DOMAIN-SPECIFIC INTERVENTION IMPACT ON ACADEMIC PERFORMANCE

INTRODUCTION

Based on the latest knowledge from cognitive and educational sciences – a domain-specific program aimed at stimulation of executive functions of underperforming children was created and, subsequently, experimentally verified. The domain-specific basis for the experimental study of the given variables was the cognitive potential of *text comprehension*. The research was structured as a pre-test – post-test experimental- vs. control-group design. Test measures were taken before and after the intervention in order to detect the changes in children's cognitive and executive functioning. Quantitative data include measurements of children's pre- and post-test performances in working memory, attention control, cognitive flexibility, cognitive planning, and language as well as reading skills. Qualitative data are collected through classroom observations (with video recording) to provide descriptive information on metacognitive instructional practices and children's responses to the intervention.

Iveta Kovalčíková Ivana Runčáková

RESEARCH CENTRE FOR COGNITIVE EDUCATION
FACULTY OF EDUCATION
UNIVERSITY OF PRESOV
SLOVAKIA

PRE-INTERVENTION

RESEARCH QUESTION

What effect does domain-specific stimulation program involving metacognitive engagement have on the level of executive functioning in low performing pupils?

HYPOTHESIS

We assumed there would be a statistically significant different in the pretest and post-test results measuring the level of executive functioning in low performing pupils as a result of intervention.

VARIABLES

INDEPENDENT VARIABLE — DOMAIN-SPECIFIC STIMULATION PROGRAM WITH METACOGNITIVE ENGAGEMENT

DEPENDENT VARIABLE — EXECUTIVE FUNCTIONING

KNOWLEDGE CONSTRUCTION FUNCTIONS:
1. EXECUTIVE FUNCTIONING ⟷ EXECUTIVE FUNCTIONS (EF)
2. COGNITIVE OPERATION
3. METACOGNITIVE SKILSS

- WORKING MEMORY
- ATTENTIONAL CONTROL AND INHIBITION
- COGNITIVE PLANNING
- COGNITIVE FLEXIBILITY

executive functioning/executive functions are the mental processes controlling cognitive function. McCloskey, Perkins and Van Divner (2008) refer to the ability to control the meaningful, organized, regulated, strategic and targeted processing of stimuli of perception, emotion, thoughts, and actions. Their role is to organize and reorganize attention-related activities (controlling and filtering sensory inputs), the child's intentions (controlling behavioral outputs) and thinking (memory and thinking tools) (Pribram, 1997; Bernstein – Waber, 2007).

SAMPLE

LOW-PERFORMING PUPILS - 4TH YEAR OF SLOVAK ELEMENTARY SCHOOLS

GROUP	INTERVENTION	NUMBER OF PUPILS
Experimental	STIMULATION PROGRAM	50
Control 1	'Hravá slovenčina' (Playful Slovak) alternative program	51
Control 2	Waiting list group	50

METHODS AND MEASURES

DELIS-KAPLAN EXECUTIVE FUNCTIONS TESTS (Delis, Kaplan, & Kramer, 2001)

The Color-Word Interference Test
The Tower Test (Tower of Hanoi modified)
The Word Context Test
The Trail Making Test
The Verbal Fluency Test
The Design Fluency Test
Cognitive Abilities Test — R.L. Thorndike, E. Hagen, N. France. (Czech adpatation : J. Vonkomer, J. Jílek) verbal battery – pre and post measures
Reading Test — (Matejček's test of reading abilities - (Matějček a kol. 1987)

INTERVENTION

November 2017 - February 2018
30 stimulation units
45 minutes/unit
2 times per week
peer interventions

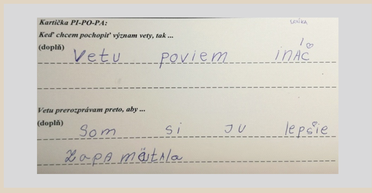
PRINCIPLES OF INTERVENTION

- working with language material (different levels - word - sentence - text)
- cognitive analysis of the task
- difficulty level modified to comply with the current proficiency of pupils
- peer mediation
- bridging
- specific and non-specific transfer
- 'think aloud' method

Demonstration of intervention
Administrator working with a pair of pupils

METACOGNITIVE ACTIVATION

(1) Naming objects included in the task:
What can you see in front of you? What are these objects called?
(2) Telling the task requirements:
What is this task about? What should you do?
(3) Self-assessment at the outset:
How well can you accomplish this task? What are you afraid of?
(4) Formulation of strategy:
What needs to be done to solve the task? How would you proceed?
(5) After solving the task - summarising the plan and procedure:
How should you proceed to solve the task correctly?
Create a similar task, assign it to a classmate, and guide him/her to solve the task
(6) Transfer - connections of the task with other contexts:
Where and how can you use what you have learned?



Metacognitive activator - a card

POST-INTERVENTION

RESULTS

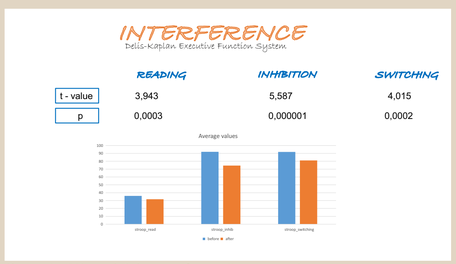


Chart 1: D-KEFS Word–Colour Interference Test – pre and post measures

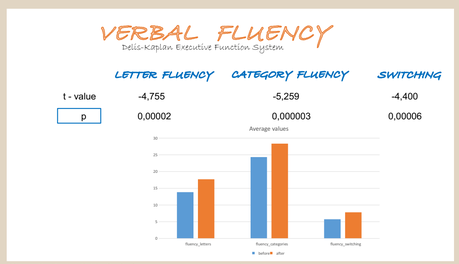


Chart 2: D-KEFS Verbal Fluency Test – pre and post measures

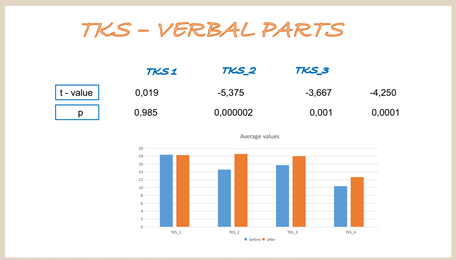


Chart 3: Cognitive Abilities Test R.L. Thorndike, E. Hagen, N. France
(Czech adpatation : J. Vonkomer, J. Jílek) – verbal battery – pre and post measures

DISCUSSION

The analysis of the results showed

- a significant difference in level of inhibition behaviors in the experimental group of pupils between measurements 1 and 2. The most difficult condition in terms of inhibition behavior is condition 4, D-KEFS Color–Word-Interference Test/Inhibition-Switching. This contains an increasing number of distractors and places increased demand on the participant's cognitive flexibility. As we found in condition 4, there was a significant difference between measurements 1 and 2 at the progressively demanding level of inhibition behavior;

- a significant change in level of verbal fluency in the experimental group. The results also showed that the intervention had an effect on level of figural fluency in individuals in the experimental group, specifically in two conditions;

- in the Cognitive Abilities Test, the experimental group achieved significantly higher posttest scores, in contrary to the pretest scores, in three subtests (completing sentences, concept making, analogies). There was no significant difference in the score in the experimental group in one of the subtests (synonyms). The results of this test could be influenced not only by the level of pupils' executive functioning but also by the extent of the pupils' vocabulary (difficult to control during the experimental intervention).

REFERENCES

1. DELIS, D. C., KAPLAN, E. & KRAMER, J. H. (2001). *The Delis-Kaplan executive function system.* San Antonio: The Psychological Corporation.
2. FERJENČÍK, J. et al. (2014). Proces a vybrané výsledky slovenskej adaptácie Delis-Kaplanovej systému exekutívnych funkcií D-KEFS. *Československá psychologie.* 58 (6). 543-558.
3. KOVALČÍKOVÁ, I. et al. (2016). *Diagnostika a stimulácia kognitívnych a exekutívnych funkcií žiaka v mladšom školskom veku.* 2. rozšírené vydanie. Prešov : Vydavateľstvo Prešovskej univerzity v Prešove, 264 s. ISBN 978-80-555-1719-3.
4. KOVALČÍKOVÁ, I. et al. (2015). Terminologické minimum kognitívnej edukácie. Prešov : Vydavateľstvo Prešovskej univerzity v Prešove, 120 s. ISBN 978-80-555-1352-2.
5. MATĚJČEK, Z., ŠTURMA J., VÁGNEROVÁ, M., ŽLAB, Z. (1987). *Zkouška čtení.* Bratislava: Psychodiagnotické a didaktické testy, n. p. 1987. T-202.
6. THORNDIKE, R. L., HAGEN, E., VONKOMER, J. (1997). Test kognitívnych schopností. TKS (T-22).Pôvodné vydanie 1986. Bratislava: Psychodiagnostika.

COLLABORATORS

Ján Ferjenčík, Eva Gogová, Miriam Slavkovská, Marta Kopčíková, Ľudmila Liptáková, Juraj Kresila, Martin Klimovič

NOTE

This study has been financially supported by APVV (Slovak Research Agency of Ministry of Education, under the contract APVV-15-0273)