

# 學習歷程中兒童注意力投注之生理證據探究——一般及特殊需求兒童生理資料庫之建置

## Children's Attention on Learning: Neuro-Physio-Behavioral Data in Children with Typical Development and Special Needs

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Attention has a significant impact on children's learning based on executive function, emotional regulation and learning performance, and it also has a significant impact on family connections, peer interactions, and social interactions at school. Among children with Special Needs, children with attention deficit and/ hyperactivity disorder (ADHD) have been pointed out that their attention deficit is related to executive function deficits. Children with autism spectrum disorder (ASD), on the other hand, face challenges in their executive function development. In clinical practice and empirical studies, it suggests that children with ASD frequently have some comorbid ADHD symptoms. According to existing research in Taiwan, there is no longitudinal research across different ages to investigate the development process of attention network and executive function in the learning process of children with general and special needs. As a result, the aim of this study is to construct a neurophysiology behavioural database of 4-6 year-old Taiwanese children with typical development and special needs.

The main research work of this study is divided into two parts: 1. Recruiting students and training them to satisfy the requirements for collecting behavioral assessments and brain wave signals, then begin data collection and analysis for children with typical development, ASD, and ADHD; 2. Planning and setting up the software interface and hardware system of the children's physiological signal database.

The achievement we have so far :

1. Recruiting and training students: In terms of professional training, in the first year, 3 undergraduate students and 1 graduate student have been well trained to collect data, and now they help to train the newcomers (see Figure 1, 2, and 3).
2. Participants recruiting: Due to the worsening of the covid-19 pandemic, mandatory social distancing has interrupted our participant recruiting, the project still completed the behavioral assessment of 25 typical development children, and 19 of the 25 revisited and finished the EEG signal acquisition. And the annual follow-up assessment will start in mid-November (see Figure 4).
3. Database construction: In terms of online database establishment, it has reached 90%, (see Figure 5 and 6). The next aim is to improve our system's searching interface in order to offer a better data visualization experience.

## Expected Key Point Index

1. Winning a multi-year team grant from the Ministry of Education of the Republic of China (Taiwan), our team members won the second-year (NT 4,000,000) and third-year (NT 3,000,000) project of the Research Service Company which is titled: The Physiological Approach: Improving Attention and E-Learning System Optimization. Part of our team also got the Ministry of Education's grand approval in April 2020: project name: "Inquiry, Design Thinking, and Practical Guidance of the Tsinghua STEAM School Construction Program" (approval cost of \$5,178,452).
2. The long term implications of this project here include establishment of a child Neuro-Behavioral database for each special needs child, as well as the possibility of launching the construction of a Web-based self-learning and self-assessment system in the RSC project. Our team successfully completed three STEAM-related courses, which included working memory, sensory integration, and executive functions (inhibition control). In addition, MindCARE psychotherapy clinic will partner to deliver these course services to children with special needs.
3. In the year 2020, members of our team published 7 research publications in the SCI / SSCI / TSSCI journals and 8 presentations at international conferences. So far in 2021, there have been 7 journal articles and 5 international conference presentations.
4. Two Ph.D. students and two graduate students collaborated on these projects for the building of a database system, course development, and neuro-behavioral performance assessment, the experiences of cooperation with others will become their most valuable and precious nutrition in their academic career.

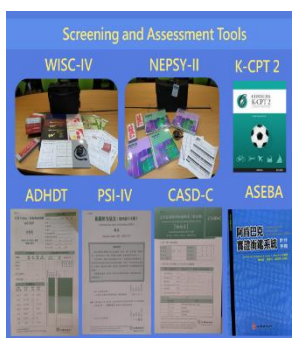


Figure 1. The example of assessment tools



Figure 2. The procedure of behavior assessment.

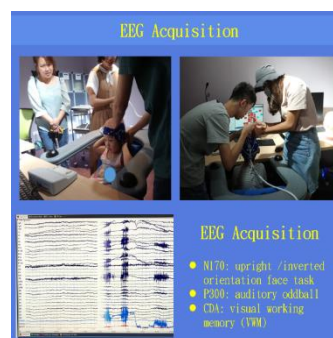


Figure 3. The example of EEG acquisition

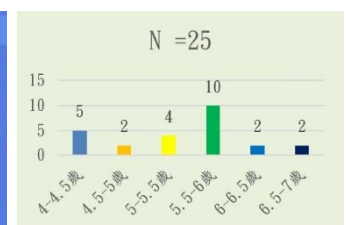


Figure 4. Age distribution of participants.

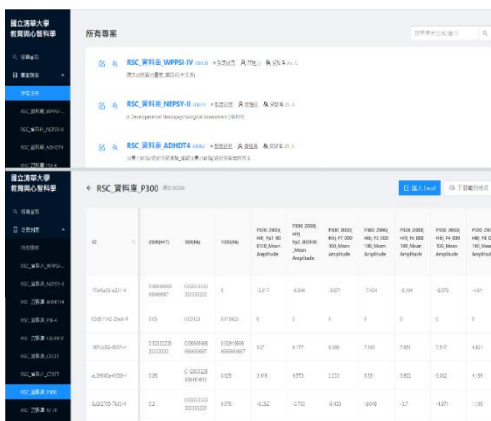


Figure 5. The web interface of our database system

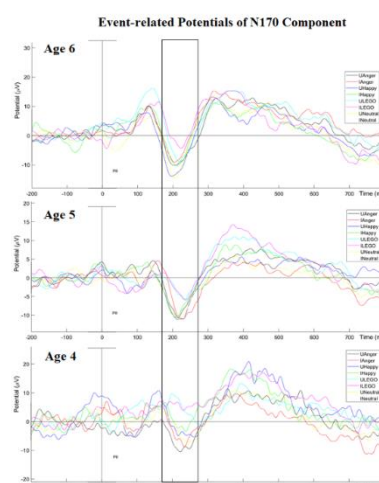


Figure 6. ERP waveforms induced by facial stimuli were averaged across 4, 5, and 6 year-old children.