



**RESEARCH SEMINAR SERIES – 2013/2014  
GRADUATE SCHOOL OF EDUCATION  
COLLEGE OF SOCIAL SCIENCES AND INTERNATIONAL STUDIES**

**Dr Dénes Szűcs  
(University of Cambridge)**

Dr Szűcs is a senior lecturer at the University of Cambridge and Deputy Director, Centre for Neuroscience in Education. He is a cognitive neuroscientist using behavioural and various brain activity measures to conclude about mental function. He is using non-invasive electrophysiology (EEG/ERP), electro-myography (EMG), near-infrared functional imaging (fNIRS) and functional magnetic resonance imaging (fMRI). He has two major lines of research. First, he examines the neural basis of number processing and arithmetic disabilities (developmental dyscalculia) in both adults and children. Second, he examines cognitive control and its development in both adults and children. Academic Area/Links Cognitive Neuroscience of Numerical Processing Developmental Dyscalculia Cognitive control/Response organisation/Response inhibition Stroop effect.

**Seminar Title: Testing theories of developmental dyscalculia**

***Abstract***

Developmental dyscalculia (DD) is a learning difficulty thought to be specific to mathematics. Currently dominant cognitive neuroscience theories of DD suggest that DD originates from the impairment of the magnitude representation (MR) of the human brain, residing in the intraparietal sulcus (IPS), or from impaired connections between number symbols and the MR. However, behavioural research offers several alternative theories for DD and neuroimaging also suggests that impairments in DD may be linked to disruptions of other functions of the IPS than the MR. That is, besides the MR, impairment of working memory, attention, inhibition and spatial processing were also proposed to underlie DD. Strikingly, the MR theory has never been explicitly contrasted with the range of alternatives in a systematic fashion. Here we have filled this gap by recording an extremely detailed profile of DD and directly contrasting five alternative theories of DD in 9-10 year-old primary school children. We used both behavioural and neuro-imaging tasks and used practically all available measures of the MR. Participants were carefully filtered from a pool of 1004 children and took part in 15 standardized tests and 9 experiments. DD and control participants were completely matched on reading skills, verbal and non-verbal IQ, general processing speed and socio-economic status. None of the results supported the MR theory of DD. In contrast, various domain general functions emerged as strong markers of impaired function in DD. The theoretical and practical significance of findings will be discussed.