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# Infancy and Early Childhood

The Educated Brain Policy Brief



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The Educated Brain Policy Brief:

# Infancy and Early Childhood

*The Educated Brain Seminar Series:*

*Bringing education, psychology and neuroscience research together to better understand how we learn, and how we can promote learning across the lifespan through policy and practice.*

Disclaimer: The case study material presented in this policy brief reflects the focus of the research presented at the seminar, and is not intended to be fully representative. The policy issues raised in this brief are not the only important issues. However, in the workshop discussions, a wide range of issues were discussed and there are references provided in this brief that direct the reader to further work in this area.

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# Executive Summary

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This brief relates to the first seminar in a series of three around the theme of 'The Educated Brain'. Each research seminar includes talks from leading researchers and roundtable discussions about the links between research, policy and practice. Presentations at the first seminar on infancy and early childhood focused on where interdisciplinary research can make progress in our understanding, with a focus on the developing brain of young children including: scanning young brains; examining the concept of 'school readiness'; learning through play; and learning in a stressful environment. Research shows innovative methodologies and data collection being applied in studies such as tracking children's movements through play and research-informed practitioner tools such as the 'school readiness questionnaire'. We focused on some areas for policy and practice that may be informed by developing research in education and neuroscience.

## Academic research presentations focused on:

- Educational research has shown that whilst parents and carers are the largest influence on a child's early learning, good quality childcare is also important for language development and educational outcomes
- Neuroscience research, using brain imaging and a scientific understanding of brain development, has progressed understanding of developmental disorders (such as Attention Deficit Hyperactivity Disorder (ADHD) and dyslexia) in children
- The brain exhibits 'neuroplasticity'; it constantly changes and adapts. For example, neuroplasticity impacts on our ability to learn languages and developmental changes (such as in puberty) can also affect neuroplasticity
- Psychology research is used to construct a questionnaire to test 'school readiness', which can be applied in wider settings
- Researchers are using innovative methods to understand how children interact through play in the school setting
- The impact of learning in a stressful environment is explored

## Areas of research that relate to policy and practice:

- A focus on learning from birth – research shows that learning starts well before children enter formal education, which suggests there should be a broader focus to early years education and learning policy
- The benefits of play – play has many benefits for children's learning and development. Cognitive processes are being used in play and playfulness. Play can support the development of self-control, which can be part of problem-solving skills in later life. Play can be part of health, social and emotional development. A 'playful' approach can support children's writing. There is value in constructing and evaluating play-based educational interventions
- Supporting school readiness for all – a more in-depth understanding of school readiness can help practitioners provide support for children starting school that will reduce differences in school readiness, and encourage learning behaviour at an earlier stage
- Understanding inequalities in childhood development – research can help understand and address atypical development as well as inequalities in the ability of children to learn and develop fully.
- Reducing stressful effects of different learning environments – understanding the positive and negative effects of different learning environments may help interventions to reduce stress amongst children, particularly in early year's settings

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# Scope of enquiry and challenges



## Professor Michael Thomas

Director, University of London Centre for Educational Neuroscience, Birkbeck, University of London.

The goal of Professor Thomas' research is to understand the nature and causes of cognitive variability in children. He employs a multi-disciplinary approach, seeking to integrate data from behavioural studies, neuroscience methods such as brain imaging and computational modelling, and genetics.

## Key Points

- Professor Michael Thomas outlined some of the challenges and opportunities for linking brain sciences with early years education.
- The scope of academic research in this field relates to the question of: what determines early child development?
- Professor Thomas provided an overview of the contribution of the study of genetics to education. Genes and the environment together can provide many of the answers regarding child development; both experience and the environment in which babies and children develop are important. Neuroscience provides a mechanistic understanding of early childhood development – but what we don't know is precisely how the environment impacts on biological development.
- Recent studies show that genetic effects on development are dynamic rather than static; so that genes are expressed differently in different environments and at different stages of development. Research increasingly shows that rather than fixed periods of focus for child development; early years, childhood and adolescence are all important in understanding brain sensitivity.
- Different study methods and approaches, together with multiple sources of data, are helping to improve our understanding of how children's experience and the environment in which they learn, plays its part.
- Bringing different research studies together has the potential to increase the validity of findings overall and to increase the impact of research.

## Why is this interesting and challenging?

- One of the key challenges is that by bringing together different research fields, such as education and neuroscience, to provide a more complete understanding of learning, it also increases complexity, and that trying to identify specific effects and relationships between effects can lead to complex studies. It also reduces the likelihood that results can be translated into clear interventions for policy makers and education practitioners. For example, large scale studies on twins, to analyse effects of heritability in different environments and at different stages of development, lead to qualified conclusions about the overall impact of interventions and the environment in different circumstances.
- As well as complexity in bringing together numerous variables and effects to explain educational outcomes, it is also challenging to think about how this type of research can lead to interventions at an individual level.

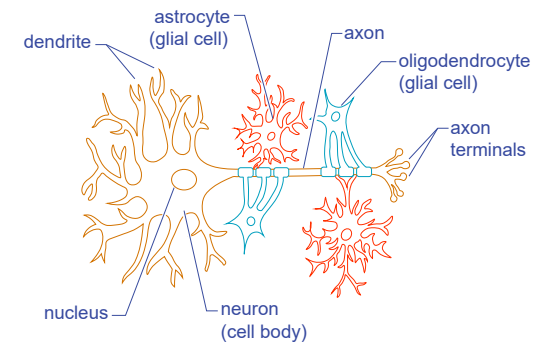
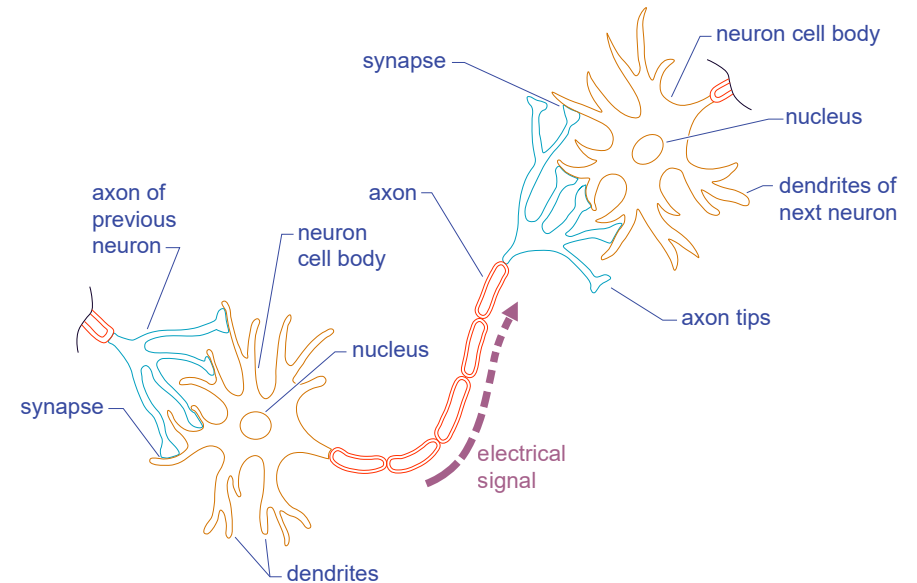
## Why is this relevant to policy and practice?

The challenges of translational research on genetics and education will depend on what objectives such research is trying to achieve; whether this is improved outcomes for low achievers, benefits for higher achievers, or improved outcomes for those children with developmental disorders. Here, in addressing the question of how you might apply research to change education policy, this would depend on what the overall objectives of education policy are.

Key references: Thomas et al, 2015

# Research

- Babies are born with the most number of neurons they'll ever have. There are a few that are created during later life, but overall the number of neurons decreases through development.
- Neurons are the functional unit of the brain. They are made up of a cell body, dendrites and an axon.
- Electrical signals – called action potentials – are created in the cell body and transmitted along the axon.
- The signals along the axon are protected by a layer of myelin. Made by oligodendrocytes, this protective sheath makes sure the messages are sent quickly from one end of the axon to another. The amount of myelin increases rapidly through the first few years of life and continues through later childhood.
- When the signal reaches the end of the axon, chemicals – neurotransmitters – are released and are picked up by the dendrites of the next neuron. These can then go on to generate another action potential.
- The connections between neurons are called synapses and during the first few years of life, neurons make trillions of them. The sheer number of these connections are what allows children to understand all the information they receive, to generate their own thoughts, and to carry out complex tasks.
- Importantly, the number of synapses decreases in later childhood. After the connections are made, the brain responds to the input it receives and prunes away the unnecessary ones.
- Sometimes, neurons need multiple signals to arrive at the same time. This is one of the ways the brain learns which connections are important and is called long term potentiation.
- Studies using animals have shown that an enriched environment can lead to more synapses and greater capacity for learning.



# Early brain development



## Professor Torsten Baldeweg

UCL Institute of Child Health, University College London (UCL)

Torsten is a cognitive neuroscientist based at the UCL Institute of Child Health with an interest in the plasticity of the developing brain to neurological insults, such as epilepsy and hypoxia-ischaemia. He uses a combination of methods, such as electrophysiology and neuroimaging to map changes in brain function and structure in relation to cognitive development.

## Key Points

- Professor Baldeweg's research focuses on maturation and critical periods for cognitive development. The research uses brain imaging techniques to study disorders like stroke and epilepsy during development.
- Diffusion tensor imaging (DTI) (with Magnetic Resonance Imaging, MRI) measures neural network density; the latter relates to IQ, white matter integrity, and shows brain injury
- White matter maturation from ages 0-4 indicates later cognitive ability
- Brain volume and area measurements (fMRI) during development along with mother education are best predictors of IQ in preterm babies (Northam et al., 2011)
- Medicine resistant epilepsy (MRE) is linked to lower IQ; the effect is larger with earlier onset
- Early surgical treatment has significant effect on educational outcomes, and can close the IQ gap; the 'catch-up' process takes more than five years (Skirrow et al., 2011)
- Each hemisphere has two language tracks – if there is an early lesion to the left language area, it can 'relocate' to the right hemisphere (see Fiori & Guzzetta, 2015)

## Why is this interesting and challenging?

- Early pre- and post-natal brain development is characterised by the most dramatic changes in the brain's size and connectivity across the life span.
- We are only at the beginning of understanding brain functional and structural maturation during the early childhood years and its importance for cognitive development.

## Why is this relevant to policy and practice?

Early years constitute a particularly critical period for cognitive development; however the role of interventions (educational and medical) during this time is not sufficiently understood.

Key references: Northam et al., 2011; Skirrow et al., 2011; Fiori & Guzzetta, 2015



# Lighting up young brains, Save the children

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## Save the Children

In 'Lighting Up Young Brains' (Finnegan and Lawton, 2016), a scientific briefing from Save the Children and the Institute of Child Health at University College London, neuroscientists point to the pre-school years as a critical opportunity for the brain to develop key skills like speech and language.

### Key findings

- The early years are critical for brain development, where most of the connections in the brain are formed
- Brain development from age 0-2 is greatly influenced by interaction with carers and the home learning environment; this has a lasting impact throughout life
- There is a symbiotic relationship between language learning and brain development (Rosselli, 2014)
- As children develop, fMRI indicates that language (speech and listening) brain activity moves from one area to another, and becomes more automatic (Weiss-Croft and Baldeweg, 2015)

### Why is this interesting and challenging?

- Polling commissioned by Save the Children showed that most parents valued school as the most important learning period for children, they had lower expectations regarding children's development before 3 years old, and they wanted more help and advice to understand their child's early learning.
- Parents can make play-time 'brain-time' by using talking, word games and singing with their children, which builds language and communication skills.
- Save the Children also want to boost learning in nursery and childcare settings, including appointing a qualified early years teacher for every nursery.

# Learning the sounds of speech



## Dr Victoria Leong

Assistant Professor of Psychology (Nanyang Technological University, Singapore)

Affiliated Lecturer (Department of Psychology, University of Cambridge)

Dr Victoria Leong (Victoria) is a developmental cognitive neuroscientist who is interested in the neuro-social processes that support learning during early life, such as the synchrony that naturally occurs between mothers and infants. She heads the Baby-LINC (Learning through Interpersonal Neural Communication) Lab at the Department of Psychology in Cambridge.

## Key Points

- Dr Leong's research combines EEG (electroencephalography; see photo) and behavioural studies with computational modelling and corpus studies, and has shed light on infants' rapid phonological learning.
- Dr Leong identifies the acoustic features in the speech signal – the amplitude modulation patterns within the speech envelope – that are key: it seems that brain oscillations 'phaselock' with these features, allowing phonological units to be identified.
- Dr Leong's research also takes into consideration the social context of language learning, and has investigated the way that Infant Directed Speech (the particular way that caregivers talk to babies and young children) has an effect on those acoustic features and even aids children's early language learning.

## What is phonology?

A language's phonology is its system of sounds: which sounds it has, what systematic variations there are of those sounds, and how those sounds combine to form bigger chunks, such as words. It also includes prosodic information, such as stress and rhythm. While phonetics is the study of all the sounds produced by a speaker, phonology is the study of sound distinctions that are meaningful in a language, or of mental representations of sounds.

## Why is this interesting and challenging?

One of the great learning challenges for infants and young children is language. How do they take the stream of sounds in speech, in a noisy environment, and find out what the words, syllable or sound units are – let alone what the words mean? Babies do seem to be good at recognising and learning phonological distinctions – differences between sounds – but how they are so successful is less well understood.

## Why is this relevant to policy and practice?

Learning begins very early in development. Children are affected by the early interactions they have with others. A better understanding of these early interactions can support the development of interventions for social development and communication skills.



Key references: Leong et al., 2017; Leong and Goswami, 2016; Leong and Goswami, 2015; Leong et al., 2014

# Learning in a stressful environment



## Dr Sam Wass

Lecturer, University of East London

Dr Wass' research looks at how stress affects early development in children from low socio-economic status backgrounds. He is also currently a co-investigator on an ESRC Grant with Dr Victoria Leong in the Psychology Department at Cambridge, and a collaborator on grants in London, Finland, the US and Canada.

## Key Points

- Dr Sam Wass investigates how children react to stressful factors in their environment, and how that affects their attention and learning.
- Past research has shown that children are less able to learn in moments when they are more stressed.
- But Dr Wass' studies suggest that the situation is more complex: when looking at babies, who have had less time to be affected by their environment, together with collaborators Clackson and De Barbaro, he found that those who were more sensitive to stressors were better at some types of learning.
- One theory that Dr Wass and collaborators are currently testing is the 'differential susceptibility theory': children who are more sensitive to stress do better in good environments, but worse in poor environments, compared to less-sensitive children.

## Why is this interesting and challenging?

- Infants' and children's learning depends on their environment and their interaction with it.
- Stress energizes learning but there can be a down side.
- Previous research has concluded that the associations widely observed between low SES and poor academic performance may be attributable to the fact that individuals from low SES backgrounds tend to experience more frequent, and intense, stressful early life events.

## Why is this relevant to policy and practice?

By combining behavioural and neural measures, Dr Wass hopes to find out how stress in children interacts with learning, which could have implications for interventions in educational settings.

Key references: De Barbaro et al., 2016a; De Barbaro et al., 2016b; Wass et al., 2016

# School readiness: developing the BESSI questionnaire



## Professor Claire Hughes

Deputy Director, Centre for Family Research,  
Department of Psychology, University of  
Cambridge

Alongside two longitudinal studies, the Toddlers Up study and the New Fathers and Mothers Study (NewFAMS), Professor Hughes has conducted several cross-cultural studies of development in theory of mind and executive function. She is also interested in the factors that contribute to children's success in the transition to school and was commissioned to develop a school readiness questionnaire.

## Key Points

- Professor Hughes recently led a research project aimed at helping teachers monitor children through the transition to school. Combining expertise in psychology with practitioners' professional judgements, Professor Hughes and her colleagues developed a simple, short questionnaire for teachers, called the Brief Early Skills and Support Index (BESSI). This one page questionnaire not only avoids having to put the child through a stressful testing process, but also removes the burden on teachers to complete lengthy, time-consuming and complex surveys.
- Developed through focus groups with teachers, the BESSI incorporates traditional aspects of school readiness, such as considerations of language and cognition, but also items about relevant 'daily living skills' for young children, like being fully toilet trained and being able to use cutlery, alongside indicators of family support, such as sleepiness, punctuality and the provision of fun activities at home.
- The results highlight the value of BESSI as a simple instrument which can be used by a wide range of staff to detect problems in school readiness. It allows for targeted support and early intervention to be provided in order to ensure that all children have the best possible start to their education.

## Key Findings

- Some problems, such as distractibility and trouble sitting still, were almost twice as common among boys, and that compared with girls, boys received much lower ratings for 'fun at home'.
- Problems were also more common among children from low-income families.
- Differences in family support mattered more than differences in income in predicting child outcomes. The potential of fun activities at home was related to higher scores for language and cognition, being able to interact well with other children and was also associated with a significantly reduced likelihood of temper tantrums and aimless behaviour at school.

## Why is this interesting and challenging?

What does it mean to be ready for school? For politicians and policymakers this often represents the introduction of baseline assessments to measure a child's foundation skills in literacy and numeracy. Teachers, however, place greater emphasis on a child's behaviour, social skills and their ability to emotionally adjust to school life (Pacey, 2013). However, the term 'school readiness' is, in itself, controversial, as it appears to shift the responsibility onto the 4-year old child to be ready for school, rather than putting the onus on the school to be ready for the child.

## Why is this relevant to policy and practice?

Globally, school readiness is gaining currency as a viable strategy to close the learning gap and improve equity in achieving lifelong learning among young children. It has been linked with positive social and behavioural competencies in adulthood as well as improved academic outcomes in primary and secondary school, both in terms of equity and performance (UNICEF, 2012). The home environment is important for preparing children for school.

Key references: Hughes, 2015; Hughes et al., 2015; Hughes et al., 2013

# The science of playtime



## Dr Jenny Gibson

Lecturer in Psychology and Education,  
Faculty of Education, University of  
Cambridge

Dr Gibson studied Speech and Language therapy before completing a PhD in Psychological Sciences. Her main research interests concern the relationship between linguistic, emotional and social development in children.

## Key Points

- Dr Gibson leads an ESRC Innovation project entitled Hi-tech observation of playground social communication trajectories in children (HOPSCoTCh). Her interdisciplinary team developed a high-precision GPS device that attaches to wearable objects to track children's movement during playtime. This technology allows researchers to harness children's every move in the playground to understand the patterns of their social behaviours.
- Tracking children's movement in the playground provides a number of interesting metrics, such as, sociability, friendship group size, degree of connections between children, the areas and proportion of playground most utilised, as well as children's physical activity. These metrics will be compared to other sources of information like questionnaires to parents and a 'peer nomination' method that will ask directly to children about their friendships and relationship to their peers.
- The project also seeks to enrich the playground experience by changing the landscape and elements available to children. The team will measure the impact of these changes by comparing before and after assessments of key indicators, for example physical activity or sociability levels.

## Why is this interesting and challenging?

- Playtime can be a challenging environment in which children display and develop sophisticated cognitive and communication skills, such as negotiating roles and alliances with peers.
- Some children may struggle to navigate the social complexities of the playground and become isolated, which further removes opportunities for practicing social skills and developing friendships. A proportion of children present developmental difficulties, like ADHD or Asperger Syndrome, that may become evident during playtime - but not in more structured school-contexts- giving practitioners the possibility to identify these issues and provide support.

## Why is this relevant to policy and practice?

What's so interesting about playtime? According to Dr Jenny Gibson, this overlooked aspect of children's everyday lives is a privileged 'window' to understand their social skills and friendships. Children practice social-emotional skills during unstructured playtime, in ways that are different to what they practice in highly structured classroom environments. At school, learning and development happen both in and out of lessons.

Key references: Brussoni et al., 2015; Hyndman et al., 2014; Gibson et al., 2013

# The power of play



## Professor Kathy Hirsh-Pasek

Temple University and The Brookings Institution

Professor Hirsh-Pasek's research examines the development of early language and literacy as well as the role of play in learning. Her research looks to bridge the gap between the science of play and educational practice. Together with Dr Roberta Golinkoff, she has authored several books discussing the scientific evidence of learning through play, making it accessible to wide audiences including parents, educators, and policy makers.

## Key Points

- Professor Hirsh-Pasek's account of the role of play in children's lives echoes many commentators concerned with the perceived decrease of play opportunities in modern urban societies. Together with increasing demands on children to acquire academic abilities (e.g. reading, shape knowledge) at younger ages, this translates into children's time being mostly adult-directed and structured.
- Opportunities for free, child-led, risky play, which allow children the opportunity to discover the world and the limits of their skills independently, are becoming scarce.
- Professor Hirsh-Pasek's research is offering an alternative way to conceive the relationship between play and learning. She argues that learning can happen via play, when a guided play approach is adopted. In guided play children take the lead, but adults support their exploration through props and by interacting in ways that scaffold interest and learning. So play, she argues, is not opposed to but equivalent to learning opportunities. Her research suggests that when comparing free play, direct instruction, and guided play to support children in learning about geometrical shapes, a guided play approach is significantly more effective.

## Why is this interesting and challenging?

Given that school readiness is associated with later academic skills, an important debate in early childhood education is concerned with the pedagogical approaches to achieve best results in reducing the learning gap associated to social inequality. Should this be play-based and child-led or academically-oriented and adult-led?

## Why is this relevant to policy and practice?

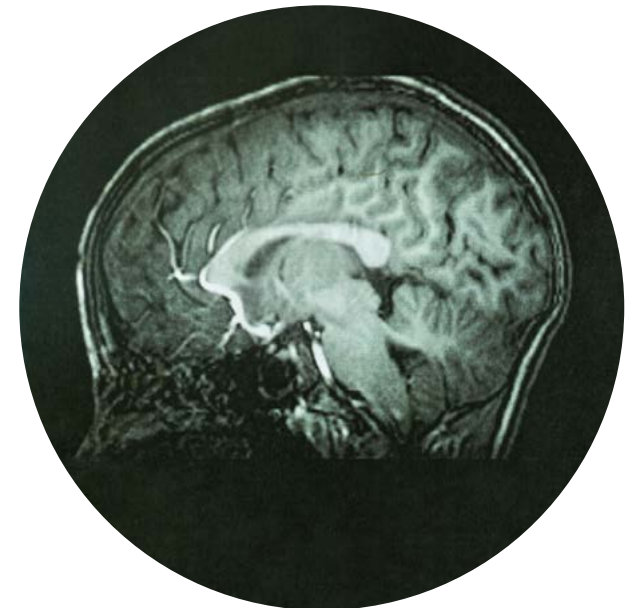
According to Professor Hirsh-Pasek, views about what is play are often mistaken or incomplete. When play is seen as a completely unstructured, frivolous, and unimportant activity, parents, educators and policy makers worry that playtime takes children away from academic goals. In this polarised view play is seen as the opposite of learning, so the educational debate is centred on whether children should spend more time playing freely or being explicitly educated on academic abilities. This false dichotomy should be set aside to allow for a more nuanced view, where some forms of play can be used as a tool for learning and development.

Key references: Weisberg et al. 2016; Golinkoff & Hirsh-Pasek 2016; Hirsh-Pasek & Golinkoff RM 2016; Weisberg et al. 2015

# Key methodologies for researching neuroscience and education

## Neuroimaging methodologies

- There are two major ways in which neuroscientists can image the developing human brain described in this brief.
- Electroencephalography (EEG) measures the electrical signals that are created when neurons send messages to each other, by recording from electrodes placed on the scalp. It is easy for babies and young children to take part in EEG studies as the technique is non-invasive and allows the participant to move freely.
- EEG has very high temporal resolution but low spatial resolution. Therefore, it is easy to see what time the brain responds to stimuli (usually shown on a screen while the baby sits on their parent's lap) but very difficult to see which part of the brain is active.
- Magnetic resonance imaging (MRI) is a test that uses strong magnetic fields and radio waves to take very clear and detailed pictures of brain structures.
- Functional MRI (fMRI) uses the fact that the body sends a rush of oxygen to parts of the brain that have just been active. Therefore, it is possible to see which parts of the brain are more active during one condition than another. For example, the part of the brain responsible for vision is more active when a child looks at a picture than when they look at a blank screen.
- MRI is also non-invasive and has quite high spatial resolution, but the images are sensitive to the child's motion during the scan. An MRI scan is also very loud and can be a little frightening for participants of all ages. Most researchers put a lot of effort into making sure that children are comfortable and know what to expect by conducting mock scans before the real thing.
- While EEG and MRI allow us to image the brains of living children as they grow up, it's important to note that neuroscience studies are expensive to undertake and therefore have small numbers of participants. They are also always using indirect measures of brain structure and function.



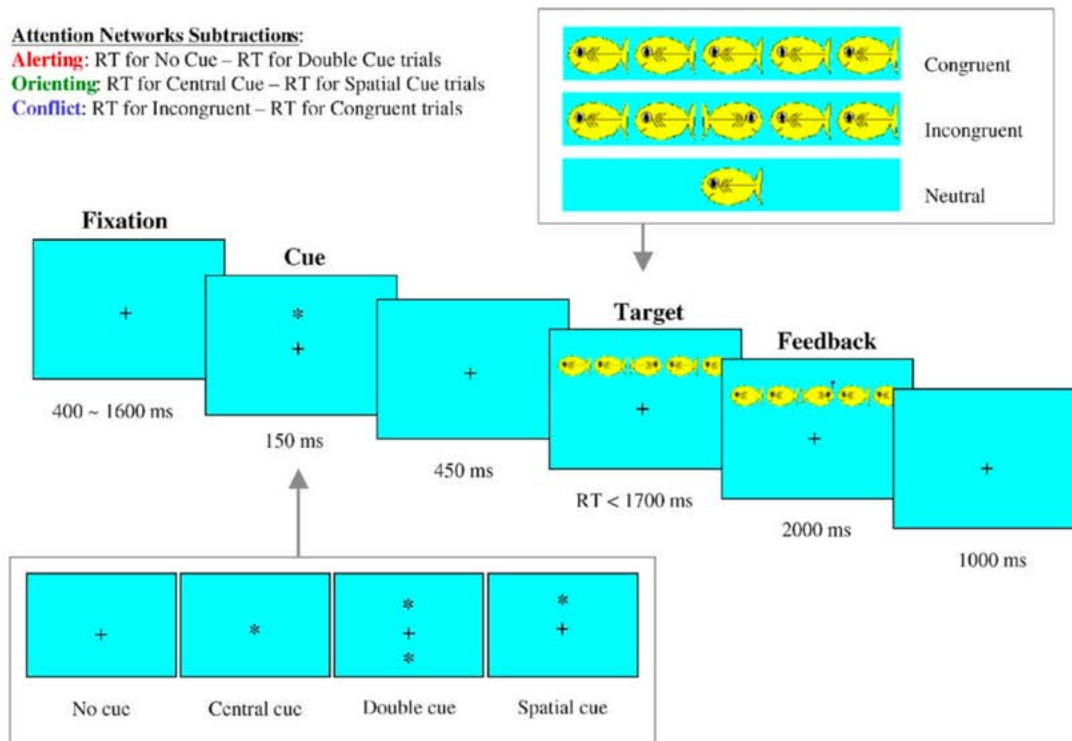
# Overlapping methodologies in neuroscience and education

## Structured behavioural observation: tasks and tests

- Besides direct physiological measures, neuroscience uses behavioural observation to infer brain activity and maturation. For example, executive functions -the skills associated to the ability to plan actions, control attention, and resist impulses - are often measured by recording children's behaviours, such as speed and accuracy, in game-like tasks (see image below left).
- In education research, learning is often measured through tests and tasks with standard instructions and scoring systems. For example, to measure receptive vocabulary, researchers use a standard set of words and ask children to find the matching picture. A higher score represents a wider vocabulary range (see image below right).

## Naturalistic behavioural observation: a picture of the 'real world'

- Neuroscientists are becoming increasingly aware of the importance to link controlled lab-observations to behaviours as they occur in the 'real world'. Some studies use naturalistic observation, that is observing behaviours without the constraints and oversimplification of standardised tasks. For example, scientists might choose to index children's language skills by analysing the transcript of a genuine conversational exchange rather than using a language test.
- Naturalistic observation is widely used in educational research to gain knowledge about learning processes in real classroom settings. For example, several indicators about the quality of teaching of can be derived from a single video-recording of a math lesson, such as the frequency of teachers' remarks that refer to higher order thinking skills (known as metacognition).



British Picture Vocabulary Scale (Dunn, L. M., Dunn, L. M., Whetton, C., & Burley, J. (1997). The British Picture Vocabulary Scale, 2nd edn (Windsor: NFER-Nelson)



# Methods in education research: listening to childrens' voices

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Besides direct observation, education research employs a variety of methods to account for the subjective aspects of learning. Some of the main methods and their uses are described below.

- Questionnaires – a document to gather information according to the individual's own account. It might report subjects' behaviours or attitudes on an ordered scale.
- Interviews – an open-ended set of questions about a particular topic. Interviews can be unstructured (unplanned questions may emerge according to previous responses) or structured (a set of questions is asked to all participants in a set order).
- Visual methods – these techniques relying on the use of artistic mediums, such as drawings or photographs to produce and represent knowledge about a topic.
- Personal constructs – these techniques are used represent a person's subjective experiences on a particular topic, such as producing a cognitive map or organising ideas in a strengths and difficulties grid.

## Summary of implications for policy and practice

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The aim of the seminar is to introduce new fields of study to an engaged audience of researchers and practitioners interested in infancy and early childhood development. It is difficult to draw straightforward links therefore between new research findings and specific policies in relation to education and early years development. What we have focused on here are some areas for policy and practice that may be informed by developing research in education and neuroscience that was discussed by participants today and by researchers involved in policy discussions around the series. They are:

- A focus on learning from birth – research shows that learning starts well before children enter formal education, which suggests there should be a broader focus to education and learning policy, to focus on learning from birth.
- The benefits of play – play has many benefits for children's learning and development. Cognitive processes are being used in play and playfulness. Play can support the development of self-control, which can be part of problem-solving skills in later life. Play can be part of health, social and emotional development. A 'playful' approach can support children's writing. There is value in constructing and evaluating play-based educational interventions.
- Supporting school readiness for all – a more in-depth understanding of school readiness can help practitioners provide support for children starting school that will reduce differences in school readiness, and encourage learning behaviour at an earlier stage.
- Understanding inequalities in childhood development – research can help understand and address atypical development as well as inequalities in the ability of children to learn and develop fully.
- Reducing stressful effects of different learning environments – understanding the positive and negative effects of different learning environments may help interventions to reduce stress amongst children, particularly in early year's settings.

# List of Speakers

## Chair

**Dr Sara Baker**, Faculty of Education, University of Cambridge  
*Introduction and welcome*

**Dr Dervila Glynn**, Cambridge Neuroscience  
*Workshop facilitator*

## Speakers

**Professor Michael Thomas**, Birkbeck College, University of London  
*Challenges and opportunities for linking brain sciences with early years education*

**Professor Torsten Baldeweg**, University College London  
*Early brain maturation and critical periods for cognitive development?*

**Dr Victoria Leong**, Department of Psychology, University of Cambridge  
*How infants discover the building blocks of language*

**Dr Sam Wass**, University of East London  
*Learning & the Autonomic Nervous System: understanding interactions between stress, concentration and learning during early childhood*

**Dr Jenny Gibson**, Faculty of Education, University of Cambridge  
*A random walk on the playground: Outdoor play as a window on children's social development*

**Professor Claire Hughes**, Department of Psychology, University of Cambridge  
*Helping teachers monitor children through the transition to school: Introducing the Brief Early Skills and Support Index (BESSI)*

**Professor Kathy Hirsh-Pasek**, Temple University  
*Public Lecture - The Power of Play: How play motivates children's academic and social development*





## Contributors to this Policy Brief

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**Dr Dervila Glynn**, Coordinator, Cambridge Neuroscience

**Dr Sara Baker**, Faculty of Education

Original illustrations: **Michalene O'Brien**

# References and further reading

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# About the Educated Brain Seminar Series

The Educated Brain consists of a series of three research seminars alongside policy-focused events, to bring together academic thinking around educational neuroscience with implications for policy makers and practitioners.

Research seminars, to be held in April 2016, October 2016 and October 2017, will focus on: Infancy and Early Childhood, Late Childhood and Adolescence, and Effectively translating neuroscience for teaching practice.

The series is funded by the ESRC, and organised by three Strategic Research Initiatives at University of Cambridge: in Language Sciences, Neuroscience and Public Policy.

For further information on the Educated Brain Seminar Series, please visit:

[www.neuroscience.cam.ac.uk/educatedbrain](http://www.neuroscience.cam.ac.uk/educatedbrain) or contact Dr Dervila Glynn:

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The Cambridge Public Policy Strategic Research Initiative (SRI) was established in 2013 with the aim to support public policy research across Cambridge University, working with colleagues in science, social science, the arts and humanities, to apply new thinking to public policy problems and promote research and analysis into the public policy process. The Bennett Institute for Public Policy was established at the University of Cambridge in April 2018.

For more information, find us at:

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