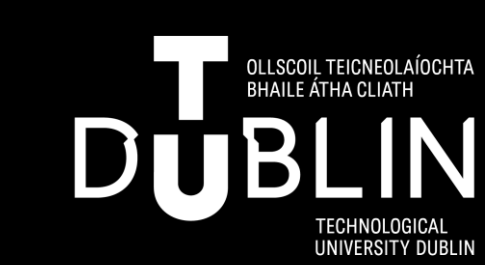




**Dubljević Olga**<sup>1</sup>  
1- Institute for Biological Research  
National Institute of Republic of Serbia



**Bjegojević Bojana**<sup>2</sup>  
2- Technological University Dublin

Notice: Both authors contributed to the realization of the study equally and should be viewed as 1<sup>st</sup> authors

## Introduction

Adolescence is a period marked by rapid cognitive development, yet paradoxically adolescents are prone to risk taking [1,2] and are less successful in setting goals and evaluating their decisions compared to adults [2,3]. This could be associated with the incomplete process of myelination and pruning of synapses in the immature frontal lobes. The efficiency of information processing associated with this region might be limited in adolescents compared to adults, which could lead to evident differences in executive functions (EF) and other cognitive abilities associated with the PFC such as inference abilities [4]. One of the most conceptually established models of EF by Miyake [5], encompasses three EF: Attention Shifting, Memory Updating and Inhibition.

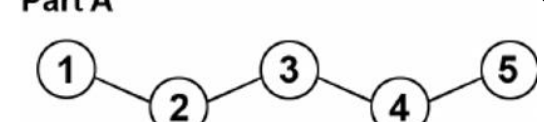
**Aim and scope** The purpose of this study was to evaluate whether adolescents differ from adults in cognitive abilities associated with the prefrontal cortex i.e. EF (Attention shifting and Inhibitory control) and logical reasoning abilities via neuropsychological assessment. The possibility of predicting the performance in the reasoning task based on the achievement in the tests of EF was explored as well.

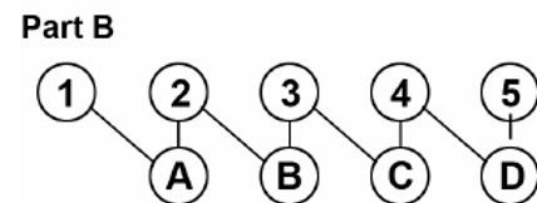
## Methods

**Sample:** The convenience sample was balanced by gender, and it consisted of 40 participants: 20 adult (20-29 years) and 20 adolescent (13-14 years) participants.


**Instruments:** The EF, Attention shifting and Inhibitory control, were operationalized as scores on standardized neuropsychological tests: Trail making test form A and B (TMT) [6] and Stroop test (SCW) [7], while Wason Selection Test (WST) [8] was adapted to assess logical reasoning abilities.

**Procedure:** All testing was conducted individually in a paper-pen format and all participants received identical verbal instructions. The sequence of test assignments was random in order to avoid possible fatigue effects.

1) 

2) 

PART 1	PART 2	PART 3
YELLOW	XXXX	RED
GREEN	XXXX	GREEN
RED	XXXX	BLUE
BLUE	XXXX	YELLOW
RED	XXXX	RED
RED	XXXX	BLUE
GREEN	XXXX	BLUE

3) 

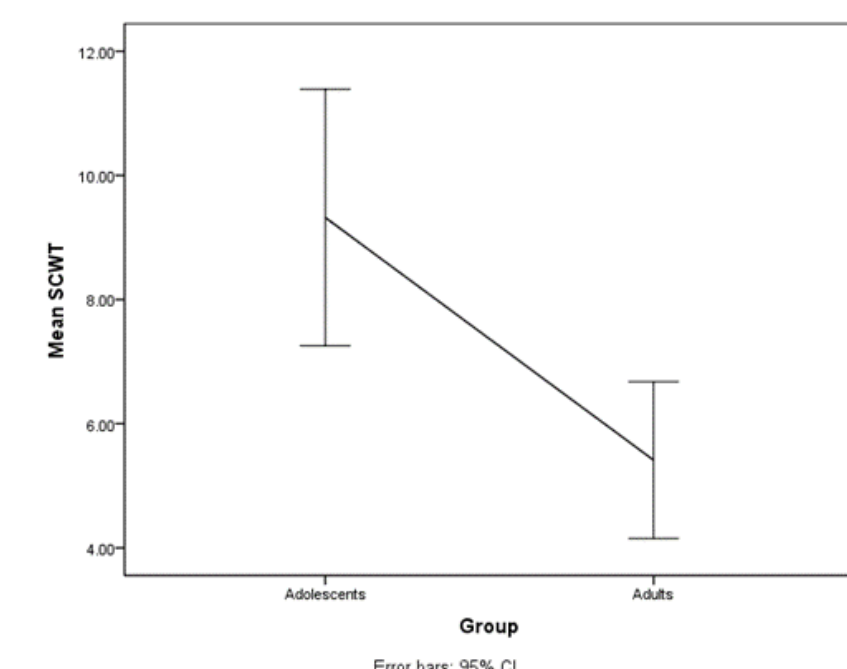
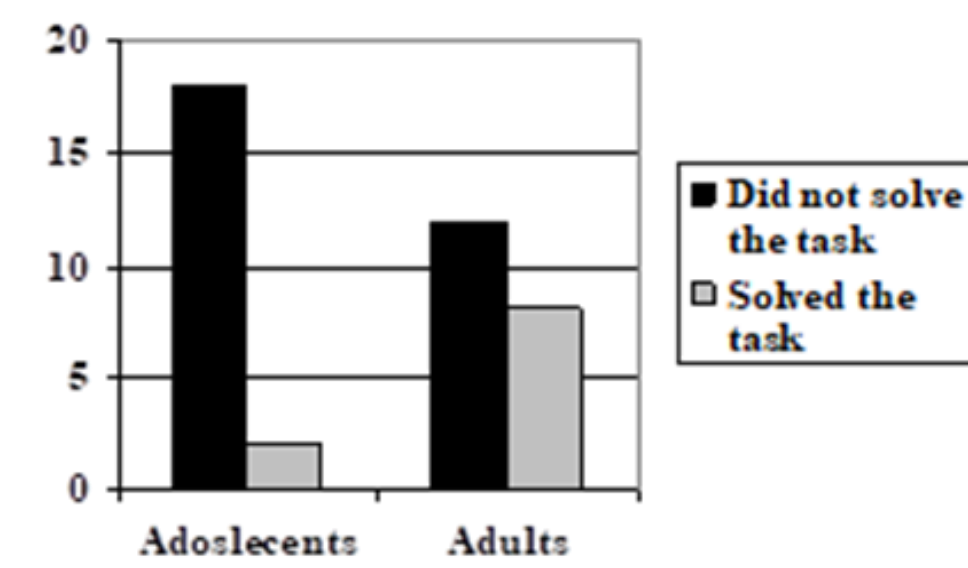
Check if the rule applies with least attempts:  
IF THE LETTER ON THE CARD IS A VOWEL THE NUMBER ON THE BACK OF SAID CARD IS EVEN.

**Figure 1:** Example of tests. 1) TMT 2) Stroop test 3) WST

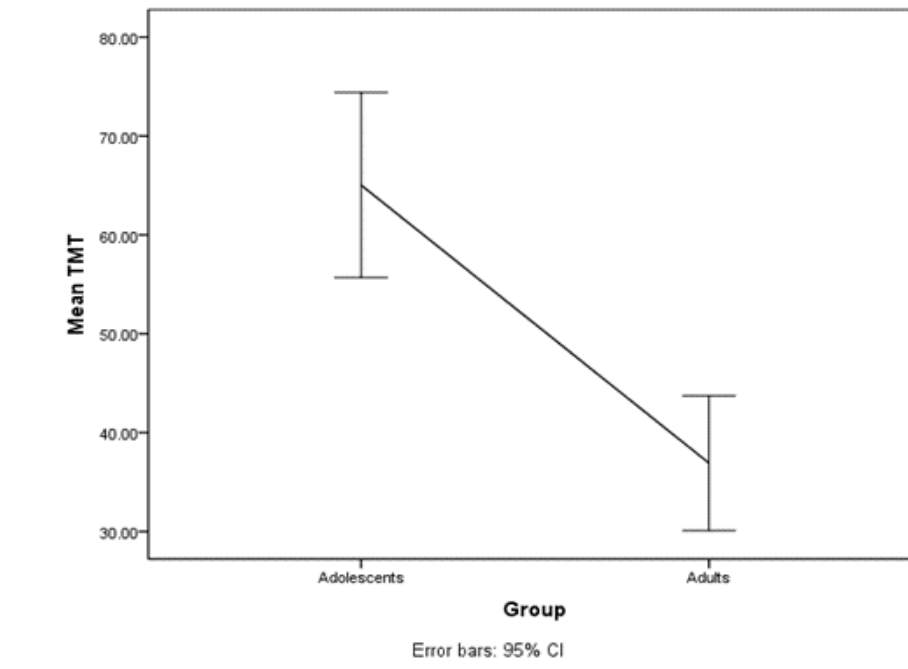
## RESULTS

Regarding the achievement in logical reasoning (WCS) task only a quarter (25%) of the sample managed to solve it successfully. In the adult group 40% of participants were successful, while in the adolescent group this number was 10% (Figure 2). Chi-square test revealed significant differences between adult and adolescent subjects in their achievement in the logical reasoning task ( $\chi^2(1, N = 40) = 4.80, p = .028, \phi = .346$ ).

**Figure 2:** Group differences on the WCS task



**Figure 3:** Group differences in reaction time on SCW test



**Figure 4:** Group differences in reaction time on TMT

Significant differences were found between the groups in the performance on both the EF tests, as demonstrated by MANOVA results ( $F(2, 37) = 15.94, p < .001$ ; Wilks'  $\lambda = .54$ , partial  $\eta^2 = 0.46$ ). Furthermore, age had a significant effect on each test of EF performance independently (Figures 3 and 4). Adolescents' inhibition ability measured by SCWT differs significantly from that of adults ( $F(1, 38) = 11.43; p = .002$ ; partial  $\eta^2 = .23$ ). Same is true for shifting ability assessed by TMT ( $F(1, 38) = 25.85; p < .001$ ; partial  $\eta^2 = .41$ ). Regarding prediction of achievement (binary variable) in the logical reasoning task based on performance on both EF tests, the model was not significant ( $\chi^2(2, N = 40) = 3.09, p = .213$ ).

## Discussion

The results obtained in this study support the assumption that age-related, developmental differences in the ability to logically reason do in fact exist. The premise that adult subjects are more successful in the tests of Inhibition and Attention-shifting is supported as well: 46% of the variance of performance on the tests of EF is explained by age differences between respondents. This is in line with research suggesting that developmental differences in cognitive functions associated with PFC do exist [e.g. 4]. However, obtained data does not support the possibility of predicting the ability of predicting success on the reasoning task based on the achievement on EF tests, which suggests that these cognitive processes might be functionally distinct, rather than overlapped.

## Conclusion

Results obtained in this study suggest that PFC related differences previously detected on a neural level, also occur on a cognitive-behavioral level. The implications for educational programs aimed at risk prevention among young people are thought-provoking: namely, given the existence of differences in EF and reasoning, as well as the fact that classical methods of informing have not proved successful, a different approach to adolescent education might be required e.g. by introducing various exercises of EF. Considering the limitations of this study (small sample size, the difficulty of the reasoning task and the fact that the study was transversal), a replication of these results is required using larger sample size, more tests and a longitudinal study.

## References:



Detailed publication available: Bjegojević, B., & Dubljević, O. (2019). Differences between Adolescents and Adults in Logical Reasoning and Executive Functioning Performance. *EMPIRICAL STUDIES IN PSYCHOLOGY*, 79