

The 17th APCG

Asia-Pacific Conference on Giftedness



Proceedings of the 17th Asia-Pacific Conference on Giftedness: **Embracing Diversity, Blooming Talents**

Edited by Ching-Chih Kuo, Hsiao-Ping Yu, Wei-Ren Chen, Yen-Wei Chen

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Contents

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Introduction of the 17 th APCG, 2022, Taipei	3
Editors: Ching-Chih Kuo Hsiao-Ping Yu Wei-Ren Chen Yen-Wei Chen	14
1. Differences in psychological traits between talented and typical students: A preliminary study	15
Proceedings of the 17 th Asia-Pacific Conference on Giftedness: Embracing Diversity, Blooming Talents	18
2. Using ...	3
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Department of Special Education, National Taiwan Normal University 129, He-ping East Road, Section 1, Taipei 10610, Taiwan	34
4. ...	10
5. ...	40
6. Twice- ...	52
1. Strength- ... Literature review Michelle Roncaloy-Pane, Janig Harley	53
2. Investigating the metaphorical perceptions of pre-school and elementary teacher candidates toward twice-exceptionality Mehmet Güneş, Mehmet Altın	55

Contents

Preface	1
Introduction of the 17th APCG, 2022, Taipei Ching-Chih Kuo, Chang-Hsin Liu, Wan-Hsuan Liu	3
Full Papers	14
A. Conception and Characteristics of Giftedness	15
1. Differences in psychological correlates between talented and typical undergraduate students in Hong Kong: some preliminary findings Anna N N Hui, Siu Fai Chan, Timothy Darsono	16
2. Using metaphors to examine preservice teachers' opinions on creativity Beyhan Can, Şule Gucyeter	26
3. Gender differences in personality traits of gifted adolescents Madlena Arakelyan	34
4. Shifting notions of giftedness and talent in the digital age Kun-Ming Lien	40
5. The relationship between intelligence and executive function among gifted adolescents Endang Widyorini	46
B. Twice-Exceptionality	52
1. Strength-based approaches for supporting twice-exceptional learners: preliminary findings from a systematic quantitative literature review Michelle Ronksley-Pavia, Janis Hanley	53
2. Investigating the metaphorical perceptions of pre-school and classroom teacher candidates toward twice-exceptionality Mehmet Gürbüz, Mehmet Atilgan	66

3. Angel of rare disease – life story on the talent development of a twice exceptional student Li-Jung Lin, Tsuei-yuan Lai	75
4. A case study on the learning experience of inclusive education for twice exceptional students Wan-ying Lin, Tsuei-yuan Lai	82
C. Program Implementation	87
1. Online STEAM education programme for gifted young girls during the covid-19 pandemic Manabu Sumida	88
2. Early childhood math education program based on Sternberg's theory of successful intelligence: development and effects Jeong-Im Koh, Kyunbin Park	94
3. The impact of Talents-Unlimited-Theory based activities on the development of divergent thinking skills and the development of motivation for creativity among primary stage students Fatema Matar	103
4. The implementation of gifted education in Indonesia Fadhilla Najmi Qinthara, Fitriani Yustikasari Lubis	121
5. A study on the effectiveness of high school gifted students participating in leadership associations Chi-chien Chang, Tsuei-yuan Lai	130
D. Curriculum and Instruction	137
1. Developing inquiry abilities: independent study curriculum-concept and cases analysis Kai-Ju Huang, Shu-Hau Jang	138
2. Effectiveness of note-taking on students' science performance in inquiry-based science learning Mei Huei Li, Yung Chiau Tsao	145

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The Relationship Between Intelligence and Executive Function among Gifted Adolescents

Endang Widyorini

Soegijapranata Catholic University, Indonesia

widyorini@unika.ac.id

Executive function is a term for a number of complex cognitive processes that are interdependent and critical to purposeful, goal directed behaviour (Lezak, et al, 2004). Miyake, et al. (2000), EF as a cognitive process (Working Memory, Inhibition, Cognitive Flexibility) which is a thorough coordination of processes in achieving a certain goal. (a) Working Memory is one of the main cognitive processes underlying thinking and learning. WM is necessary because it allows internal representation of information to guide decision-making and open behaviour; (b) Cognitive Flexibility /CF is often called mental flexibility, mental shift and is closely related to creativity; (c) Inhibitory control (IC). IC is the ability to inhibit attention to the distractor thus enabling selective and sustained attention. The ability to inhibit strong behavioural tendencies can help make a person flexible to changes that may occur, as well as obey social decency.

Chichekian & Shore (2017) said that gifted adolescents with this enormous potential, they have good cognitive flexibility (able to categorize problems into meaningful and able to make relevant solutions), metacognition (related to EF and self-regulation), strategic planning, prioritize complexity and troubleshooting, has an excellent memory (developed WM to solve problems), and has a broad knowledge of things. Previous studies have stated that there is a relation between EF and intelligence. As research conducted by Arffa (2007) states that full-scale IQ is significantly related to EF. EF are considered necessary to be able to better understand human behaviour in all its aspects. EF are those skills that can help the person adapt to a continuously changing environment and suppress any non-desirable behaviour, through self-regulation and adaptation, for their own benefits (Bernal, et al.2021).

But in fact, although gifted students have very high intelligence, there are also weaknesses that are owned, one of which is EF. Some gifted children were found to have poor EF. The lack of EF ability in gifted students makes various problems that will have an impact on themselves and others. Silverman (2013) mention the problems faced by students related to EF, namely problems in planning and organizing that interfere with school performance, lack of time management, work is often done at the last moment, less able to sort verbal and written expressions, inability to express how to get answers, impulsiveness, and make decisions without careful thought. The ability to solve problems, plan and manage time in doing tasks requires good cognitive flexibility). Likewise, to control oneself and control emotions related to Inhibitory Control, as well as the ability to analyse, think, reason, and learn requires working memory.

Executive function is a term for a number of complex cognitive processes that are interdependent and critical to purposeful, goal directed behaviour (Lezak, et al 2004). Executive functions refer to a variety of correlated abilities ranging from simple voluntary initiation and inhibition of behaviour to those involving complex planning, problem solving, and insight. Planning problem solving, and insight certainly correspond to psychological and even lay concepts of "intelligent behaviour". However, evidence for a relationship of intelligence tests to executive function measures is inconsistent and not strong (Arffa, 2007). The purpose of this research, in order to know the relationship between intelligence and executive function (EF) in gifted children. The hypothesis: (a) there is relationship between Intelligence and EF of the gifted adolescents; (b) There is a relationship between three domains (Working Memory, Cognitive Flexibility, and Inhibitory Control) in Executive Function and Intelligence in gifted adolescents.

Method

Participants in the study were students in special class for gifted students with IQs above 130, total 132, they are 73 boys and 59 girls. Age of 13-15 years. IQ is measured by CFIT. EF data collection using neuropsychological test tools, namely Wisconsin Card Sorting Test (WCST) and Stroop Colour and Word Task online version of Psytoolkit.org, Trail Making Test (TMT), and Digit Span

Results

From statistical analysis. The results showed there was no significant correlation between Intelligence and Executive Function (measured by Wisconsin Card Sorting Test (WCST) in gifted adolescents ($r=0,311$; $p>0,05$). The results of statistical analysis IQ with the three domains contained in the EF showed different correlations; Likewise, the Cognitive Flexibility/CF domain as measured by the Trail Making Test (TMT) there is not find a significant correlation ($r=-0.418$; $p>0.05$). There is a significant correlation for Intelligence and Working memory/WM of the Backward Digit Span measuring instrument ($r=0.347$; $p<0.05$), and There is a significant correlation between Intelligence and Inhibitory Control/IC of the Stroop Colour and Word Task ($r=0,241$; $p<0,05$).

Discussion

The first hypothesis is not accepted. It means that there is no correlation between Intelligence and Executive Function. According to Arffa (2018) Intelligence is a concept developed in psychology and in particular the psychometric tradition, executive function is a concept created in the domain of cognitive neuroscience. It is not surprising that the two remain as parallel concepts in the explanation of human cognition. Research has shown that, when viewed as a whole, executive functions are only partially according to the psychometric concept of intelligence. Therefore, it is evident that some elements of executive function, or rather, certain executive functions clearly correspond to intelligence, while some do not refer to intelligence. If uses the key difference between metacognitive –or simply “intellectual”—executive function, and emotional/motivation – or just a non-intellectual—executive function, it becomes proven that general intelligence can be equated with metacognitive executive function but not with emotional/motivational executive function. It has recently been proposed that cognitive tests knock general-domain executive processes; executive process is intercepted overlapping across cognitive tests so that they are needed more often than specialized domains (Kovacs & Conway, 2016).

Several studies have shown that not all domains of EF are affected by intelligence. The most highly correlated with intelligence is WM (Friedman, et al, 2006; Fugate et al, 2013), especially in adolescents (Giofre et al, 2013). Gifted adolescents have better working memory than non-gifted adolescents (Leikin, et al, 2013; van Viersen et al, 2014). There is clearly a close relationship between intelligence and working memory, and both play an important role in a variety of developmental areas during childhood. Interestingly, both involve prefrontal areas of the brain. This raises the question of whether, when solving problems involving working memory, more intelligent individuals show more activity in the prefrontal brain relative to those who are less intelligent (Neubauer and Fink, 2009).

In gifted children, WM-related self-control mechanisms are also associated with Inhibitory Control (IC). Gifted children can inhibit irrelevant information and divert information processing so that new information that should be remembered can be well received. In gifted children, the corpus colosum is larger than normal children so that there is more space in the brain to channel information from one part of the brain to another and in the end the two parts of the brain can be synchronized properly (MacIntyre, 2008). WM is the capacity that underlies complex cognitive processes and this ability is possessed by gifted children (Dehn, 2011).

This study indicate that intelligence is not related to the Flexibility Cognitive (FC). Several previous studies have found that intelligence is weakly or even unrelated to flexibility cognitive (Benedek, et al 2014; Friedman, Miyake, Corley, Young, DeFries, & Hewitt, 2006). This is because, FC is able to see things from different points of view.

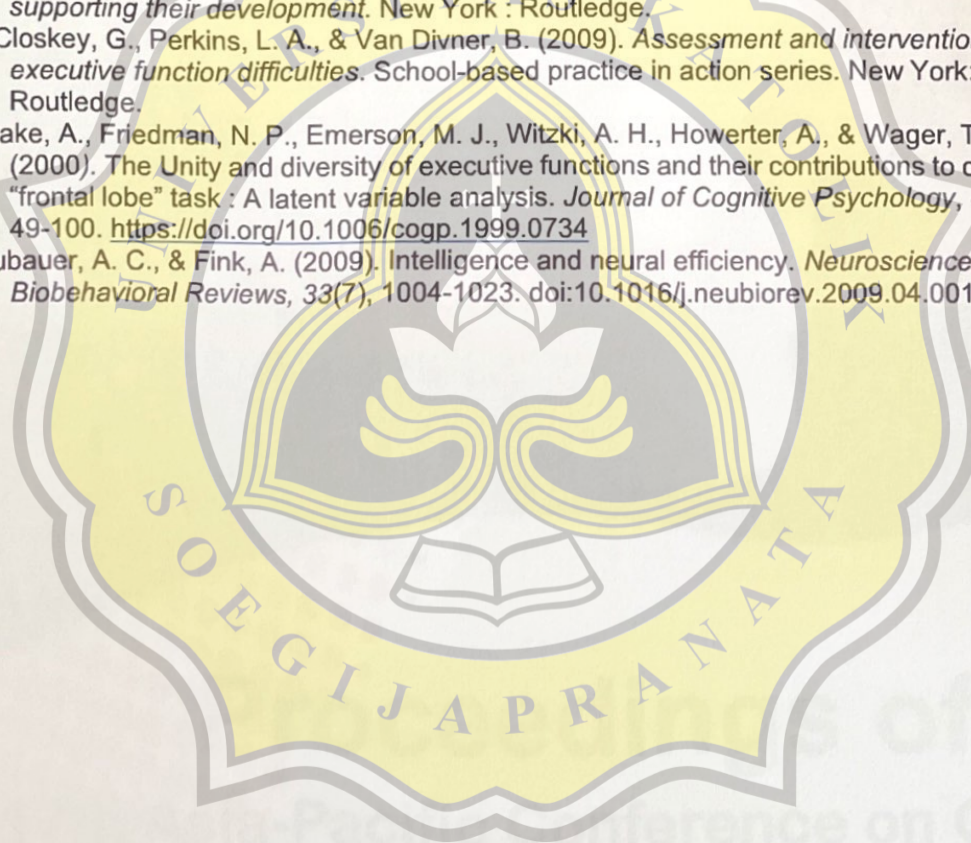
The results of this study indicate that intelligence has a significant correlation with inhibitory control/IC. This is probably because gifted adolescents have a larger gray matter area than non-gifted adolescents (gray matter area is the site of the cell body and is the most active site in the brain, consists of nerve cell bodies, and is a structure that houses the nucleus of neurons, which serves as a sign of self-control. Gray matter also works for higher level learning). Therefore, gifted adolescents have good cognitive control so that even though the brain demands continuous activation from other parts of the brain, gifted adolescents can still control themselves to commit to their tasks (Miyake, et al, 2010)

Carlson, Zelazo, & Faja (2013) state that EF is not influenced by intelligence, but is more influenced by socioeconomic factors, gender, culture, language, parenting, gene-environment interactions, and sleep patterns. The first factor that affects EF is socioeconomic factors. The level of education of parents also affects the EF and language development of children. In addition, children who often move places of residence, trauma, childhood stress can also affect EF. Briggs, et al (2008) conducted research on gifted children and found that they were culturally, linguistically, and ethnically different and students were not identified as gifted children.

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