Session 2. Insights from the Learning Sciences

How can the science of learning mitigate the impacts of poverty and inequality on learning outcomes?
Poverty and inequality are distal causes of poor learning, mediated by proximal causes such as hunger, violence, lack of schools and unprepared teachers, among others. These latter factors impact directly on cognitive abilities and brain development, which have consequences on the learning outcomes of children. This session will showcase educational interventions informed by the 'science of learning' for improving learning outcomes, especially for vulnerable and disadvantaged children.

Moderator

Grégoire BORST, Professor of Developmental Psychology and Cognitive Neuroscience of Education, Université Paris Cité (FRANCE)

Panelists

Kathy HIRSH-PASEK, Temple University (USA)

Active Playful Learning: A pedagogical approach aligned with the science of learning. The "factory model" of education that dominates classrooms around the world is outdated. Our current model of education neither prepares students to thrive in the 21st century nor does it address systemic inequalities. In our Brookings Big Ideas Piece (Hirsh-Pasek et al., 2020), A new path to education reform, and in Making Schools Work (Hirsh-Pasek et al, 2022), we argue for a developmentally appropriate pedagogy built on the latest science of learning while offering children rich curricular learning. The model, Active Playful Learning (APL) uses a 3-part equation, based in the science of learning, to realize this goal. We start with cultural contexts that embrace community funds of knowledge that children bring to our classrooms. We then add the "how" of learning such that if we teach in ways that capitalize on how brains learn, children are more likely to retain and transfer their knowledge. Third, we add "what" the children need to know to thrive in a world dotted with Chat GPT, and with workplaces that will later require them to expand their repertoire of outcomes to include a breadth of skills, 6Cs -- collaboration, communication, content, critical thinking, creative innovation, and confidence (grit and growth mindset). In this talk, I demonstrate how this equation has been used to design an evidence-based pedagogical approach that is being evaluated in a longitudinal study in the US. We also speak to how the approach is being loosely applied to schools internationally in Japan, Vietnam, Iran, and Ghana. Active, playful learning offers a powerful route for re-imagining our educational pedagogy and policy in ways aligned with the latest science of learning.

Andrea CHIBA, University of California at San Diego and Global Science of Learning Education Network (USA)

The importance of time and timing in social interactions for improving learning. The science of learning provides the knowledge and motivation for designing learning contexts that vary according to the needs of the learner. Exploration of cultural practices and their role in development provide opportunities for understanding foundations for learning. Whereas the prioritization of technical skills such as computing, and mathematics is a logical step in the effort to develop curricula that meet the increasing technical demands of society, methods of training broad cognitive and pro-social skills such as communication, cooperation, attention, and creativity are elusive, yet critical, to the development of a healthy and dynamic generation of children. A growing body of evidence suggests that the practice and study of group music may be one such method. Our work includes ongoing research that is revealing links between general cognitive characteristics such as attention and specific musical abilities such as rhythmic precision. We conclude that musical and rhythmic training may be beneficial at many levels, from enhancing social timing, attention, interaction, and cooperation, to improving the way the brain encodes sound. Thus, a synthesis of discoveries emanating from the science of music and the science of learning suggest the possibility of incorporating culturally and socially relevant group music programs into school curricula to better prepare students for the demands of a technologically advanced, global innovation ecosystem.

Shelley Xiuli TONG, The University of Hong Kong (CHINA)

Reimagining the Future of Special Education: An Intelligent Dyslexic Interface Design (I-DID). Traditional diagnosis and remediation programs for children with developmental dyslexia (DD) tend to adopt a one-size-fits-all approach that focuses on deficits rather than strengths, often overlooking the untapped potential of these children. By combining cutting-edge artificial intelligence (AI) technology with a diagnostic assessment and treatment game design, my team and I have developed the Intelligent Dyslexic Interface Design (I-DID), an online system that aims to leverage the unique strengths of children with dyslexia while improving their specific language and reading skills. Unlike costly human-delivery services, I-DID offers a family-based assessment that accommodates the diverse needs of Chinese-English bilingual children of different ages through the use of graphic design, animation techniques, game mechanics and multimedia displays. The ultimate goal of I-DID is to make dyslexia diagnosis and intervention accessible to all families. By harnessing AI technology, individual user strengths, and a game-oriented design that creates a more accessible and empowering learning environment, I-DID offers a promising solution for the future of special education, one that promotes acceptance of children with dyslexia and thus contributes to a more inclusive society.

Bosiljka MILOSAVLJEVIC, Queen Mary University of London (UK)

Infant predictors of preschool age outcomes: Evidence from the Brain Imaging for Global Health (BRIGHT) project. The Brain Imaging for Global Health project (BRIGHT) is a prospective longitudinal study that examines child development from the antenatal period to preschool age in a rural area of The Gambia. The primary goal of this work is to map the trajectories of neurocognitive development in the

context of poverty-related risk and to better understand how environmental risk and protective factors impact on developmental trajectories and preschool age outcomes. Mothers were initially seen during the third trimester of pregnancy and the children participated in study visits at 7-14 days after birth, and at 1-, 5-, 8-, 12-, 18-, 24-months and 3-5 years of age. Using a multi-method approach, we examined neural (using functional Near Infrared Spectroscopy [fNIRS] and Electroencephalography [EEG]) and cognitive functioning, as well as caregiver, nutrition, and health-related factors.

Preliminary findings suggest that, at preschool age, children in this setting generally show normative development in a number of cognitive domains, but that there is substantial variation in skills related to school readiness (i.e., literacy and numeracy). In spite of this, markers of undernutrition, such as anaemia and poorer physical growth, as early as 5-months of age are related to poorer performance on cognitive tasks. Furthermore, infant neural markers related to sensory processing and functional connectivity have emerged as predictors of later cognitive skills.

With this work, we suggest that factors which contribute to school readiness and educational outcomes, emerge in infancy. Thus, we highlight the importance of incorporating early development into educational interventions and policy.

Kaja JASIŃSKA, University of Toronto (CANADA)

Neurocognitive development and learning in environments with high poverty-related risk of illiteracy.
Compared to other regions, Sub-Saharan Africa has the largest number of young children experiencing poverty (Black et al., 2017), the largest number and proportion of 3-4-year-olds (29.4 million; 44%) failing to meet cognitive, language, and social-emotional milestones (McCoy et al., 2016), and the lowest literacy rates—22% of youth and 32% of adults are illiterate (UIS, 2022). Poverty and its co-occurring risks (malnutrition, disease, maternal stress, low-quality learning environments) negatively impact neurocognitive development and children's readiness to learn—the cognitive, social, and emotional capacities essential to children's success in school. Yet, much of what is currently known about neurocognitive development and learning comes from studies almost exclusively done in high-income countries across the Global North, limiting the generalizability of our current understanding of neurocognitive development and the ability to enact effective evidence-based policies for vulnerable learners growing up in environments with high poverty-related risk of illiteracy. Focusing on the context of rural Côte d'Ivoire, this talk will discuss how the latest tools of cognitive neuroscience—portable neuroimaging technologies—can be used to track neurocognitive development and learning in environments with high poverty-related risk of illiteracy, and how such insights can be leveraged to inform educational practices and social policies that strengthen children's potential for success. The talk will present evidence on how the typical neurodevelopmental trajectory for literacy responds to low education quality in contexts of poverty and high rates of child labor and explore the potential of quality education and poverty reduction programs for improving learning at scale.