains of learning. More specifically, number processing has repeatedly been associated with arithmetic development (Schneider et al., 2017), and phonological processing has often been found to be related to reading development (Wagner & Torgesen, 1987).

Despite the fact that research on arithmetic and reading has mostly occurred in isolation from each other, these academic abilities are, in fact, highly correlated and even share genetic influences (so-called "generalist genes"; Plomin & Kovas, 2005). Additionally, learning disorders characterized by specific deficits in arithmetic (dyscalculia) or reading (dyslexia) frequently co-occur (Dirks et al., 2008). Against this background, researchers have started to look into the overlap between arithmetic and reading, and dyscalculia and dyslexia, and have reported that the correlates associated with different domains of learning may not be as specific as originally assumed (see e.g., Peters, Bulthé, Daniels, Op de Beeck, & De Smedt, 2018).

In this symposium, the overlap between reading and arithmetic abilities is further scrutinized through four research talks cutting through multiple levels of analysis: cognition, neuroscience and genetics. Professor Bert De Smedt (University of Leuven) will discuss a study in preschoolers that investigates the associations between neurocognitive predictors of reading and arithmetic, and to what extent predictors of one academic domain predict performance in the other domain. Professor Marc Joanisse (University of Western Ontario) will discuss a DTI study examining how differences in white matter connectivity correlate with reading and math scores in children with and without reading disabilities. Dr. Joe Bathelt (University of Cambridge) will highlight recent studies that investigated the commonalities between learning problems in a large sample of struggling readers, their link with overall white matter brain organization, and the mediating effects of cognitive abilities. Dr. Kaili Rimfeld (King's College London) will explore the variance in academic achievement explained by genome-wide polygenic scores and intelligence across development while controlling for family socioeconomic status.

Finally, there will be a discussion period between the audience and this expert panel introduced by Professor Daniel Ansari and Dr. Lien Peters (University of Western Ontario), who will discuss limitations associated with studying children with specific learning disorders to inform our understanding of learning and neurocognitive development. Theoretical, methodological and educational implications of research on the overlap between reading and arithmetic will be debated.

## Innovative Uses of Game-Based Learning and Data Analytics in Educational Neuroscience

**Sat., Sept. 29, 10:30am–12:30pm: The Forum**

**Chair:** **Jodi Asbell-Clarke**, TERC
**Speakers:** **Elizabeth Rowe**, TERC; **Ibrahim Dahlstrom-Hakki**, Landmark College; **Jan Plass**, NYU; **Bruce Homer**, CUNY

This panel brings together learning game designers, cognitive psychologists, and learning data analysts to discuss how game-based learning paired with multi-modal data analytics can provide new insights into learning.

Jodi Asbell-Clarke and Elizabeth Rowe from EdGE at TERC will discuss how they are measuring implicit learning in personalized learning environments, such as games. Data mining detectors, grounded in extensive observation and human-coding, can automatically detect implicit STEM learning in games at scale. Using Educational data mining (EDM) for formative assessment may reveal abilities of learners with cognitive differences who perform poorly on tests and schoolwork, particularly in areas such as Computational Thinking, which may profit from strong systematic thinking and creativity of some cognitively diverse learners.

Ibrahim Dahlstrom-Hakki from Landmark College will discuss how he and EdGE integrate eye-tracking data into data log analysis from learning games to explore the role of attention in implicit learning. Having identified features through human observation, EDM detectors analyzing eye-tracking and game data simultaneously can show features consistent with players attending (or not attending) to critical game features that may help explain their performance in the game. This talk will share research challenges in designing a system to synchronize multi-modal data "in the wild", and will discuss some of the preliminary constructs of visual attention that are thought to play a key role in implicit game-based learning.

Bruce D. Homer, from the CUNY Graduate Center, will discuss how adolescents' neurocognitive development has informed the design of CREATE Lab's SmartSuite, a set of digital games to improve executive functions (EF). Studies examining the effects of matching design features in games from the SmartSuite to specific neuro-cognitive changes in our adolescent participants show that younger adolescents benefit more if their EF training game focuses on speed of response, while older adolescents benefit more from an emphasis on accuracy. Similarly, older adolescents benefit from increased activations of emotions during EF training, while younger children benefit from a more emotionally neutral version of the game. The findings will be discussed in light of both having a better understanding of the development of EF in adolescence, as well as the ways in which building digital games that are neuro-cognitively age appropriate can enhance learning and training of cognitive skills.

Jan L. Plass from New York University will discuss in more detail the study on hot vs. cool executive functions (EF), asking whether a game designed to induce higher emotion arousal (hot EF) would be better able to train EF compared to a game designed to induce lower emotion arousal (cool EF), and whether this effect differed for different age groups, and for students with different levels of EF. In a study with middle and high school students we found that the version of the game inducing higher emotion arousal was especially effective for older students, and for younger students with higher levels of EF. Theoretical as well as practical implications for the role of emotions on EF training will be discussed.

## Neuropsychology in the Classroom: Executive Function in the Context of Learning and Development

**Sat., Sept. 29, 10:30am–12:30pm: Franklin**

**Chair:** **Michelle Downes**, University College Dublin
**Speakers:** **Joe Bathelt,** University of Cambridge; **Olivier Houdé**; **Gregoire Borst,** Paris-Descartes University**;** **Tieme Janssen,** VU University Amsterdam

Executive functions are cognitive skills that are important for regulating behaviour and for achieving everyday goals, particularly in the classroom. This symposium will explore research from four European centres that have used neuroimaging, physiological, and behavioural methods to better develop our understanding of executive functioning in the context of learning and brain development from preschool through to university. The translation of neuropsychological findings into the classroom environment will be considered in the context of

teacher-led research that focuses on their current understanding and experiences.

Executive deficits are common in children who struggle in school and are associated with multiple neurodevelopmental disorders. However, there is also considerable heterogeneity across children, even within diagnostic categories. In the first talk, Dr Joe Bathelt, Investigator Scientist, University of Cambridge, will describe recent results from data-driven methods to characterise the heterogeneity of executive function difficulties in struggling learners and link them with white matter differences in the brain.

Professor Olivier Houdé, Professor of Psychology, and Professor Gregoire Borst, Professor of Developmental Psychology and Cognitive Neuroscience of Education, Paris-Descartes University, will report on functional, anatomical and connectivity changes following inhibitory control training in children and adolescents in the second talk. Inhibitory control, or the ability to withhold a prepotent response, plays a critical role in academic success. While the effect of cognitive training on inhibitory control efficiency has been studied in young children and adults, the neurocognitive effects of training from childhood to adolescence is understudied. This is surprising given that adolescence is a developmental period defined by a high brain plasticity and environmental sensitivity during which the inhibitory control neural network becomes more specialized and integrated.

Making mistakes is inherent to learning, and one could say, essential to learning. Students, however, may hold different views on what these mistakes mean to them. Some will interpret mistakes in a constructive manner, signalling the need for more learning and challenge, while others tend to interpret mistakes as personal failure and avoid them where possible. Dr Tieme Janssen, Postdoctoral Researcher, VU University Amsterdam, will discuss an electrophysiological study of executive function which focuses on students' reactions to making mistakes. Heart rate, electrodermal activity, and neurophysiological activity were measured during the Math Effort Task and Stop-Signal Task. This study can inform us on the mediating effects of stress on the relation between ability beliefs and approach/avoidance behavior, and consequences for educational practice.

Finally, Dr Michelle Downes, Assistant Professor in Developmental Neuropsychology, University College Dublin, will discuss recent findings on primary school teachers' understanding of executive function and the reported barriers to supporting children with neuropsychological difficulties in the classroom, including current challenges of neuropsychological assessment of executive dysfunction and the translation of lab and/or clinical findings into accessible resources for teachers. The symposium will conclude with a panel discussion facilitated by Dr Downes on the implications of current research findings across neuroscience, cognitive, and educational domains for promoting executive functions in classroom contexts.

## Relational Learning in Mind, Brain, and Education

**Sat., Sept. 29, 10:30am–12:30pm: Trojan C**

**Chair:** **Priya Kalra**, University of Madison, Wisconsin
**Speakers:** **Keith Holyoak**, University of California, Los Angeles; **Adam Green**, Georgetown University; **Silvia Bunge**, University of California, Berkeley; **Micah Goldwater**, University of Sydney

Relational reasoning has been identified as "the foundation of higher cognition" (Halford, Wilson, & Philips, 2010) and as fundamental to learning in STEM fields (Alexander, 2016; Goldwater & Schalk, 2016, Richland & McDonough 2010). Relational reasoning refers to reasoning about the relationships among entities (for example, bigger-than, member-of, parent-of) rather than about the properties of the entities themselves. Until now, most research on relational reasoning has focused on analogy: how we apply relations from one domain to another. However, the question of how relations are learned in the first place has not been explored as thoroughly. Despite human facility in learning and using relations, computational and neuroscientific models to explain how this happens have only recently emerged. Similarly, the fact that relational reasoning can be improved through experience has been established, but the mechanisms by which this improvement take place are still largely mysterious. This symposium presents research on the mechanisms by which relations can be learned and by which relational reasoning can be improved, incorporating computational and neuroscientific perspectives as well as examples of interventions in real-world educational settings. The presenters are experts in the areas of developmental cognitive neuroscience and cognitive psychology; two of the presenters in particular are also noted for their work bridging cognitive and educational psychology. The

symposium overall will span the distance between real-world learning and the cognitive neuroscience of relational cognition.

The first presentation will provide a computational model of how abstract semantic relations (e.g., synonym, antonym, cause-effect) can be learned from non-relational feature vectors. The model combines deep learning of feature vectors from big data with fast learning of relations from small data. The second presentation will examine underlying mechanisms of relational reasoning improvement, using novel eye gaze metrics to pinpoint key drivers of improved performance associated with completion of a 6-week course on reasoning; the gaze data provide evidence that reasoning instruction and practice lead to increased efficiency of relational thinking. The third presentation will consider the results of a 1-year longitudinal neurocognitive study of spatial STEM instruction in real-world high school classroom settings. These results provide insights into effects of spatial learning on performance and neural bases of mental models-based relational reasoning. The final speaker will present work applying findings on relational learning to improve the understanding of common principles governing complex systems across disparate domains in high school science. In addition, this work has been brought back to the laboratory for neuroscientific measurement with an event-based paradigm examining complexity learning. Together, the presentations will take relational learning from the classroom to the lab and back again.

The overall structure of the symposium will be as follows: (1) each presentation will take 20 minutes, with 5 minutes for audience questions and responses (100 minutes in total); (2) a discussion among speakers, and between speakers and the audience facilitated by the discussant (approx. 20 minutes).

## Emotional Learners: The Effects of Stress and Emotion on Education, Learning, and Cognition

**Sat., Sept. 29, 10:30am–12:30pm: Trojan AB**

**Chair:** **Lindsey Richland**, UCI; **Kelly Trezise**, University of Chicago
**Speakers:** **Daniel Hackman**, USC; **Jodi Quas**, UCI; **David Kraemer**, Dartmouth; **Rich Daker**, Georgetown University

Classrooms are emotional spaces: students can bring their own emotions and stress into the classroom, and educational environments can provoke pressure for many students. How do these emotions and stress impact students' ability to learn, retain, and use information? This symposium will address this question by characterizing different emotions and their associated learning consequences, with the aim of better understanding the educational consequences of emotions and stress in learning contexts. We will discuss stressors that accompany children into the classroom (e.g., socioeconomic), trauma and maltreatment, and anxieties provoked from academic contexts, focusing in particular on those that result from what is increasingly described as crucial to 21st century education - activities that require innovation and creativity (Creativity Anxiety). We examine consequences of these stressors that range from neurocognitive structural changes to effects on memory and educational achievement, as well as impacts on gender gaps in achievement. Together, the presentations integrate perspectives from neuroscience, cognitive, developmental, and education research. The presenters represent a range in disciplines and approaches, and thus will provide rich new opportunities for insights into levers for reducing the negative consequences of stress and negative emotions on youth's classroom learning.

Dr Daniel Hackman will use neuroscience methods understand the neural and cognitive effects of socioeconomic disadvantage and related environmental stressors. Dr Jodi Quas will adopt a developmental and physiological perspective to examine the effects of stress on memory, a core cognitive function necessary for success in academics. Dr David Kraemer will present the development of the Academic Anxiety Questionnaire, which aims to separately assess anxiety related independently to testing, writing, science, math, and general trait-level anxiety. Dr Rich Dexler adopts a cognitive approach to characterise Creativity Anxiety, an

anxiety associated with creativity and innovation, and explore related associated gender differences and possible implications for STEM education. Co-Chairs for the symposium are Dr Lindsey Richland and Dr Kelly Trezise. They take a psychological and educational approach to these questions, and will lead a discussion that highlights the educational implications of the panelists research. Taken together, the presentations demonstrate an interdisciplinary approach to emotions and learning research, and the symposium will build a more comprehensive understanding of the relationships to physiological, cognitive, and educational consequences.

## The Elephant in the (Class)room: Learning Occurs in Multisensory Environments

**Sat., Sept. 29, 10:30am–12:30pm: Trojan D**

**Chair:** **Paul Matusz**, University of Lausanne–Information Systems Institute, University of Applied Science Western Switzerland (HES SO) Valais
**Speakers:** **Anna Fisher,** Carnegie Mellon University; **Natasha Kirkham**, Birkbeck University of London; **Silvia Brem**, University Hospital of Psychiatry Zurich - University of Zurich; **Dima Amso**, Brown University

Great strides have been made in understanding how learning to read or do basic math is supported by such domain-general processes as attention and cognitive control (executive) processes, e.g., how efficiently children allocate attention to target shapes surrounded by distractors or recall a sequence of sounds. However, certain disparity exists between these unisensory (visual, auditory) processes and how reading and maths are taught and learnt – with information stimulating one, two or multiple senses at once. Basic research has established that brains naturally represent objects (e.g. human faces, animals, also alphanumeric symbols) in a multisensory way, with visual, auditory, etc. information activating same areas (e.g. Mahon ea. 2009). Importantly, as brains integrate multisensory information, recognising, attending to or learning about objects is more accurate/stronger in multisensory than unisensory settings (e.g. Matusz ea. 2017). Yet, there is scarce research on how early in development, which and in what contexts multisensory-integrative processes improve domain-general functions (e.g. attention, memory) that shape developmental/educational outcomes. This symposium gathers educationally-minded cognitive and developmental psychologists and neuroscientists working to address these vital lacks in knowledge. Scientific results will be discussed in contexts of insights into pragmatics of conducting education-relevant research in Switzerland (French and German-speaking), UK and USA.

## Creating Connections Between Researchers and Educators: The Intersection of Cognitive Neuroscience and Education

**Sat., Sept. 29, 2:00pm–4:00pm: Franklin**

**Chair:** **Lauren Vega O'Neil**, University of Oregon
**Speakers:** **Eric Pakulak,** University of Oregon; **Courtney Stevens**, Willamette University; **Mary Margaret Reynolds**, Head Start of Lane County, Oregon

The development, implementation, and assessment of interventions that are informed by evidence from developmental cognitive neuroscience show promise to improve outcomes for children from lower socioeconomic status (SES) backgrounds. One promising line of research involves two-generation approaches, which target both children and their parents/caregivers. The development of two-generation programs that are supported by rigorous scientific evidence requires a close, productive partnership between researchers and educators. In particular, as such programs move toward scalable delivery models that can be implemented widely in different educational settings, a partnership that emphasizes the unique perspectives of educators at all levels is crucial.

The focus of this symposium will be one such partnership between researchers from the University of Oregon Brain Development Lab and Head Start of Lane County, Oregon, that has produced a successful two-generation intervention (Neville et al., 2013).

Stevens (developmental cognitive neuroscientist, Willamette University) will trace the early history of this partnership, which began with basic research on the neuroplasticity of selective attention that identified a neurobiological target for intervention (e.g., Stevens et al., 2009) and continued with a collaboration on many levels that supported the development, implementation, and assessment of a two-generation intervention. In a randomized controlled trial study we have shown this program to improve brain function for attention as well as

behavior and cognition in preschool children from lower SES backgrounds and to reduce parenting stress in their caregivers (Neville et al., 2013).

Pakulak (developmental cognitive neuroscientist, University of Oregon) will then discuss the next step in this collaboration, an ongoing project that is funded by a grant to both entities and that thus represented a substantial increase in the degree of collaboration on many levels. He will provide an overview of multiple phases of the project, from the development of a scalable delivery model of the intervention to subsequent phases of the project focusing on implementation and assessment, with an emphasis on how this increased collaboration was crucial to the achievement of project goals (Pakulak et al., 2015; 2017).

O'Neil (former elementary educator / Ph.D. candidate, University of Oregon) and Reynolds (Head Start Special Projects Coordinator, Head Start of Lane County, Oregon) will then present results from a recent qualitative study that focused on the current project from the perspective of researchers and educators (O'Neil, Pakulak, et al., under review). In this study we examined challenges and successes, both from the perspective of researchers and also from educators at HSOLC, ranging from administration and management to classroom-level teachers, whose input has been crucial to the success of the project. The presentation will focus on three specific aspects of the project: the development of a scalable delivery model of the program, implementation of the program in the classroom, and implementation of the group-based parent component.

We will conclude with a reflective discussion of broader benefits and challenges from both researcher and educator perspectives, taking a "lessons learned" approach with advice for others embarking on similar collaborative efforts. While this collaboration has not proceeded without challenges, it has nonetheless been successful on many levels.

## What are the Barriers to MBE? Insights from Conversations and Collaborations with Early Maths Educators and Researchers

**Sat., Sept. 29, 2:00pm–4:00pm: Trojan C**

**Chair:** **Rebecca Merkley**, Carleton University
**Speakers:** **Megan von Spreckelsen**, University of Oxford; **Amy Napoli**, University of Nebraska, Lincoln; **Andres Bustamante**, University of California Irvine School of Education; **Rene Grimes**, University of Texas, Austin

Questions of how people learn and develop new skills are of central interest to both educators and developmental cognitive scientists alike. Unfortunately, communication between the two fields is all but absent (Bruce et al., 2017). Indeed, the 'research-practice gap' represents a persistent and major obstacle in the pursuit towards bi-directional knowledge exchange and creation. As such, there is a growing need to build infrastructure that supports and facilitates opportunities for collaborative, productive, and iterative exchange between the disciplines of education and developmental cognitive science. The aim of this symposium is to highlight projects that have involved researcher-teacher collaboration in order to shed light on current barriers to MBE and potential solutions. We plan to incorporate teachers' perspectives by recording interviews with teachers who have participated in these projects, as they are unlikely to be able to attend the event due to scheduling conflicts and the high expense.

In the first presentation, Rebecca Merkley will report on the design, implementation, and effects of an in-service mathematics Professional Development (PD) model for teachers of Kindergarten–2nd Grade. Developmental cognitive neuroscience researchers worked closely with a team of K–2 educators over an 18-week period with the shared goal of improving students' numerical thinking. Central to this model was the integration of research and practice and helping teachers develop research-inspired activities to test out in their classrooms and share with the group. Both the successes and the obstacles of this approach will be discussed.

In the second presentation, Megan von Spreckelsen will report on a project investigating the impact of preschool educators' use of mathematics language on the academic outcomes for the children in their

care. Data were collected from 13 preschool and nursery settings over 'lunch and learn' sessions, as part of a wider study into cognitive and educational foundations of mathematics in preschool children. Preschool practitioners reported their levels of teaching confidence across different areas of mathematics and their use of maths language was observed in the classroom.

In the third presentation, Amy Napoli will report on work designing, implementing, and evaluating a parent-based home numeracy intervention. Parents of 3 and 4 year old children attended an informational meeting and received text messages with strategies for incorporating numeracy practices into their children's daily lives. Children were pre- and post-tested on their general numeracy skills, and parents reported on their frequency of numeracy engagement, beliefs of the importance of math development, and self-efficacy at engaging their children in math activities.

In the final presentation, Andres Bustamante will share his research and experience with Parkopolis: A life-size playful learning board game that fosters science and math skills. Derived from cutting edge research in the science of learning, Parkopolis is designed for installation in public spaces with the intent of promoting engagement and learning dialog between parents, children, and their peers. During this presentation, Andres will discuss the pilot work, community partnerships, and the latest findings from this project.

Rene Grimes will serve as discussant and draw on her unique perspective from her experience as a general and special education early childhood educator and a mathematics learning disability researcher. Rene is passionate about involving the 'educator's voice' in MBE initiatives and will share her opinions on ways to move forward in this regard.

## Multi-disciplinary Approaches to Understanding Reading Ability in Minority Populations

**Sat., Sept. 29, 2:00pm–4:00pm: Trojan AB**

**Chair:** **Jeffrey Gruen**, Yale School of Medicine
**Speakers:** **Dongnhu Truong**, Yale School of Medicine **Miao Li**, University of Houston; **Jeffrey Malins**, Yale School of Medicine; **Kimberley Tsujimoto**, University of Toronto

Reading disability is the most common neurodevelopmental disorder among school aged children and is associated with a life long struggle with literacy, often leading to poor school performance and significant public health and economic consequences. A majority of research on reading disability has focused on participants of European descent. With the push towards precision education, which tailors an educational plan to the unique needs of the student, the lack of participant diversity in reading research could leave out minority groups from benefiting from these initiatives.

In this symposium, we highlight multi-disciplinary approaches spanning molecular genetics, cognitive neuroscience, and psychology to the study of reading-related abilities in Hispanic American and African American children in the Genes, Reading, and Dyslexia Study (GRaD) and the New Haven Lexinome Project (NHLP). We bring together experts in neuroimaging, molecular genetics, developmental psychology, and educational psychology to present on the following topics: 1) Dr. Truong, a molecular geneticist and neuroscientist, will discuss how genetic variants associated with reading-related traits, like rapid automatized naming/rapid alternating stimulus, can elucidate novel neurobiological mechanisms that contribute to reading ability; 2) Dr. Li, an educational psychologist, will discuss a novel classification of reading disability subtypes based on a core + comorbidity model of reading disability and how genetic variants of risk genes DCDC2 and KIAA0319 are associated with different reading disability comorbidity subtypes; 3) Dr. Malins, a cognitive neuroscientist, will discuss resting state functional connectivity between brain regions important for reading in Hispanic American and African American children with specific reading comprehension impairments associated with variants of the READ1 regulatory element in the DCDC2 gene; and 4) Ms. Tsujimoto, a developmental and educational psychologist, will discuss individual differences in reading-related attributions using latent profile

analysis identifying a positive association between reading skills, attention, and how children perceive their experiences of success and failure in reading. The goal of this symposium is to showcase the relationships between genes, brain, and behavior in populations of children historically understudied in reading research. Discussion, led by Dr. Frijters, a developmental and educational psychologist, and Dr. Gruen, a molecular geneticist, will focus on how cross-disciplinary approaches can provide insights into genetic, neurobiologic, and behavioral factors that contribute to the etiology of reading disability, their effect on a child's reading-related performance over time, and their predicted outcome as we move toward educational approaches that are tailored to the needs of diverse student populations.

## Bridging Knowledge from Education and Neuroscience for Personalized Learning: UCSD – VUSD Partnership

**Sat., Sept. 29, 2:00pm–4:00pm: The Forum**

**Chair:** **Amanda Datnow**, University of California, San Diego
**Speakers:** **Matt Doyle**, Assistant Superintendent for Innovation for VUSD and Executive Director of ICERP; **Tim Brown**, Assistant Professor of Neurosciences; **Alison Wishard Guerra**, Associate Professor of Education Studies; **Shana Cohen**, Assistant Professor of Education Studies; **Terry Jernigan**, Professor of Cognitive Science and Director, Center for Human Development

Our interdisciplinary group of academics and educators have forged a partnership to gather real-time information about children's developing minds and brains. Lacking information about how to personalize their methods, teachers often struggle to reach the wide range of learners in their classrooms. Better understanding of children's development as part of the systems in which they develop and grow will help us to address mismatches between educational practices and learning science.

An invaluable strength of this work is the resilient partnership between UCSD faculty and the highly innovative Vista Unified School District (VUSD). VUSD serves approximately 22,000 students from P-12. With a student population that is 60% Hispanic, 58% of students who qualify for free or reduced-price lunch, and 24% English learners, this district represents the growing diversity of many districts across the state and the nation. In many ways, the district and city of Vista represents the educational challenges we face across the nation. VUSD and UCSD have joined together in a research-practice collaborative called the VUSD-UCSD International Center for Educational Research and Practice (ICERP). Conducting school-community embedded research that impacts practice quickly. ICERP aims to provide education that is early, personal, and relevant (see overview in Education Week).

Our team will study 100 4-year old children, continuously assessing their early neurocognitive, language/literacy, numeracy, attention, executive function/self-regulation, and social-emotional development within the context of their classrooms. We will also assess early functional brain development with a novel application of wireless, child-friendly, EEG caps. The children's classrooms will be live learning laboratories, where the learning process happening there is carefully protected. The research plan will allow us to improve models explaining differences in learning outcomes, identify areas of need, and evolve interventions that adapt intelligently to promote better, and more consistent, learning outcomes and increased student engagement and agency.

Amanda Datnow is a Professor of Education Studies and Associate Dean of Social Sciences at UCSD. She will describe the evolution of the partnership and a focus on the use of data to inform teaching and learning. Matt Doyle is Assistant Superintendent for Innovation for VUSD and the Executive Director of ICERP. He will describe the aims of VUSD and ICERP for innovation in P-3 education and the educator roles in the partnership. Tim Brown, Assistant Professor of Neurosciences, conducts research on brain mechanisms in language development. He will talk about the use of noninvasive brain measures in models of academic skills and engagement. Alison Wishard Guerra, Associate Professor of Education Studies, conducts research on culture and development in early childhood, with particular focus on social and language development among Latino children from low-income families. She will describe this aspect of the research plan. Shana Cohen, Assistant Professor of Education Studies, conducts research examining Mexican heritage families' beliefs and experiences with autism spectrum disorder. She will describe the component of the research program focusing on these issues. Finally, Terry Jernigan, Professor of Cognitive Science and Director, Center for Human Development, will describe the rationale for the unique research model adopted for our collaboration.

# Psychophysiological Approaches to Understanding Children's Learning in Educational Media Contexts

**Sat., Sept. 29, 2:00pm–4:00pm: Trojan D**

**Chair:** **Gabrielle Strouse**, University of South Dakota
**Speakers:** **Seung Heon Yoo**, University of Wisconsin-Madison; **Justin Robert Keene**, Texas Tech University; **Brandon H. Nutting**, University of Nebraska-Lincoln

This symposium will bring together four perspectives on using psychophysiological markers to understand children's learning and engagement in educational media contexts. Psychophysiological markers have been used by media researchers to better understand adults' attention to and memory for advertising and other television content (e.g., Bolls & Muehling, 2003; Lang et al., 1999; Lang et al., 2005). However, the presenters in this symposium are some of the first to use this biological approach to understand children's engagement in educational media contexts.

Our first speaker, an education researcher, will present a project (Strouse, Newland, Mourlam, Nutting) in which 3- to 5-year-old children are read two engineering-themed books (one print, one digital) by a researcher. Children's heart rate (marker of sustained cognitive attention) and skin conductance (marker of emotional arousal) will be used to predict their story comprehension. Prior research using observational techniques has indicated a paradox: that children may find digital books more engaging, but not comprehend them as well as print books. The use of psychophysiological markers in this study will provide a more nuanced understanding of children's attention allocation and its link with comprehension in the two educational media contexts.

The second speaker, a cognitive development researcher, will present a project (Yoo & Kirkorian) that examines the relation between children's (3-5 years) attention to TV programs and their subsequent memory for those programs. Attention measures include visual attention (eyes on screen) and physiological markers of arousal and engagement (heart rate, electrodermal activity, accelerometry). Children play with toys in a comfortably furnished laboratory room while three randomly ordered 8-min segments of a child-directed science-themed TV show (Tumble Leaf), an adult-directed TV show (Psych), and no TV (white noise) are playing. Attention measures will be used to predict children's free recall, cued recall, and recognition memory for the programs. Data from a comparison group of adult participants will also be presented.

The third speaker, a media psychology researcher, will present a project (Keene) in which children and their parents co-view an educational program or watch it independently. Recent research has shown that the mere presence of a parent can affect a child's cognitive and emotional processing of televised content being viewed (Rasmussen et al., 2016; Berke et al., 2016). One explanation involves social facilitation: co-viewing causes children to have greater arousal responses to exciting content, but far lower arousal responses to boring content when with a parent. In this study, the moderately arousing stimuli are predicted to result in cognitive resource allocation (heart rate deceleration) and arousal (skin conductance level) that increase over time for parents and children. Co-viewers are also expected to display greater memory for the program content versus children or parents who view the stimuli individually. The study will also investigate synchrony in parent and child physiological signals, as physiological synchrony is predicted to result in greater cognitive resource allocation, arousal, and memory for the educational stimuli.

Our final speaker (Nutting), in the role of discussant, will provide an adult media psychology research perspective. He will facilitate collaboration across media, cognitive/developmental science, and education researchers by providing a discussion of the ways these differing fields can use psychophysiological approaches to answer questions about how children learn.

# Posters

## Friday, September 28

**1. SPATIAL ALIGNMENT IN STEM VISUALS**
**Bryan Matlen**, WestEd; **Benjamin Jee**, Worcester State University; **Nina Simms**, **Dedre Gentner**, Northwestern University

**2. THE IMPORTANCE OF ATTENTION TO NUMBER**
**Eric D. Wilkey** and **Gavin R. Price**, Vanderbilt University

**3. NEUROCOGNITIVE MECHANISMS OF DIGIT PROCESSING AND THEIR RELATIONSHIP WITH MATHEMATICS COMPETENCE**
**Courtney Pollack**, and **Gavin R. Price**, Vanderbilt University

**4. USING THE PEN: PRINCIPLES TO TEACH FUTURE TEACHERS ABOUT THE LEARNING BRAIN**
**Chris Mattatall** and **Nancy Grigg**, University of Lethbridge

**5. OVERLAPPING RECRUITMENT OF PARIETAL AND PREFRONTAL REGIONS DURING INHIBITORY CONTROL**
**Annie Brookman-Byrne**, **Denis Mareschal**, Birkbeck University of London; **Andy Tolmie**, UCL Institute of Education; **Iroise Dumontheil**, Birkbeck University of London

**6. EFFECTS OF OPEN-BOOK AND CLOSED-BOOK ACTIVITIES ON CHILDREN'S LEARNING**
**Caroline Hornburg**, **William Aue**, **Stephanie Karpicke** and **Jeffrey Karpicke**, Purdue University

**7. WILL A WARNING INTERVENTION IN QUANTITATIVE REASONING AFFECT BRAIN ACTIVATION PATTERNS?**
**Genevieve Allaire-Duquette**, **Reuven Babai** and **Ruth Stavy**, Tel Aviv University

**8. INTUITIVE DIVISION BEFORE FORMAL INSTRUCTION**
**Emily Szkudlarek** and **Elizabeth Brannon**, University of Pennsylvania

**9. THE NAÏVE BLINDSPOT: WHEN TEACHERS' PEDAGOGICAL SKILLS ARE OVERSHADOWED BY THEIR INTUITIONS**
**Katarina Gvozdic** and **Emmanuel Sander**, University of Geneva

**10. PROBING THE MECHANISMS OF NUMEROSITY-TO-NUMERAL MAPPINGS AND THEIR RELATION TO MATH COMPETENCE**
**Darren Yeo**, Peabody College, Vanderbilt University and Nanyang Technological University; **Gavin Price**, Peabody College, Vanderbilt University

**11. IS IT SOUND OR NOISE? IMPROVING ATTENTION AND REDUCING NOISE ANNOYANCE THROUGH SCHOOL WORKSHOPS.**
**Jessica Massonnie**, Birkbeck University of London; **Philippe Frasseto**, Charles Andrei Elementary School; **Denis Mareschal**, **Natasha Kirkham**, Birkbeck University of London

**12. THE BEST KIND OF DUAL-LANGUAGE STORYBOOKS FOR DUAL-LANGUAGE LEARNERS? IT DEPENDS**

**Kirsten Read** and **Paloma Contreras**, Santa Clara University

**13. INTELLIGENCE: NEURAL ARCHITECTURES/ EDUCATIONAL BRIDGES TO FUTURE: MULTIPLE INTELLIGENCES @35 YEARS**

**Branton Shearer**, MI Research and Consulting

**14. CHILDREN'S NEURAL RESPONSES TO MATHEMATICS CONCEPT LEARNING**

**Caron Clark**, **Sam Pérez-González** and **Ryan Hudnall**, University of Nebraska-Lincoln

**15. DESIGN, EVALUATION, AND DISSEMINATION OF TEACHING MATERIALS FOR IMPROVING SCIENTIFIC LITERACY**

**Courtney Stevens**, **Melissa Witkow,** Willamette University; **Kathryn Becker-Blease**, Oregon State University; **Brenna Smelt**, Willamette University; **Raechel Soicher**, Oregon State University

**16. CAN TWO NEGATIVES MAKE A POSITIVE? INFUSING WORKED EXAMPLES INTO NEGATIVE NUMBER INSTRUCTION**

**Laura Young**, and **Julie Booth**, Temple University

**17. LEXICAL AND SUBLEXICAL PROCESSING TIMES FOR CHINESE AND ENGLISH IN BILINGUAL ADULT READERS**

**Beth A. O'Brien**, **Chiao-Yi Wu**, **Marilyn Cai Ling Yeo**, **Hengshuang Liu**, **Annabel Shen-Hsing Chen**, Nanyang Technological University; **Brenda Rap**, Johns Hopkins University

**18. SUPERMARKET SIGNS PROMOTE MATH TALK AMONG ADULTS AND YOUNG CHILDREN**

**Erinn Hanner**, **Emily Braham**, **Leanne Elliott** and **Melissa Libertus**, University of Pittsburgh

**19. LEARNING VERBAL NUMBER WORDS RELATES TO HOW CHILDREN ATTEND TO NUMERICAL QUANTITY**

**Helen Moriah Sokolowski,** University of Western Ontario; **Rebecca Merkley**, Carleton University; **Sarah Samantha**, University of Toronto; **Praja Vaikuntharajan, Daniel Ansari,** University of Western Ontario

**20. A CONTEMPLATIVE NEUROSCIENCE APPROACH FOR THE INTEGRATION OF MIND, BRAIN AND EDUCATION**

**Noa Albelda**, Interdisciplinary Center Herzliya; **Oren Ergas**, **Linor Hadar**, Beit Berl College; **Nava Levit Binnun**, Interdisciplinary Center Herzliya

**21. THE SANCTIFICATION OF EXPERIENCED DIFFICULTY: WHEN DIFFICULTIES MAKE ONE A BETTER PERSON**

**Gulnaz Kiper**, **Mohammad Atari**, University of Southern California; **Veronica Yan**, University of Texas at Austin; **Daphna Oyserman** University of Southern California

**22. SCHOOL SETTING IMPACTS POST-ERROR MONITORING AND EXPLORATORY BEHAVIOR**

**Solange Denervaud**, Geneva University; **Jean-François Knebel**,Laboratory for Investigative Neurophysiology; **Eleonora Fornari**, Vaudois University Hospital; **Micah M. Murray**, Laboratory for Investigative Neurophysiology; **David Sander**, Geneva University; **Patric Hagmann**,University Hospital Lausanne; **Edouard Gentaz** Geneva University

**23. WHAT INFORMATION DO CHILDREN REMEMBER ABOUT SCIENCE CONCEPTS LEARNED USING STRUCTURAL ALIGNMENT?**

**Emma Lazaroff** and **Haley Vlach**, University of Wisconsin-Madison

**24. EFFECTS OF MUSIC TRAINING ON INHIBITORY CONTROL IN SCHOOL-AGED CHILDREN: A LONGITUDINAL STUDY**

**Sarah Hennessy**, **Priscilla Perez** and **Assal Habibi** University of Southern California

**25. BRINGING NEUROSCIENCE LITERACY TO SCHOOL PRINCIPALS: FINDINGS FROM A YEAR LONG IN-SERVICE PROJECT**

**Abigail Larrison** and **Linda Lyman**, Illinois State University

**26. EXECUTIVE FUNCTION AND THE VOCABULARY GAP**

**Emma Hart**, **Margaret Shavlik** and **Amy Booth**, Vanderbilt University

**27. WEARABLE NEUROPHYSIOLOGICAL RECORDINGS IN MIDDLE-SCHOOL CLASSROOM CORRELATE WITH STUDENTS' ACADEMIC PERFORMANCE**
**Fei Qin**, **Yu Zhang**, **Bo Liu**, **Xuan Qi**, **Yingying Zhao** and **Dan Zhang**, Tsinghua University

**28. NAVIGATING LEARNER VARIABILITY: INFUSING LEARNING ENVIRONMENTS WITH RESEARCH-BASED PEDAGOGY**
**Tyler Richendollar**, **Medha Tare**, **Vic Vuchic**, **Susanne Nobles**, **Brian Wrightson**, **Barbara Pape**, **Alison Shell**, **Wendy Xiao** and **Victor Ngo**, Digital Promise

**29. DEVELOPMENTAL CHANGES IN WHITE MATTER TRACTS FOR SYMBOLIC AND NON-SYMBOLIC FRACTIONS**
**Yunji Park**, **John V. Binzak**, **Douglas C. Dean III**, **Andrew L. Alexander**, **Percival G. Matthews**, and **Edward M. Hubbard**, University of Wisconsin

**30. PREDICTING STEM-RELATED ACADEMIC OUTCOMES WITH MATH ANXIETY AND ATTITUDES IN UNIVERSITY STUDENTS**
**Selvia Gattas**, **Richard Daker** and **Ian Lyons**, Georgetown University

**31. GAMIFICATION**
**David Gonzalez**, UCSD

**32. DIFFERENTIAL IMPROVEMENT IN FRACTION ESTIMATION IN 2ND VS. 5TH GRADE CHILDREN: LONGITUDINAL ANALYSIS**
**Alexandria A. Viegut**, **Yunji Park**, **Edward M. Hubbard**, **Percival G. Matthews**, University of Wisconsin

**33. COGNITIVE AND NEURAL INDICATORS OF SPATIAL THINKING: EFFECTS OF A HIGH SCHOOL GEOSCIENCE COURSE**
**Emily Grossnickle, Peterson**, American University; **Nhi Dinh**, **Adam Weinberger**, **Robert Cortes**, **Richard Daker**, Georgetown University; **Bob Kolvoord**, James Madison University; **David Uttal**, Northwestern University; **Adam Green**, Georgetown University

**34. REVEALING IMPLICIT SCIENCE LEARNING THROUGH MULTIMODAL PLAYBACK VISUALIZATIONS**
**Jodi Asbell-Clarke,** TERC; **Ibrahim Dahlstrom-Hakki**, Landmark College Institute for Research and Training (LCIRT); **Elizabeth Rowe**, TERC; **Micah Altman**, MIT; **Ma. Victoria Almeda**, TERC

**35. CHILDREN'S SYMBOLIC AND NONSYMBOLIC NUMBER COMPARISONS RELY ON DIFFERENT BRAIN REGIONS: AN ERP STUDY**
**Ruizhe Liu**, **Emily Braham, Melissa Libertus**, University of Pittsburgh

**36. AMBIGUOUS PSYCHOLOGICAL ENVIRONMENTS IN MIDDLE SCHOOL MATHEMATICS: A MIXED METHOD**
**Bradley Brock** and **Chris Eccles**, Johns Hopkins University

**37. EVIDENCE OF NEURAL MECHANISM BEHIND INSIGHT PROBLEM SOLVING – A POTENTIAL ENHANCEMENT MECHANISM?**
**Miriam Reiner** and **Amit Rosen**, Technion

**38. UNDERSTANDING THE HUMAN BRAIN: A NEW FRONTIER IN EDUCATION REFORM OR YET ANOTHER PASSING FAD?**
**Christine M. Neumerski**, University of Michigan

**39. TEACHING TO LEARN AND LEARNING TO TEACH: SCAFFOLDING SUPPORTS CHILDREN'S SELF-REGULATED LEARNING**
**Audrey K. Kittredge**, **Krishna Kulkarni**, **Natalie Day** and **Sara Baker**, University of Cambridge

**40. CONTEXT MATTERS IN EXECUTIVE FUNCTIONS ASSESSMENTS: THE ROLE OF CHILD AGENCY**
**Janina Eberhart**, **Hayley Gains** and **Sara Baker**, University of Cambridge

**41. PREDICTORS OF READING FLUENCY IN MIDDLE CHILDHOOD**
**Jessica Wise Younger,** University of California; **Bruce D. McCandliss**, Stanford University; **Fumiko Hoeft**, **Joaquin A. Anguera**, **Jyoti Mishra**, **Adam Gazzaley**, **Melina R. Uncapher**, University of California

**42. TEACHERS' FACILITATION OF SPATIAL THINKING IN THE CLASSROOM: DEVELOPMENT OF AN OBSERVATION TOOL**
**Zoe Carlini**, **Dira Hanifah**, **Emily Grossnickle Peterson**, and **Sarah Irvine Belson**, American University

**43.** **RELATIONSHIP BETWEEN GROWTH MINDSET AND EXECUTIVE FUNCTION IN MIDDLE CHILDHOOD**

**Zoe M. D'Esposito**, **Jessica Wise Younger**, University of California, San Francisco; **Bruce D. McCandliss**, Stanford University; **Fumiko Hoeft**, **Joaquin A. Anguera**, University of California, San Francisco; **Jyoti Mishra**, University of California, San Diego; **Miriam Rosenberg-Lee**, Rutgers University; **Adam Gazzaley**, **Melina R. Uncapher**, University of California, San Francisco

**44.** **PARENT PERSPECTIVES: SCHOOL REENTRY CHALLENGES FOR PEDIATRIC CANCER SURVIVORS**

**E. Juliana Pare-Blagoev**, **Lisa Jacobson Kennedy** and **Kathy Ruble**, Johns Hopkins University

**45.** **INHIBITORY CONTROL PREDICTS LEARNING FROM INTENSIVE MATH INSTRUCTION IN LOW-INCOME COLLEGE STUDENTS**

**Melanie Pincus**, **Dominique Smart**, **Davendra Beni**, **Nermine Ghazy**, **Linsah Coulanges**, Rutgers University; **Joaquin A. Anguera**, **Melina Uncapher**, **Adam Gazzaley**, University of California, San Francisco; **Robert Puhak**, **Deborah Walker-McCall**, **Miriam Rosenberg-Lee**, Rutgers University

**46.** **MEDIA MULTITASKING AND EXECUTIVE FUNCTION IN MIDDLE CHILDHOOD**

**John David Lorentz**, **Jessica Younger**, **Melina Uncapher**, University of California; **Anthony Wagner**, Stanford University

**47.** **MULTISENSORY CONTROL OVER DEVELOPING VISUAL SELECTIVE ATTENTION AND ITS ROLE IN EDUCATIONAL OUTCOMES**

**Nora Turoman**, **Ruxandra Tivadar**, **Chrysa Retsa**, **Micah Murray**, Lausanne University Hospital Center (CHUV) & University of Lausanne (UniL); **Gaia Scerif**, University of Oxford; **Pawel Matusz**, University of Applied Sciences Western Switzerland (HES-SO)

**48.** **AN ERP INVESTIGATION OF THE TIMECOURSE OF SYMBOLIC AND NONSYMBOLIC FRACTION PROCESSING**

**Victoria Jay**, University of Illinois Urbana-Champaign; **John Binzak**, **Percival Matthews**, **Edward Hubbard**, University of Wisconsin-Madison; **Daniel Hyde**, University of Illinois Urbana-Champaign

**49.** **CHILDREN USE SEMANTIC PROCESSES WHEN VERIFYING ARITHMETIC FACTS: AN ERP STUDY**

**Amandine E. Grenier**, **Danielle S. Dickson**, **Nicole Y.Y. Wicha**, The University of Texas at San Antonio

**50.** **THE DEVELOPMENT OF SPATIAL-NUMERICAL ASSOCIATIONS FOR FRACTIONS**

**Elizabeth Toomarian**, **Edward Hubbard**, University of Wisconsin-Madison

**51.** **EVENT-RELATED POTENTIAL EFFECTS OF CONCRETENESS IN CLASSROOM LEARNERS OF A SECOND LANGUAGE**

**Gabriela Meade**, San Diego State University & University of California; **Alexandra Geyer**, Tufts University; **Katherine J. Midgley, Phillip J. Holcomb**, San Diego State University

**52.** **EFFECT OF TEST METHODS ON THE NEURAL MECHANISMS OF TEST TAKERS: THE CASE OF LISTENING COMPREHENSION**

**Chiao-Yi Wu**, **Yuvadarshini Ilang Kumaran**, **Hsin-Yu Lin**, **Shen-Hsing Annabel Chen**, **Vahid Aryadous**, Nanyang Technological University

**53.** **HAIR CORTISOL, DHEA COVARIATES AND ITS RELATION TO EARLY CHILDHOOD COGNITIVE AND HEALTH OUTCOMES**

**Megan Chung**, UC Berkeley; **Ella Pyle**, **Isabel Sunshine** UC San Francisco; **Chloe Jones**, **Roeland Hancock**, University of Connecticut; **Fumiko Hoeft**, **Stephanie Haft,** UC San Francisco

**54.** **FORTNITE, BLUE LIGHT, AND PREADOLESCENT BOYS: EXPLORING THE COGNITIVE EFFECTS OF BLUE LIGHT ON VIDEO**

**Ritu Gaikwad,** Del Norte High School, **Elizabeth R Ricker**, NeuroEducate; **Adrian Stetensko-Carter**, Westview High School; **Amy L. Daitch**, Stanford Medical School

**55.** **NEUROSCIENCE LEAVES THE LAB: TESTING THE FEASIBILITY OF GATHERING EEG FROM AN OPEN-AIR FESTIVAL**

**Elizabeth R Ricker**, NeuroEducate; **Amy L. Daitch**, Stanford Medical School

# Saturday, September 29

**56. BETTER TOGETHER: ENHANCED AUDITORY WORKING MEMORY DURING MULTISENSORY PROCESSING**
**Radhika Gosavi**, **Edward Hubbard**, University of Wisconsin-Madison

**57. IS THE UNDERSTANDING OF GEOMETRIC PRINCIPLES RELATED TO VISUAL EXPERIENCE AND EDUCATION?**
**Judy Kohan-Mass**, The College for Academic Studies; **Tomer Behor**, The Hebrew University of Jerusalem

**58. CHARACTERISTICS OF PARENTS AND CHILDREN EXPLAIN DIFFERENCES IN MATH TALK AT A CHILDREN'S MUSEUM**
**Emily Braham**, University of Pittsburgh; **Koleen McCrink**, Barnard College; **Melissa Libertus**, University of Pittsburgh

**59. WHAT COMES FIRST? EXAMINING THE CAUSAL RELATIONS BETWEEN EARLY EF SKILLS AND MATH ACHIEVEMENT**
**Alexa Ellis**, **Sammy Ahmed**, **Pamela Davis-Kean**, **Frederick Morrison**, University of Michigan

**60. EVIDENCE FOR NON-SYMBOLIC RATIO ARITHMETIC IN ADULTS AND CHILDREN**
**Isabella Starling Alves**, **Edward Hubbard**, University of Wisconsin-Madison

**61. EDUCATION AND NEUROSCIENCE AS PART OF THE LEARNING PROCESS IN BRAZIL**
**Juliana Caulkins**, Centro Paula Souza

**62. FRACTIONS WAR: AN IOS GAME TO MEASURE AND TRAIN MAGNITUDE PROCESSING WITH FRACTIONS**
**John Binzak**, **Elizabeth Toomarian**, **Percival Matthews**, **Edward Hubbard**, University of Wisconsin –Madison

**63. NEUROCOGNITIVE MECHANISMS UNDERLYING AFFECTIVE AND MOTIVATIONAL FACTORS IN MATH PROBLEM SOLVING**
**Julia Kang**, **Hyesang Chang**, **Lang Chen**, **Vinod Menon**, Stanford University School of Medicine

**64. PHYSIOLOGICAL SUBSTRATES OF WORKING MEMORY IN YOUNG CHILDREN**
**Sam Perez-Gonzalez**, **Ryan Hudnall**, **Caron Clark**, University of Nebraska-Lincoln

**65. COGNITIVE PROCESSES AND GESTURE DURING SPATIAL THINKING**
**Christine Bresnahan**, **Emily Grossnickle Peterson**, American University

**66. ADDRESSING STATISTICS ANXIETY IN UNDERGRADUATE NURSING STUDENTS**
**Marissa Brash**, Azusa Pacific University

**67. NEUROPSYCHO-LOGICAL LITERACY FOR OLDER ADULTS**
**Astrid Schmied**, University of Minnesota – Twin Cities

**68. EFFORT OR LUCK? COMPARING NEURO-PHYSIOLOGICAL CORRELATES OF EVALUATIVE AND NON-EVALUATIVE FEEDBACKS**
**Keye Xu**, **Maria Guevara**, **Patricia Tan**, **Jennie Grammer**, University of California, Los Angeles

**69. ACCESS TO ARITHMETIC FACTS FROM VERBAL MEMORY DOES NOT DIFFER ACROSS LANGUAGES IN BILINGUAL CHILDREN**
**Vanessa Cerda**, **Amandine Grenier**, **Nicole Wicha**, University of Texas at San Antonio

**70. IMPACT OF SCRIPT TYPES ON THE NEURAL REPRESENTATIONS OF READING FOR EARLY PROFICIENT BILINGUALS**
**Chiao-Yi Wu**, **Beth Ann, Marilyn Cai Ling Yeo**, **Shen-Hsing**, **Annabel Chen** Nanyang Technological University; **Brenda Rapp**, **Michael McCloskey**, **Kenichi Oishi**, **John E. Desmond**, Johns Hopkins University

**71. NUMBER TRAINING REMEDIATES MATH LEARNING DIFFICULTIES IN CHILDREN : BEHAVIORAL AND NEURAL CORRELATES**
**Shelby Karraker**, **Flora Schwartz**, **Hyesang Chang**, Stanford University School of Medicine; **Teresa Iuculano**, University Paris Descartes; **Emma Adair**, Stanford University School of Medicine; **Miriam Rosenberg-Lee**, Rutgers University; **Lang Chen**, **Vinod Menon**, Stanford University School of Medicine

**72. SOCIOECONOMIC DIFFERENCES IN KINDERGARTNERS' PERFORMANCE MONITORING: AN ERP INVESTIGATION**
**Nicholas Waters**, **Sammy Ahmed**, **Pamela Davis-Kean**, **Frederick Morrison**, University of Michigan

**73. USING EYETRACKING TO REVEAL OPTIMAL MATRIX COMPLETION STRATEGIES IN CHILDHOOD**
**Jesse Niebaum, Yuko Munakata**, University of Colorado

**74. ITERATIVE INTERVENTIONS: APPLYING COGNITIVE MODELS TO USING MATH MANIPULATIVES**
**Carlos Amador**, University of Texas

**75. DEVELOPING SELF REGULATION AND EXECUTIVE FUNCTIONS IN LATIN AMERICAN PRESCHOOL CHILDREN**
**Anna Lucia Campos**, **Vania Marquina**, **Benjamin Lira Luttges**, Child Development Lab IDEA, Peru

**76. COMPONENTIAL INTERFERENCE IN FRACTION PROCESSING: EVIDENCE FROM ERP COMPONENTS**
**Brian Rivera**, **Firat Soylu**, University of Alabama

**77. EXAMINING THE COGNITIVE FEATURES OF NATURE-BASED LEARNING**
**Joshua Meyer**, Montana State University

**78. VALUE OF A SET OF NEUROSCIENCE CONCEPTS FOR LESSON PLANNING**
**Vicki Hinesley**, University of Texas at Arlington; **Janet Dubinsky**, University of Minnesota Minneapolis; **Zhengsi Chang**, University of Texas at Dallas; **Marc Schwartz**, University of Texas at Arlington

**79. RELATIONAL REASONING PREDICTS FRACTION KNOWLEDGE**
**Priya Kalra**, **Edward Hubbard**, **Percival Matthews**, University of Wisconsin – Madison

**80. WHEN LESS IS MORE: PRIOR EXPERIENCE IS ASSOCIATED WITH POORER PERFORMANCE IN A STATISTICS COURSE.**
**Mary Tucker**, **Stacy Shaw**, **Jim Stigler**, University of California, Los Angeles

**81. BUILDING SUSTAINED ATTENTION WITH NEUROFEEDBACK**
**Jason Krell**, The Study Academy; **Anderson Todd**, University of Toronto; **Patrick Dolecki**, The Study Academy

**82. DUAL-TASK STUDIES OF WORKING MEMORY AND MATHEMATICS: A META-ANALYSIS**
**Edward Chen**, **Drew Bailey**, University of California, Irvine

**83. IMPACT OF SENSORY FEATURES ON SCHOOL PERFORMANCE OUTCOMES IN AUTISM SPECTRUM DISORDER**
**Christiana Butera**, **Laura Harrison**, **Cristin Zeisler**, **Emily Kilroy**, **Lisa Aziz-Zadeh**, University of Southern California

**84. A CRITICAL INTERROGATION OF THE MIND, BRAIN, & EDUCATION MOVEMENT: TOWARD A SOCIAL JUSTICE PARADIGM**
**Bibinaz Pirayesh**, Loyola Marymount University

**85. MIND, MOTIVATION, AND MEANINGFUL LEARNING: A COGNITIVE SCIENCE APPROACH TO LEARNING HOW TO LEARN**
**Melissa Miller**, University of Southern California

**86. NEURAL AND PSYCHOSOCIAL DEVELOPMENT UNDERLYING ADOLESCENTS' ABSTRACT LIFE GOALS**
**Rodrigo Riveros**, **Xiao-Fei Yang**, **Dakarai McCoy**, **Christina Krone**, **Rebecca Gotlieb**, **Mary Helen Immordino-Yang**, University of Southern California

**87. A NEW THEORETICAL FRAME SUPPORTING HIGH SCHOOL TEACHERS IN WAYS TO INCLUDE NEUROSCIENTIFIC INSIGHTS**
**Nadja Marie Mariager**, University of Southern Denmark

**88. LEARNING TO APPRECIATE OTHERS' VIRTUE: BEHAVIORAL AND NEURAL PROCESSES FACILITATE MORAL THINKING**
**Xiao-Fei Yang**, University of Southern California; **Gabriela Pavarini**, University of Oxford; **Simone Schnall**, University of Cambridge; **Mary Helen Immordino-Yang**, University of Southern California

**89. APPROXIMATE ARITHMETIC TRAINING DOES NOT IMPROVE SYMBOLIC MATHEMATICS IN 3RD AND 4TH GRADE CHILDREN**
**Stephanie Bugden**, **Elizabeth Brannon**, University of Pennsylvania

**90. BRAIN-TO-BRAIN SYNCHRONY TRACKS CLASSROOM ENGAGEMENT AND SOCIAL DYNAMICS**
**Ido Davidesco**, **Suzanne Dikker**, **Dana Bevilacqua, David Poeppel**, New York University

**91. DYNAMIC FUNCTIONAL CONNECTIVITY OF BRAIN NETWORKS PREDICTS SPATIAL THINKING**
**Adam Weinberger**, **Robert Cortes**, **Adam Green**, Georgetown University

**92. COGNITIVE AND NEURAL EFFECTS OF GEOSPATIAL EDUCATION ON SYLLOGISTIC REASONING**
**Robert Cortes**, **Nhi Dinh**, Georgetown University; **Emily Grossnickle Peterson**, American University; **Adam Weinberger, Richard Daker**, Georgetown University

**93. THE IMPACT OF A SLEEP DELAY ON RELATIONAL MEMORY INTERFERENCE IN YOUNG CHILDREN**
**Susan Benear**, **Zoe Ngo**, **Nora Newcombe**, **Ingrid Olson**, Temple University

**94. MORE THAN NUMBER SENSE: THE ADDITIONAL ROLE OF COGNITIVE CONTROL AND METACOGNITION IN ARITHMETIC.**
**Elien Bellon**, KU Leuven; **Wim Fias**, Ghent University **Bert De Smedt**, KU Leuven

**95. ASSESSING KNOWLEDGE TRANSLATION IN THE FIELD OF MIND, BRAIN AND EDUCATION IN PRE-SERVICE TEACHERS**
**Celia Goffin**, **H. Moriah Sokolowski**, University of Western Ontario; **Anna A. Matejko**, Georgetown University; **Stephanie Bugden**, University of Pennsylvania; **Ian M. Lyons**, Georgetown University; **Daniel Ansari**, University of Western Ontario

**96. NEURAL MECHANISMS OF MENTAL ROTATION: IMPLICATIONS FOR UNDERSTANDING MOLECULE STRUCTURE AND INTERACTIONS**
**Nehai Farraj, Miriam Reiner**, Technion – Israel Institute of Technology

**97. EXECUTIVE FUNCTION SKILLS: DEVELOPMENTAL TRAJECTORIES AMONG BILINGUAL AND MONOLINGUAL CHILDREN**
**Anabel Castillo**, University of California Merced; **Alexander Khislavsky**; **Meaghan Altman**; **Jeffrey Gilger**

**98. TRAINING MINDFUL AWARENESS: RAISING AWARENESS ON TRAINING ATTENTION**
**Dan Siegel**, Mindsight Institute; **Rian Doris**, Kings College London; **Talya Vogel**, Stanford University; **Andrew Villamil**; **Elli Weisbaum**

**99. FAMILY CO-PLAY AND THE INFLUENCE OF ADVANCING TECHNOLOGY**
**Debbie Cockerham**, **Lin Lin**, University of North Texas

**100. DEVELOPMENTAL NEURAL, PSYCHOLOGICAL, AND EMOTIONAL CORRELATES OF ACADEMIC MINDSETS**
**Christina Krone**, **Xiao-Fei Yang**, University of Southern California; **Camille Farrington**, University of Chicago Consortium on School Research; **Mary Helen Immordino-Yang**, University of Southern California

**101.** **SYMBOL PROCESSING IN HEALTHY KINDERGARTNERS: AN EVENT-RELATED FMRI STUDY**

**Benjamin Conrad**, **Darren Yeo**, **Richard Pigg**, **Adam Kaminski**, **Lisa Venanzi,** **Gavin Price**, Vanderbilt University

**102.** **DEVELOPMENT OF AN INTERACTIVE GAMING PARADIGM FOR FUNCTIONAL BRAIN ASSESSMENT OF PRESCHOOL CHILDREN**

**David Gonzalez-Maldonado**, **Sarah Dowling**, **John Iversen**, **Terry Jernigan**, **Tim Brown**, University of California, San Diego

**103.** **IS INTERVENTION FADEOUT A SCALING ARTIFACT?**

**Sirui Wan**, University of California; **Timothy Bond**, Purdue University; **Kevin Lang**, Boston University; **Greg Duncan**, University of California, Irvine; **Doug Clements**, **Julie Sarama** University of Denver; **Drew H. Bailey**, University of California, Irvine

# **2018** IMBES Awards

## The International Mind, Brain and Education Society Early Career Award

This award is designed to recognize early career scholars who have made significant, original research contributions to the field of Mind, Brain, and Education. Nominees who earned their doctorate in or after 2008 are eligible.

- Elizabeth A. Gunderson, PhD
- Gavin R. Price, PhD

## The International Mind, Brain and Education Society Translation Award

This award is designed to recognize senior scholars who have made significant progress towards strengthening the links between research and practice in Mind, Brain, and Education. Nominees' work can target translation of research into practice in traditional/formal or in non-traditional/informal contexts. (For example, the work can target formal learning environments such as schools and colleges, informal learning environments such as museums, community centers and rehabilitation programs, or science media intended for the broader public.)

- Fumiko Hoeft, MD, PhD
- Paul A. Howard-Jones, PhD

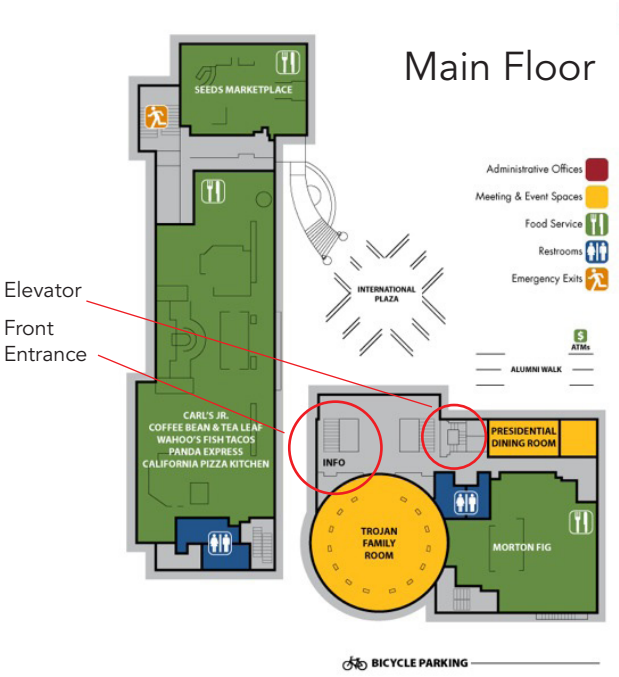
## Award for Exemplifying the Mission of the International Mind, Brain and Education Society

Recognizes Pre K-12 educators, institutions or programs demonstrating success in establishing, building and supporting infrastructure that enhances collaboration between themselves and MBE researchers for the purpose of improving educational knowledge and practice. We seek to honor the creators of infrastructure that models how productive collaboration can unfold in the field of Mind, Brain and Education.

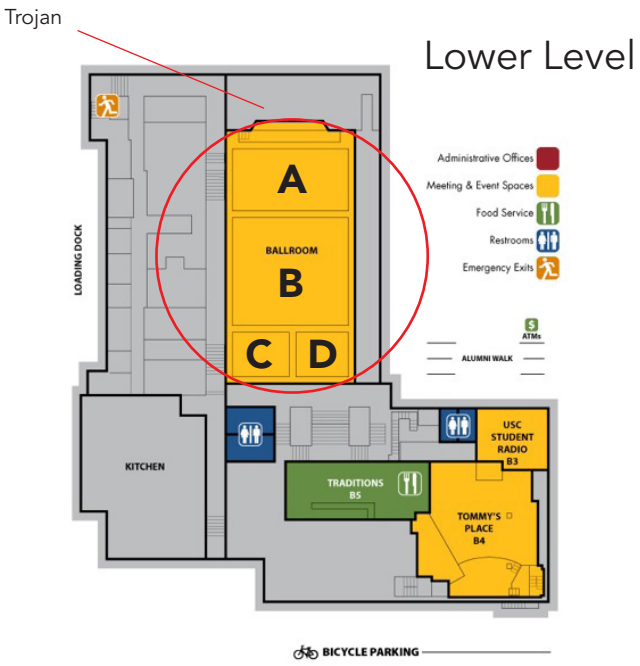
- Anna Lucia Campos

# Ronald Tutor Campus Center Maps

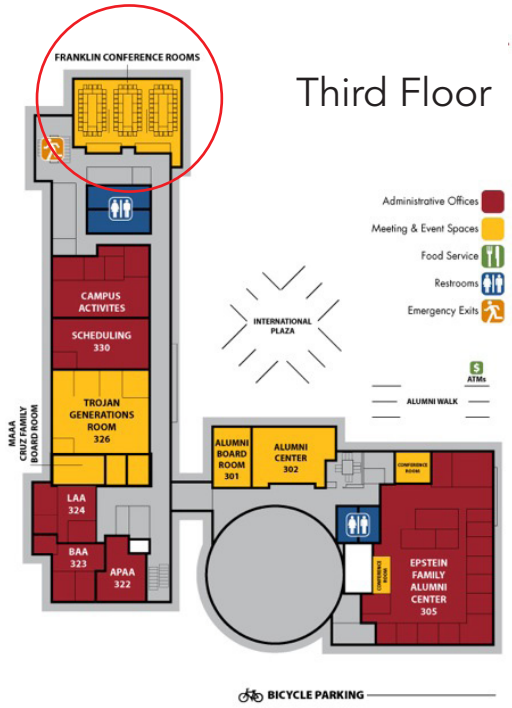
## Main Floor



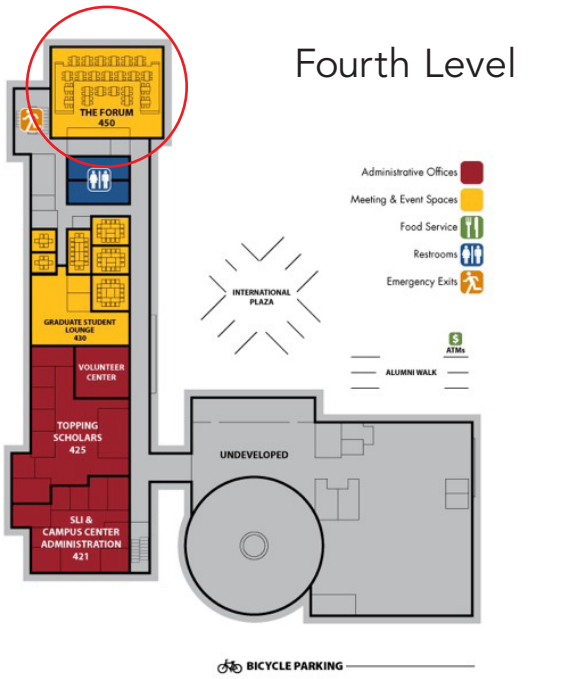

## Lower Level




## Third Floor




## Fourth Level



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