

Research Article

Cite this article: Gatial, V., & Šášíková, A. (2025). Executive functions as a predictor of the teacher's didactic competencies. *Educational Process: International Journal*, 16, e2025289.
<https://doi.org/10.22521/edupij.2025.16.289>

Received April 28, 2025

Accepted June 11, 2025

Published Online June 29, 2025

Keywords: Executive functions, didactic competency, predictor, teacher

Author for correspondence:

Viktor Gatial

 vgatial@ukf.sk

 Constantine The Philosopher University in Nitra, Slovakia

Executive Functions as a Predictor of the Teacher's Didactic Competencies

Viktor Gatial , Andrea Šášíková 

Abstract

Background/purpose. Executive functions are generally considered crucial for an individual's capacity to adapt. This also applies to the domain of professional competencies. However, relatively few scientific studies have specifically examined the role of executive functions in relation to teachers' professional competencies. Didactic competencies represent a subset of teachers' professional competencies. The present study addresses this gap in the literature by exploring the significance of executive functions for teachers' didactic competencies. The main goal of the research was to find the state of executive functions as a predictor of didactic competencies in teachers in pedagogic practice. The motive of the study was to identify possibilities for improving teachers' didactic competencies, specifically in the area of executive functions.

Materials/methods. The research was quantitative in nature and had a relational, comparative, and predictive design. It was carried out using the Executive Skills Questionnaire and the Didactic Competencies Questionnaire. The sample included 128 pre-school, primary, and secondary school teachers with different lengths of experience.

Results. The presupposed positive relationships between executive functions and didactic competencies exist between the executive function Organisation and the didactic competency Self-reflection, between the executive function Emotional Regulation and the didactic competencies Diagnostics and Evaluation and Self-reflection, and between the executive function Behavioural Regulation and the didactic competencies Implementation of the Lesson and Self-reflection. The didactic competency of Self-reflection was also predicted by the executive functions of Emotional Regulation and Behavioural Regulation.

Conclusion. Executive functions are a significant and relevant predictor of didactic competencies in teachers. The correlations between executive functions and didactic competencies suggested that teachers with highly developed executive functions have a tendency to be more effective when planning, organising and implementing the educational process, as well as in solving problem situations that can arise during class.



OPEN ACCESS

© The Author(s), 2025. This is an Open Access article, distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted re-use, distribution, and reproduction, provided the original article is properly cited.

1. Introduction

Executive functions are understood as a set of skills required for purposeful and goal-directed behavior, socially appropriate conduct, and independent regulation and activity (Lyon, 1994). They are conceptualized as an umbrella term for higher-order cognitive processes necessary for goal attainment, sustained attention, and inhibition of impulsive responses during problem-solving (Best, Miller & Jones, 2009), as well as mental processes that both regulate and operate in conjunction with cognitive functions (Burgess, 2008). According to Vandenbroucke et al. (2018), executive functions are essential cognitive processes that enable goal-directed behavior and develop through maturation and environmental stimulation. Moriguchi et al. (2016) emphasize that the development of executive functions is critically important for understanding the complexity of human development, as their healthy maturation is a determinant of both cognitive and socio-emotional development. In general, executive functions are neuroanatomically linked to multiple partially overlapping neural networks located in various regions of the prefrontal cortex (Zelazo et al., 2016). From this, the adaptive role of executive functions in human life can be inferred.

Didactic competencies are a component of teachers' professional competencies. They encompass the various methods, approaches, and strategies that teachers employ in their work and are shaped by their personality traits, pedagogical knowledge, and experience. Didactic competencies also reflect teachers' responses to the specific needs of their students and the educational context in which they operate (Pavlov, 2013). These competencies relate to how teachers present instructional content, organize learning activities, and create conditions that facilitate student learning. Teachers' didactic competencies include the ability to design and implement instruction that is tailored to the individual needs and abilities of students, as well as the capacity to evaluate and reflect on the outcomes of the teaching process. A teaching style that favors traditional expository methods may be effective in certain contexts, while a constructivist approach that encourages active student engagement in the learning process may be more appropriate in others (Spiegel et al., 2021).

Nowadays, with education focusing increasingly on individualised teaching and teaching becoming an ever more a complex and challenging task, it is important to understand how we can improve the didactic competencies of teachers. The goal of the research, therefore, is to find out whether executive functions can serve as a predictor of didactic competencies, i. e. if teachers with strong executive functions also have strong didactic competencies. If the predictive capacity of executive functions with regard to teachers' didactic competencies were confirmed, it would be possible to enhance these competencies through the development of executive functions. The potential for their development and direct support has been documented by several authors (Rueda, Paz-Alonso, 2013; Kovalčíková, 2016; Diamond, Ling, 2016; Gunzenhauser, Nückles, 2021).

The research investigated how executive functions influence the ability of teachers to direct their class, approach students individually and adapt the educational material to fit diverse needs and styles of learning. It was found that teachers with better executive functions are usually more capable of implementing flexible didactic strategies and adapting to dynamic educational environments and the changes that may occur. As opposed to expectations, it was found a negative relationship between the executive function Planning and the didactic competency Classroom Climate and Discipline (also in the sense of prediction), and no significant relationships were shown between the executive function Time Management and the didactic competencies. It was not possible in the research to identify significant intergender differences from the viewpoint of either executive functions or didactic competencies.

The results can be used to create teacher study programs and improve teachers' skills in practice.

Since the main goal of the research was to identify the state of executive functions as a predictor of didactic competencies in teachers within pedagogic practice, the main research problem was stated as follows: “What is the relationship between executive functions and didactic competencies of teachers, and to what extent can didactic competencies be predicted by executive functions in teachers?” To achieve the research goal and address the research problem, the following research hypotheses and questions were formulated:

H1: We presuppose a positive relationship between the executive function Planning and didactic competencies.

H2: We presuppose a positive relationship between the executive function of Time Management and didactic competencies.

H3: We presuppose a positive relationship between the executive function Organisation and didactic competencies.

H4: We presuppose a positive relationship between the executive function Emotional Regulation and didactic competencies.

H5: We presuppose a positive relationship between the executive function Behavioural Regulation and didactic competencies.

RQ1: Do intergender differences in levels of didactic competencies exist?

RQ2: Do intergender differences in levels of executive functions exist?

RQ3: Do differences in levels of didactic competencies depending on the stage of education exist?

RQ4: Do differences in levels of executive functions depending on the stage of education exist?

RQ5: Are executive functions predictors of didactic competencies?

2. Literature Review

The development of executive functions normally takes a rather complicated neuropsychological path from early childhood on. The final goal of this path is to obtain the best possible control of one's own behaviour and effective achieving of defined goals (Moriguchi et al., 2016). Executive functions can also be understood as a range of skills required for purposeful and deliberate action, socially acceptable behaviour and independent management and action (Lyon, 1994). Other authors perceive executive functions to be a term covering higher cognitive processes necessary for achieving goals, maintaining attention, and inhibiting impulsive reactions when using problem-solving strategies (e. g., Best, Miller, 2009; Burgess, 2008). It can generally be stated that executive functions influence the educational process directly as well as indirectly, in teachers as well as students. As Juhásová and Gatíal (2019) state, executive functions are a predictor for the correct functioning of cognitive functions and self-management, wherein they help an individual face new situations, act appropriately and manage the solving of new problems determined by their surroundings. Most research, however, is focused on the development of executive functions in the context of academic success in students (e.g., Baggetta and Alexander, 2016; Morgan et al., 2019; Spiegel et al., 2021). Little research attention has thus far been focused on the relationship between the level of executive functions of teachers and their professional competencies (Gatíal, Juhásová, Süttö, 2023; Ballová Mikušková, 2022; Juhásová, Gatíal, Mesíková, 2022; Roloff et al., 2020). The aim of our research is to contribute to the broadening of knowledge in this specific area.

Authors Verešová, Rapsová and Krause (2023) state that in the profession of a teacher, several competencies are applied that influence a teacher's expertise and professionalism. They consider the definition of individual groups problematic because teachers often differ in working in diverse stages

of education; they teach diverse subjects, belong to diverse categories of pedagogical employees and often carry out many other professional activities requiring diverse methods with specific requirements for the teacher. Didactic competencies, together with interaction and education styles, are considered to be among the most important professional competencies of teachers, constituting key elements that influence the quality of education and the results of students (Gatíal, Juhášová, Süttö, 2023). Didactic competencies represent diverse methods, approaches, and strategies teachers use in their work, and they are formed by their personality characteristics, pedagogical knowledge, and experience. They also represent a reaction to specific needs of students and the educational space in which the teachers work (Pavlov, 2013; Spiegel et al., 2021). The abilities of an individual develop on both the personal and social level. Unlike formal qualifications, competencies reflect action in practical situations. Conditions and context being variable, it is not possible to consider these abilities as absolute (Veteška, Turecki, 2008). The path to becoming a teacher is not an easy one. The study by Roloff et al. (2020) can be referenced, in which the extent to which levels of personality traits, cognitive abilities, and academic knowledge of applicants for teaching positions and practicing teachers—measured longitudinally over a 10-year period at the end of secondary education as well as during the first and second stages of teacher education—are able to predict the later quality of teaching was investigated.

The authors Gatíal, Juhášová and Süttö (2023) researched the relationships between the levels of executive functions and didactic competencies in samples of teachers in undergraduate training and teachers in practice and identified a negative relationship between problems with executive functions and didactic competencies. The authors Juhášová, Gatíal and Mesíková (2022) conducted research that showed that a relationship exists between executive functions and didactic competencies. They found an interconnection of three areas of didactic competencies (Implementation, Diagnostics and Evaluation, and Self-reflection) in relation to two executive functions (Emotional Regulation and Behavioural Regulation). In their discussion, they speak of a negative relationship between Emotional Regulation and Behavioural Regulation and Self-reflection and a negative relationship between Emotional Regulation and the Diagnostics and student Evaluation competency. In relation to this, findings of the opposite character are also encountered in the literature, i.e., that the aforementioned variables are positively correlated (e.g. Herwig et al., 2010; Hen & Sharabi-Nov, 2014). This was also addressed by Ballová Mikušková (2022) in her research, where she came to the following conclusions. Fewer problems in the time management area were related to more developed didactic competencies aimed at the Class Climate and Discipline as well as those aimed at Diagnostics and Evaluation. A well-developed organizational area was related to all didactic competencies (besides self-evaluation). Similarly, well-developed Emotional Regulation was related to the didactic competencies Lesson Implementation, Class Climate and Discipline and Diagnostics and Evaluation. The executive functions of Organisation, Emotional Regulation, and Behavioural Regulation did not have any relation to any competency.

3. Methodology

The research was quantitative in nature and had a relational, comparative, and predictive design. Specifically, it aimed to investigate the relationship between teachers' executive functions and didactic competencies, compare the levels of executive functions and didactic competencies with respect to gender and educational level, and predict the level of teachers' didactic competencies based on their executive function levels. A questionnaire method was employed to collect the data. Paper questionnaires were administered to pedagogical staff, and school principals were requested to assist in their distribution among teachers.

3.1. Research sample

The study was aimed at pedagogues operating within real school environments, specifically preschool, primary, and secondary educational institutions located in the Trnava and Nitra districts of Slovakia. Overall, 128 pedagogues active in the Slovak school system joined the study. From the viewpoint of gender, 72.7% ($n=93$) of the respondents were women and 27.3% ($n=35$) were men. The age in our research sample ranged from 25 to 63 years ($AM = 44.87$, $SD = 10.020$). The length of pedagogic practice ranged from $Min = 1$ to $Max = 38$ years ($AM = 17.19$, $SD = 9.557$). The majority of respondents were from the Trnava district (68.8%; $n = 88$), while the remaining 31.3% were from the Nitra region ($n=40$). Most respondents were active in secondary schools (36%, $n = 46$); teachers active in primary schools made up 34% ($n = 43$) of our sample and teachers active in pre-schools had a 30% representation in our sample ($n = 39$).

Although an a priori power analysis was not conducted, a post hoc evaluation (Magnusson, n.d.) indicates that the sample size of $n = 128$ provides sufficient power (.80) to detect small-to-medium effect sizes (Cohen's $d \approx 0.25$) at the conventional alpha level of 0.05.

3.2. Method

The research battery included two research instruments – the Executive Skills Questionnaire and the Didactic Competencies Questionnaire. The Executive Skills Questionnaires (Strait et al., 2020) are questionnaires used to evaluate executive functions via self-evaluation or evaluation by others (e.g., parents and teachers). In our research we used the Executive Skills Questionnaire to evaluate executive functions in adults (ESQ-R; Strait et al., 2020); it includes the following aspects: Planning (11 elements) Time Management (4 elements), Organisation (3 elements), Emotional Regulation (3 elements) and Behavioural Regulation (4 elements). The questionnaire contains 25 elements in total, which respondents answer on a scale of 1 – never, 2 – seldom, 3 – sometimes, 4 – very often, 5 – always, where a higher score expresses a higher level of problems with executive functions. The values of the elements were inversely coded so that a higher score would express a higher level of executive functions. The reliability of the questionnaire was on a slightly reduced to an acceptable level in our research sample, with Cronbach's $\alpha = 0.625 - 0.747$. The Didactic Competencies Questionnaire (DCQ, Ballová Mikušková, 2022) is an instrument used to evaluate the teaching abilities and skills of teachers. This questionnaire covers diverse aspects of didactic competencies – Planning and Preparation of the Lesson (13 elements), Implementation of the Lesson (16 elements), Classroom Climate and Discipline (8 elements), Diagnostics and evaluation (14 elements), and Self-reflection (5 elements). The questionnaire contains 57 elements in total, which the respondents answer on a scale of 1 – never, 2 – seldom, 3 – sometimes, 4 – very often, 5 – always, where a higher score expresses a higher level of didactic competencies. The reliability of the questionnaire was slightly reduced to a good level in our sample, with Cronbach's $\alpha = 0.641-0.801$.

For the purposes of statistical data analysis, the SPSS 2.1.0 program was used. Descriptive analysis of continuous variables was conducted using basic statistical indicators of central tendency (arithmetic mean, median, mode), measures of variability (minimum and maximum values, standard deviation), and measures of distribution shape (coefficients of skewness and kurtosis). Given that the subscales of both standardized questionnaires used in the study comprised a different number of items, the statistical analyses were based on the average scores. These were calculated as the sum of item scores divided by the number of items in the respective subscale. As a result, the range of average scores for all subscales corresponded to the response range of the Likert scales, i.e., from 1 to 5. The use of average scores was preferred, as it allows for better comparability of the levels of individual didactic competencies or executive functions. With regard to the items in the Executive Functions Questionnaire, these were reverse-coded due to their negative wording, so that higher values would indicate a higher level of executive functioning.

Inferential statistical analysis aimed at testing research hypotheses and research questions was conducted using selected statistical tests. The selection of these tests was determined based on the nature of the variables and the results of normality tests of the data distribution, specifically, the Kolmogorov-Smirnov test for the overall research sample and for groups meeting the criterion of $N > 50$, and the Shapiro-Wilk test for groups with $N \leq 50$.

The results of the normality distribution testing (Kolmogorov-Smirnov test of normality) were as follows: Within individual executive functions, as well as within specific didactic competencies, the data did not follow a normal distribution (see Appendix). Similar results were obtained when testing for normality in relation to gender (see Appendix). The results of the Shapiro-Wilk test of normality showed that, for both individual executive functions and didactic competencies, the data did not follow a normal distribution with respect to the educational level (see Appendix).

As the assumption of normality was not confirmed for any of the examined continuous variables across any of the compared groups, non-parametric statistical methods were employed. Specifically, the following tests were used: Spearman's rank-order correlation analysis to examine relationships between continuous variables, where at least one variable did not satisfy the assumption of normal distribution; Mann-Whitney U test to compare the levels of a continuous variable between two groups, in cases where the variable failed to meet the assumption of normality in at least one group; Kruskal-Wallis analysis of variance to compare the levels of a continuous variable across three or more groups, where the variable did not follow a normal distribution in at least one of the groups. Subsequently, a multiple linear regression analysis was performed to assess the predictive capacity of executive function levels on individual didactic competencies.

The substantive significance of the results obtained from the statistical tests was evaluated using the following effect size indicators: the correlation coefficient for Pearson's correlation analysis, Cohen's d for the Mann-Whitney U tests, Eta squared for the Kruskal-Wallis analysis, and the coefficient of determination (R^2) for the linear regression analysis.

4. Results

In Table 1, the descriptive data of didactic competencies and executive functions of the participants in the research sample are presented. These data were obtained using the Executive Skills Questionnaire and the Didactic Competencies Questionnaire. The results are reported as average gross scores, median, mode, standard deviations, minimums, maximums, skewness and kurtosis of the measured variables, including didactic competencies (Planning and Preparation of the Lesson, Implementation of the Lesson, Classroom Climate and Discipline, Diagnostics and Evaluation, and Self-reflection) and executive functions (Planning, Time Management, Organisation, Emotional Regulation, and Behavioural Regulation) of the participants.

Table 1. Descriptive data on didactic competencies and executive functions in participants

		N	AM	Med	Mode	SD	Min	Max	Skew.	Kurt.
Didactic competencies	PPL		4.74	4.77	5.00	.228	3.00	5.00	-.803	1.19
	IL		4.79	4.81	4.75	.130	4.00	5.00	-.838	1.09
	CCD	128	4.71	4.75	4.75	.181	4.00	5.00	-.711	.269
	DE		4.74	4.71	4.71	.153	4.00	5.00	-.752	.870
	SR		4.68	4.80	4.80	.250	4.00	5.00	-.748	-.082
Executive functions	Planning		4.08	4.09	4.00	.172	3.00	5.00	.188	.471
	Organization		3.54	3.50	3.50	.287	2.00	4.00	-.105	-.047
	Time management	128	3.73	4.00	4.00	.434	2.00	4.00	-.941	1.81
	Emotional regulation		3.76	4.00	4.00	.370	2.00	4.00	-.947	.648
	Behavioural regulation		3.25	3.25	3.25	.259	2.00	4.00	.185	.228

N – number, AM – arithmetic mean, Med – median, SD – standard deviation, Min – minimum value, Max – maximum value, Skew. – skewness, Kurt. – kurtosis, PPL – Preparation and Planning of the Lesson, IL – Implementation of the Lesson, CCD – Classroom Climate and Discipline, DE – Diagnostics and Evaluation, SR – Self-reflection

The relationships between executive functions and didactic competencies were examined both at the level of the entire sample and within groups of teachers categorized by gender and school grade. In the case of the executive function Planning, the results showed that it is in a negative relationship to the didactic competency Classroom Climate and Discipline, on the level of the entire sample, $r = -.314$, $p < 0.001$, in the group of men, $r = -.440$, $p = 0.008$, in the group of women $r = -.276$, $p = 0.007$, in the group of pre-school teachers, $r = -.447$, $p = 0.004$, as well as in the group of primary school teachers $r = -.302$, $p = 0.049$ (Table 2).

Table 2. Relationships between the executive function Planning and didactic competencies

		Executive function Planning					
		Sample	Men	Women	Pre-school	Primary	Secondary
Didactic Competencies	N	128	35	93	39	43	46
PPL	r	-.066	-.147	-.037	-.139	.079	-.071
	p	.462	.401	.724	.399	.615	.641
IL	r	-.050	-.071	-.033	.061	.023	-.214
	p	.578	.678	.756	.712	.885	.154
CCD	r	-.314***	-.440**	-.276**	-.447**	-.302*	-.110
	p	<.001	.008	.007	.004	.049	.466
DE	r	-.051	-.099	-.031	.066	.102	-.198
	p	.570	.571	.768	.688	.517	.188
SR	r	-.111	-.181	-.092	-.092	-.054	-.190
	p	.211	.299	.379	.579	.730	.205

PPL – Preparation and Planning of the Lesson, IL – Implementation of the Lesson, CCD – Classroom Climate and Discipline, DE – Diagnostics and Evaluation, SR – Self-reflection, N – number, r – Pearson's correlation coefficient, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In the case of the executive function Time Management, the results showed it to not be in any relationship to any didactic competency (Table 3).

Table 3. Relationships between the executive function, Time Management, and didactic competencies

		Executive Function Time Management					
		Sample	Men	Women	Pre-school	Primary	Secondary
Didactic competencies	N	128	35	93	39	43	46
PPL	r	-.040	-.019	-.047	.158	.059	-.290
	p	.653	.916	.655	.337	.708	.051
IL	r	-.073	-.221	-.024	-.177	.093	-.165
	p	.414	.203	.821	.280	.553	.273
CCD	r	.035	-.085	.082	.223	.021	-.107
	p	.692	.626	.437	.173	.895	.480
DE	r	-.075	.038	-.128	-.222	-.034	.019
	p	.399	.831	.221	.174	.828	.900
SR	r	-.087	-.041	-.107	-.099	-.126	-.029
	p	.331	.813	.309	.547	.422	.848

PPL – Preparation and Planning of the Lesson, IL – Implementation of the Lesson, CCD – Classroom Climate and Discipline, DE – Diagnostics and Evaluation, SR – Self-reflection, N – number, r – Pearson’s correlation coefficient, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.01$

In the case of the executive function Organization, the analysis results showed it to be in a positive relationship to the didactic competency Self-reflection, on the level of the entire sample, $r = 0.203$, $p = 0.021$, in the group of women, $r = 0.269$, $p = 0.009$, and in the group of pre-school teachers $r = 0.335$, $p = 0.037$ (Table 4).

Table 4. Relationships between the executive function Organisation and didactic competencies

		Executive Function Organization					
		Sample	Men	Women	Pre-school	Primary	Secondary
Didactic competencies	N	128	35	93	39	43	46
PPL	r	-.040	-.157	.022	-.249	-.010	.088
	p	.651	.367	.833	.126	.948	.562
IL	r	.042	.020	.070	.264	.017	-.136
	p	.641	.907	.506	.105	.912	.367
CCD	r	.028	-.129	.116	-.117	.040	.081
	p	.754	.459	.268	.477	.799	.592
DE	r	.029	.277	-.090	-.102	-.053	.089
	p	.743	.108	.390	.537	.738	.558
SR	r	.203*	.081	.269**	.335*	-.011	.268
	p	.021	.646	.009	.037	.944	.071

PPL – Preparation and Planning of the Lesson, IL – Implementation of the Lesson, CCD – Classroom Climate and Discipline, DE – Diagnostics and Evaluation, SR – Self-reflection, N – number, r – Pearson’s correlation coefficient, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.01$

In the case of the executive function Emotional Regulation, the analysis results showed it to be in a positive relationship to the didactic competency Diagnostics and Evaluation in the group of primary school teachers, $r = 0.329$, $p = 0.031$, and to the didactic competency Self-reflection, on the level of the entire sample, $r = 0.289$, $p = 0.001$, as well as in the group of men $r = 0.537$, $p = 0.001$, and in the group of primary school teachers $r = 0.324$, $p = 0.034$ (Table 5).

Table 5. Relationships between the executive function, Emotional Regulation, and didactic competencies

		Executive Function Emotional Regulation					
		Sample	Men	Women	Pre-school	Primary	Secondary
Didactic competencies	N	128	35	93	39	43	46
PPL	r	.052	.185	-.002	-.044	.078	.113
	p	.564	.286	.985	.789	.620	.456
IL	r	.081	-.033	.131	.273	.080	-.076
	p	.363	.850	.211	.093	.610	.614
CCD	r	.037	.272	-.054	-.148	.073	.109
	p	.676	.115	.609	.368	.642	.471
DE	r	.171	.263	.120	.293	.329*	-.116
	p	.054	.126	.252	.071	.031	.444
SR	r	.289***	.537***	.180	.283	.324*	.243
	p	.001	.001	.084	.081	.034	.104

PPL – Preparation and Planning of the Lesson, IL – Implementation of the Lesson, CCD – Classroom Climate and Discipline, DE – Diagnostics and Evaluation, SR – Self-reflection, N – number, r – Pearson's correlation coefficient, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

In the case of the executive function Behavioural Regulation, the results of the analysis showed it to be in a positive relationship to the didactic competency Implementation of the Lesson, on the level of the entire sample, $r = 0.172$, $p = 0.052$, as well as in the group of women $r = 0.233$, $p = 0.025$, and to the didactic competency Self-reflection, on the level of the entire sample, $r = 0.251$, $p = 0.004$, as well as in the group of women, $r = 0.330$, $p = 0.001$ and in the group of pre-school teachers $r = 0.377$, $p = 0.018$ (Table 6).

Table 6. Relationships between the executive function, Behavioural regulation, and didactic competencies

		Executive Function Behavioural Regulation					
		Sample	Men	Women	Pre-school	Primary	Secondary
PPL	N	128	35	93	39	43	46
	r	.121	.137	.123	-.033	.233	.117
	p	.173	.433	.240	.840	.132	.439
IL	r	.172*	.017	.233*	.202	.193	.103
	p	.052	.924	.025	.217	.215	.494
CCD	r	.042	-.028	.078	-.145	.023	.141
	p	.638	.875	.455	.378	.886	.350
DE	r	.107	.200	.060	.206	.206	-.076
	p	.230	.250	.565	.209	.184	.616
SR	r	.251**	.086	.330***	.377*	.219	.206
	p	.004	.623	.001	.018	.158	.170

PPL – Preparation and Planning of the Lesson, IL – Implementation of the Lesson, CCD – Classroom Climate and Discipline, DE – Diagnostics and Evaluation, SR – Self-reflection, N – number, r – Pearson's correlation coefficient, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The question (RQ1) of whether gender differences exist in the level of didactic competencies was examined using Mann-Whitney U tests. The results of the analysis did not reveal any gender differences in the levels of didactic competencies: Lesson Planning and Preparation ($U = 1482.0$, $p = 0.432$), Lesson Implementation ($U = 1535.0$, $p = 0.617$), Classroom Climate and Discipline ($U = 1588.5$, $p = 0.830$), Diagnostics and Evaluation ($U = 1521.0$, $p = 0.563$), and Self-reflection ($U = 1580.5$, $p = 0.794$). The observed gender differences in the mean and median scores for the didactic competencies, Lesson Planning and Preparation, Implementation of the Lesson, Classroom Climate and Discipline, Diagnostics and Evaluation, and Self-reflection, were found to be negligible, even when assessed in terms of practical significance (Table 7).

Table 7. Gender differences in the level of didactic competencies

Didactic competencies	Gender	Level of didactic competencies					Mann-Whitney U test		
		N	MR	AM	Med	SD	U	p	d
PPL	Men	35	60.34	4.70	4.77	.270	1482.0	.432	0.14
	Women	93	66.06	4.75	4.77	.10			
IL	Men	35	61.86	4.78	4.81	.119	1535.0	.617	0.09
	Women	93	65.49	4.79	4.81	4.79			
CCD	Men	35	63.39	4.71	4.75	.179	1588.5	.830	0.04
	Women	93	64.92	4.71	4.75	.183			
DE	Men	35	67.54	4.75	4.71	.176	1521.0	.563	0.10
	Women	93	63.35	4.73	4.71	.144			
SR	Men	35	63.16	4.67	4.80	.274	1580.5	.794	0.04
	Women	93	65.01	4.69	4.80	.242			

N – number, MR – mean rank, AM – arithmetic mean, SD – standard deviation, Med – median, U – Mann-Whitney U test, p – signification, d – Cohen's d as a measure of effect size and practical significance, PPL – Preparation and Planning of the Lesson, IL – Implementation of the Lesson, CCD – Classroom Climate and Discipline, DE – Diagnostics and Evaluation, SR – Self-reflection

Similarly, the results of the Mann-Whitney U test did not show any gender differences in the levels of executive functions (RQ2): Planning ($U = 1498.0$, $p = 0.482$), Time Management ($U = 1583.0$, $p = 0.805$), Organization ($U = 1371.0$, $p = 0.143$), Emotional Regulation ($U = 1588.0$, $p = 0.818$), and Behaviour Regulation ($U = 1489.5$, $p = 0.438$). Gender-related differences identified in the mean and median values of the executive functions Planning, Time Management, Emotional regulation and Behavioural regulation were negligible in terms of practical significance. The identified differences between men and women in the mean and median values of the executive function Organization were small in terms of practical significance ($d = 0.24$) (Table 8).

Table 8. Gender differences in the level of executive functions

Executive functions	Gender	Level of executive functions					Mann-Whitney U test		
		N	MR	AM	Med	SD	U	p	d
Planning	Men	35	68.20	4.09	4.09	0.173	1498.0	.482	0.12
	Women	93	63.11	4.07	4.09	0.172			
Time management	Men	35	65.77	3.54	3.50	0.294	1583.0	.805	0.04
	Women	93	64.02	3.55	3.50	0.285			
Organization	Men	35	71.83	3.82	4.00	0.423	1371.0	.143	0.24
	Women	93	61.74	3.70	3.67	0.436			
Emotional regulation	Men	35	65.63	3.77	4.00	0.386	1588.0	.818	0.04
	Women	93	64.08	3.76	4.00	0.366			
Behavioural regulation	Men	35	68.44	3.29	3.25	0.279	1489.5	.438	0.13
	Women	93	63.02	3.24	3.25	0.251			

N – number, MR – mean rank, AM – arithmetic mean, SD – standard deviation, Med – median, U – Mann-Whitney U test, p – signification, d – Cohen's d as a measure of effect size and practical significance

The answers to Research Questions 1 and 2 are as follows: From the viewpoint of gender, we did not find differences among teachers in either the level of didactic competencies or the level of executive functions ($p > 0.05$).

The question (RQ3) of whether differences in the level of didactic competencies exist based on the educational level was examined using Kruskal-Wallis analysis of variance. The results of the analysis did not reveal any significant differences in the level of didactic competencies based on educational level for the following domains: Lesson Planning and Preparation ($\chi^2 = 0.338$, $p = 0.845$), Lesson Implementation ($\chi^2 = 0.452$, $p = 0.798$), Classroom Climate and Discipline ($\chi^2 = 3.352$, $p = 0.187$), and Self-reflection ($\chi^2 = 2.363$, $p = 0.307$). However, the analysis indicated a significant difference in the level of the didactic competency Diagnostics and Evaluation depending on educational level ($\chi^2 = 6.792$, $p = 0.034$). Follow-up Mann-Whitney U tests showed that primary school teachers reported a significantly higher level of the Diagnostics and Evaluation competency (Med = 4.79) compared to secondary school teachers (Med = 4.71). The differences between pre-school and primary school teachers, as well as between pre-school and secondary school teachers, in the level of this competency were not statistically significant. The identified differences among preschool, primary, and secondary school teachers in the mean and median values of the didactic competencies Preparation and Planning of the Lesson, Implementation of the Lesson, Diagnostics and Evaluation, and Self-reflection were negligible in terms of practical significance. The identified difference among pre-school, primary, and secondary school teachers in the mean and median values of the didactic competence Classroom Climate and Discipline was small in terms of practical significance (Table 9).

Table 9. Differences in the level of didactic competencies depending on the school level

Didactic competencies	School level	Level of didactic competencies					Kruskal-Wallis analysis of variance			
		N	MR	AM	Med	SD	H(χ^2)	df	p	η^2
PPL	pre-school	39	67.15	4.76	4.77	0.210	0.338	2	.845	<0.01
	primary	43	64.19	4.73	4.69	0.246				
	secondary	46	62.54	4.72	4.77	0.230				
IL	pre-school	39	66.99	4.80	4.81	0.119	0.452	2	.798	<0.01
	primary	43	65.17	4.78	4.81	0.148				
	secondary	46	61.76	4.78	4.78	0.121				
CCD	pre-school	39	69.85	4.74	4.75	0.164	3.352	2	.187	0.02
	primary	43	67.91	4.73	4.75	0.177				
	secondary	46	56.78	4.68	4.75	0.196				
DE	pre-school	39	63.12	4.74	4.71	0.124	6.792	2	.034	0.04
	primary	43	75.49	4.79	4.79	0.138				
	secondary	46	55.40	4.69	4.71	0.174				
SR	pre-school	39	59.71	4.65	4.80	0.258	2.363	2	.307	0.01
	primary	43	71.15	4.73	4.80	0.239				
	secondary	46	62.35	4.67	4.80	0.254				

N – number, MR – mean rank, AM – arithmetic mean, SD – standard deviation, Med – median, H(χ^2) – Kruskal-Wallis analysis of variance, df – degrees of freedom, p – signification, η^2 – eta squared as a measure of effect size and practical significance, PPL – Preparation and Planning of the Lesson, IL – Implementation of the Lesson, CCD – Classroom Climate and Discipline, DE – Diagnostics and Evaluation, SR – Self-reflection

The question of whether differences exist in the level of executive functions based on educational level (RQ4) was examined using Kruskal-Wallis analysis of variance. The results revealed differences in the level of the executive function Planning depending on educational level ($\chi^2 = 7.370$, $p = 0.025$). Follow-up Mann-Whitney U testing showed that secondary school teachers demonstrated a significantly higher level of Planning (Med = 4.09) compared to pre-school teachers (Med = 4.00). However, the identified difference between secondary and pre-school teachers was small in terms of effect size ($\eta^2 = 0.04$). No statistically significant differences were found between pre-school and primary school teachers, or between primary and secondary school teachers in the level of the executive function Planning. Additionally, the analysis did not reveal statistically significant differences in other executive functions based on educational level: Time Management ($\chi^2 = 1.076$, $p = 0.584$), Organization ($\chi^2 = 2.987$, $p = 0.225$), Emotional Regulation ($\chi^2 = 0.862$, $p = 0.683$), and Behavior Regulation ($\chi^2 = 2.421$, $p = 0.298$). The identified differences among pre-school, primary, and secondary school teachers in the mean and median values of individual executive functions were small or negligible in terms of practical significance (Table 10).

Table 10. Differences in the level of executive functions depending on the school level

Executive functions	School level	Level of executive functions					Kruskal-Wallis analysis of variance			
		N	MR	AM	Med	SD	H(χ^2)	df	p	η^2
Planning	pre-school	39	55.79	4.04	4.00	0.168	7.370	2	.025	0.04
	primary	43	60.12	4.06	4.09	0.194				
	secondary	46	75.98	4.13	4.09	0.141				
Time Management	pre-school	39	69.29	3.60	3.50	0.290	1.076	2	.584	<.01
	primary	43	61.42	3.51	3.50	0.281				
	secondary	46	63.32	3.54	3.50	0.289				
Organization	pre-school	39	66.14	3.73	4.00	0.458	2.987	2	.225	.01
	primary	43	70.22	3.81	4.00	0.420				
	secondary	46	57.76	3.65	3.67	3.65				
Emotional regulation	pre-school	39	64.62	3.78	4.00	0.318	0.862	2	.683	<.01
	primary	43	67.70	3.80	4.00	0.357				
	secondary	46	61.41	3.72	4.00	0.421				
Behavioural regulation	pre-school	39	70.59	3.29	3.25	0.240	2.421	2	.298	.01
	primary	43	65.19	3.27	3.25	0.264				
	secondary	46	58.70	3.21	3.25	0.269				

N – number, MR – mean rank, AM – arithmetic mean, SD – standard deviation, Med – median, H(χ^2) – Kruskal-Wallis analysis of variance, df – degrees of freedom, p – signification, η^2 – eta squared as a measure of effect size and practical significance,

The answers to Research Questions 3 and 4 are as follows: From the viewpoint of the grade of school, we identified differences in the didactic competency Diagnostics and Evaluation as well as the executive function Planning. Specifically, it was shown that in primary school teachers, the level of didactic competency Diagnostics and Evaluation is at a higher level than in secondary school teachers and that in secondary school teachers, the level of executive function Planning is on a higher level than in pre-school teachers.

Regarding the possibility of predicting didactic competencies based on executive functions, the following conclusions were reached through multiple linear regression analysis: The level of the didactic competency Classroom Climate and Discipline is negatively related with statistical significance to the executive function Planning, $\beta = -0.334$, $p < 0.001$. The negative direction of the prediction indicates that the higher the level of executive function planning that teachers have, the lower their level of didactic competency is, in class climate and discipline. The combination of all independent variables (executive functions) in the regression model explained a total statistically significant 7.3% of the variance (Adj.R2 = 0.073) in the level of the didactic competency Class Climate and Discipline (Table 11).

Table 11. Prediction of the didactic competency, Class Climate and Discipline based on executive functions (N = 128)

Prediction of the didactic competency Class climate and discipline					
Executive functions	B	SE	β	t	p
Planning	-.352	.095	-.334	-3.711	<.001
Time Management	.016	.054	.025	.286	.775
Organisation	.015	.037	.036	.400	.690
Emotional Regulation	.037	.047	.075	.787	.433
Behavioural Regulation	.074	.063	.106	1.178	.241
MODEL	Adj.R ² = 0.073, F = 2.999, p = 0.014				

B – non-standardised regression coefficient, SE – standard error of B, β – standardised regression coefficient, p – level of significance, Adj.R² – indicator of explained variance in the dependent variable of model, F – predictive power of the regression model

The level of the didactic competency Self-reflection is related with statistical significance to the levels of the executive function Emotional Regulation, β = 0.181, p = 0.052, and Behavioural Regulation, β = 0.185, p = 0.038. The positive direction of the prediction indicates that the higher the levels of executive functions, emotional regulation, and behavioural regulation in teachers, the higher the level of didactic competency in self-reflection. The combination of all independent variables (executive functions) in the regression model explained a statistically significant 10.4% of the variance (Adj.R² = 0.104) in the level of the didactic competency Self-reflection (Table 12).

Table 12. Prediction of the didactic competency Self-reflection based on executive functions (N = 128)

Prediction of the didactic competency Self-reflection					
Executive functions	B	SE	β	t	p
Planning	-.177	.129	-.122	-1.375	.172
Time Management	-.087	.074	-.099	-1.179	.241
Organisation	.094	.051	.163	1.857	.066
Emotional Regulation	.123	.064	.181	1.931	.052
Behavioural Regulation	.179	.085	.185	2.101	.038
MODEL	Adj.R ² = 0.104, F = 3.956, p = 0.002				

B – non-standardised regression coefficient, SE – standard error of B, β – standardised regression coefficient, p – level of significance, Adj.R² – indicator of explained variance in the dependent variable of model, F – predictive power of the regression model

5. Discussion

Nowadays, increased attention is focused on the issue of professional competencies. Teachers are expected to be able to use their professional competencies in the educational process, emphasizing a meaningful achievement of educational goals. Their development is demonstrably linked to executive functions, which have remarkable significance not only in education but also in the life of any individual. This is why the main goal of our research was to identify the material and statistical significance, as well as the directions of relationships, between the levels of executive

functions and didactic competencies of teachers active at pre-schools, primary and secondary schools.

As concerns the first research hypothesis, our results did not support it. The negative direction of the relationships found suggests that with a growing level of the executive function Planning, the level of the didactic competency Classroom Climate and Discipline decreases. The inverse, i. e., our expected direction of the relationship between the executive function Planning and didactic competency Maintaining a Positive Classroom Climate and Discipline was also found by Gatíal, Juhásová and Süttö (2023) in their research, in which they identified negative relationships between problems with the executive function Planning and the didactic competencies, including Maintaining a Positive Class Climate and Discipline, in samples of teachers in undergraduate preparation and active teachers. Ballová Mikušková (2022) showed the same in her study of a sample of teachers and pedagogy students, where she found that fewer problems in the area of Planning were related to more developed didactic competencies. On the other hand, in the study by Juhásová, Gatíal, and Mesíková (2022), no significant relationships were identified between the executive function Planning and any didactic competency. The negative relationship that we found between the level of the executive function Planning and the didactic competency Maintaining a Positive Class Climate and Discipline can be explained by the fact that the majority of the cited research was carried out on a sample of future teachers. Research works in which active teachers participated can also differ from ours from the viewpoint of several characteristics of teachers, who were not included in the analysis as factors that could potentially influence the directions of relationships between the variables researched (e.g., the grade of school in which the teacher is active, the subject they teach or the level of their personality or motivational characteristics). It is possible that the teachers in our research who exhibit high levels of the executive function Planning use it to strengthen other aspects of their lessons, such as maintaining a positive climate and discipline.

Regarding the second research hypothesis, our results did not confirm it, either. The analysis did not demonstrate the existence of any statistically significant relationships between the executive function Time Management and any researched didactic competencies, either on the level of the entire sample or in any groups determined based on gender or type of school. Juhásová, Gatíal, and Mesíková (2022) found the same in their research conducted on a sample of future teachers; i. e., they did not demonstrate any significant relationships between the executive function Time Management and didactic competencies. On the other hand, the research of Ballová Mikušková suggests that in teachers and students of pedagogy, having fewer problems in the area of Time Management is related to more developed didactic competencies aimed at Class Climate and Discipline as well as Diagnostics and Evaluation. Similarly, Gatíal, Juhásová and Süttö (2023) found in their research that problems with the executive function Time Management relate negatively to all didactic competencies.

Our results supported the third research hypothesis. The analysis showed the existence of statistically significant relationships between the executive function Organisation and the didactic competency of Self-reflection on the level of the entire sample as well as in the group of women and the group of preschool teachers. Gatíal, Juhásová, and Süttö (2023) found the same on a sample of active teachers – that problems with the executive function Organisation correlate negatively with all didactic competencies, including the competency Self-reflection. Similarly, Ballová Mikušková (2022) showed in her study that a well-developed area of Organisation was related to all didactic competencies (besides Self-evaluation), i.e. also with the competency Self-reflection. On the other hand, in further research (Juhásová, Gatíal & Mesíková, 2022) no significant relationships were confirmed between the executive function Organisation and didactic competencies.

As concerns the fourth research hypothesis, our results supported it. The analysis demonstrated the existence of statistically significant relationships between the executive function of Emotional

Regulation and the didactic competency of Class Climate and Discipline in the group of primary school teachers. The positive direction of the relationship suggests that with a growing level of the executive function Emotional Regulation, the level of the didactic competency Diagnostics and Evaluation also grows in the group of primary school teachers. It was also shown that the executive function of Emotional Regulation is in a statistically significant relationship with the didactic competency of Self-reflection on the level of the entire sample as well as in the group of men and the group of primary school teachers. This positive relationship suggests that with a growing level of executive function and emotional regulation, the level of didactic competency and self-reflection also grows. The same findings were made by Juhášová, Gatíal, and Mesíková (2022), who reached the conclusion in their research that there is a statistically significant negative relationship between problems with the executive function, Emotional Regulation, and the didactic competencies Diagnostics and Evaluation, Self-reflection, and Implementation of the Lesson. The same results were achieved in their research by Ballová Mikušková (2022). Similar findings were made by Gatíal, Juhášová, and Süttö (2023) in their research, where they found in a sample of active teachers that problems with the executive function, Emotional Regulation, are in negative relationships with all didactic competencies.

With regard to the fifth research hypothesis, our research supported it. The analysis demonstrated the existence of statistically significant relationships between the executive function, Behavioural Regulation, and the didactic competency, Implementation of the Lesson, on the level of the entire sample as well as in the group of women. The positive direction of the correlation suggests that with a growing level of the executive function Behavioural Regulation, the level of the didactic competency Implementation of the Lesson also grows. It was also shown that the executive function Behavioural Regulation is in a statistically significant relationship with the didactic competency Self-reflection on the level of the entire sample as well as in the group of women and in the group of pre-school teachers. The positive direction of the relationship suggests that with a growing level of the executive function Behavioural Regulation, the level of the didactic competency Self-reflection also grows. Gatíal, Juhášová, and Süttö (2023) also showed in their research a significant negative relationship between problems with the executive function Behavioural Regulation and didactic competency Implementation of the Lesson; they also showed that problems with the executive function Behavioural Regulation are a negative relationship with the didactic competency Classroom Climate and Discipline. On the other hand, Ballová Mikušková (2022) did not show the existence of any significant relationships between the executive function of Behavioural Regulation and the didactic competencies of teachers.

As for the formulated research questions, the results of the analysis did not show the existence of any intergender difference either on the level of any of the researched didactic competencies or on the level of any of the researched executive functions. Contrary to our findings, some studies suggest that the development of executive functions also depends on gender, although they point out the cultural conditionality of gender differences (Ackerman & Friedman-Krauss, 2017). One possible reason for the differing results could be the size of the research sample (given the number of variables examined, a larger sample would have been more appropriate) or the fact that the teachers came from only two districts in western Slovakia, which must be taken into account when interpreting the findings. Furthermore, the subjects taught by the teachers were not considered, which may have specifically influenced the development of their executive functions and didactic competencies.

The analysis results showed a difference in the didactic competency Diagnostics and Evaluation, indicating that in primary school teachers, the level of the didactic competency Diagnostics and Evaluation is on a significantly higher level than in secondary school teachers. The results of the analysis also showed a difference in the levels of the executive function Planning, indicating that in secondary school teachers, the level of the executive function Planning is on a significantly higher

level than it is in pre-school teachers. Gatíal, Juhásová, and Süttö (2023) identified a difference in the level of didactic competencies and executive functions between in-service teachers and pre-service teacher education students, with in-service teachers achieving higher scores. A possible explanation for our findings could also be that certain groups of teachers may have adjusted their responses to align with socially desirable norms and overestimated their abilities, as the data were collected through self-assessment questionnaires.

The levels of the didactic competencies Planning and Preparation of the Lesson, Implementation of the Lesson and Diagnostics and Evaluation are not with statistical significance contingent on the levels of any of the executive functions. The analysis results showed that the level of didactic competency in classroom climate and discipline was negatively contingent with statistical significance on the level of executive function planning. The negative direction of the prediction indicates that the higher the level of the executive function Planning is in teachers, the lower the level of the didactic competency Classroom Climate and Discipline. The level of didactic competency and self-reflection is positively contingent on the levels of executive functions, such as emotional regulation and behavioral regulation. The positive direction of the prediction indicates that the higher the level of executive functions, emotional regulation, and behavioral regulation in teachers, the higher the level of didactic competency in self-reflection.

We can summarise the findings from our research and the research studies of cited authors as inconsistent in several aspects, which suggests that the relationships between executive functions and didactic competencies of future and currently practicing teachers are not necessarily direct. The fact that in some research samples, the relationships between executive functions were wholly confirmed and in others, they did not suggest that specific mediators or moderating variables may appear in these relationships that have not yet been the subject of research interest. Important factors mediating relationships between executive functions and didactic competencies could be specific personality, motivational, cognitive, or professional characteristics of teachers, which would be necessary to include in the analyses of relationships between executive functions and didactic competencies in the future, or to control for their influence. The findings of Roloff et al. (2020), for example, are in favor of this argument. In their research, they carried out multilevel regression analyses, which revealed that entry characteristics of candidates to the teaching profession hold predictive value in the direction of the quality of teaching. Specifically, a higher level of cognitive functions, approachability as a personality trait, and the results of the state exam in the second stage of pedagogic education predict the level of professional competencies of the teacher.

6. Conclusion

The correlations between executive functions and didactic competencies suggested that teachers with highly developed executive functions have a tendency to be more effective when planning, organising and implementing the educational process, as well as in solving problem situations that can arise during class. The results of the research specifically show that the presupposed positive relationships between executive functions and didactic competencies exist between the executive function Organisation and the didactic competency Self-reflection, between the executive function Emotional Regulation and the didactic competencies Diagnostics and Evaluation and Self-reflection, and between the executive function Behavioural Regulation and the didactic competencies Implementation of the Lesson and Self-reflection. As opposed to expectations, we found a negative relationship between the executive function Planning and the didactic competency Classroom Climate and Discipline (also in the sense of prediction), and no significant relationships were shown between the executive function Time Management and the didactic competencies.

It was not possible in the research to identify significant intergender differences from the viewpoint of either executive functions or didactic competencies. There were, however, some differences identified as regards the grade of the school. In primary school teachers, the level of the didactic competency Diagnostics and Evaluation was significantly higher than it was in secondary school teachers, and in secondary school teachers the level of the didactic competency Planning was significantly higher than in pre-school teachers.

The research also investigated how executive functions influence the ability of teachers to direct their class, approach students individually and adapt the educational material to fit diverse needs and styles of learning. It was found that teachers with better executive functions are usually more capable of implementing flexible didactic strategies and adapting to dynamic educational environments and the changes that may occur. The didactic competency of Self-reflection was also predicted by the executive functions of Emotional Regulation and Behavioural Regulation. Based on the results obtained, it can be stated that executive functions are a significant and relevant predictor of didactic competencies in teachers.

Despite the persuasive evidence of the significance of executive functions to didactic competencies, it is necessary to note that the findings only represent one segment in a wider context of factors influencing pedagogic practice in general. Further research should therefore include longer-term studies which could research the causal relationships and influences of other variables, such as personality traits, emotional intelligence or social-cultural factors.

7. Suggestion

On the basis of the research findings, we formulate the following recommendations for practice:

The inclusion of programs for the development of executive functions into pedagogic education – specialized courses and workshops aimed at the development of executive functions in teachers should be created, with an emphasis on planning, flexibility, working memory, and inhibition. These courses should be included in the initial as well as continuous education of teachers so that teachers can learn how to effectively manage their own cognitive resources in a teaching context.

Individualisation of approaches – it should be recognised that every teacher has unique strengths and challenges, and therefore the development of executive functions should be adapted to individual needs. This can include mentoring, coaching or small group discussions aimed at specific growth areas.

Support for reflection and self-evaluation – teachers should be supported in regular self-evaluation of their didactic competencies and executive functions. This can be achieved through the use of portfolios, reflexive diaries or feedback from colleagues and students. The goal is to help teachers identify areas in which they need further development.

Prioritisation of mental health and wellbeing – since healthy executive functions are related to overall mental health, programmes in support of teacher well-being should be integrated into school systems, including strategies for handling stress and preventing burnout.

Declarations

Author Contributions. Viktor Gatíal: Literature review, conceptualization, original manuscript preparation, review-editing and writing. Andrea Šášiková: methodology, data analysis. All authors have read and approved the published on the final version of the article.

Conflicts of Interest. The authors declare no conflict of interest.

Funding. -

Ethical Approval. Ethics Committee of Constantine The Philosopher University in Nitra, Tr. A Hlinku 1, 949 01 Nitra, Slovakia. Ethics Committee Approval Form nr. UKF-2023/888-1:191013.

Data Availability Statement. The data for this study were obtained in the pre-school, primary and secondary educational institutions in the Trnava and Nitra districts, Slovakia.

Acknowledgements. The study was supported by the scientific grant agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic as part of the project 1/0255/24 - Professional competencies and psychological literacy of teachers.

References

- Ackerman, D. J., Friedman-Krauss, A. H. (2017). Preschoolers' executive function: Importance, contributors, research needs and assessment options. In *Research Report* [online]. vol. 2017, issue 1., pp. 1-24. <https://doi.org/10.1002/ets2.12148>
- Baggetta, P., & Alexander, P. A. (2016). Conceptualization and operationalization of executive function. *Mind, Brain, and Education*, 10(1), 10-33. <https://doi.org/10.1111/mbe.12100>
- Ballová Mikušková, E. (2022). *Meranie profesijných kompetencií učiteľov* [Measuring teachers' professional competencies]. Nitra: PF UKF.
- Best, J. R., Miller, P. H., & Jones, L. L. (2009). Executive functions after age 5: Changes and correlates. *Developmental review*, 29(3), 180-200. <https://doi.org/10.1016/j.dr.2009.05.002>
- Burgess, P. (2008). Assessment of Executive Function. Online. *Archives of Clinical Neuropsychology*. 23, 2, 201-216. <https://doi.org/10.1016/j.acn.2007.08.010>
- Diamond, A., Ling, D. S. (2016). Conclusions about interventions, programs, and approaches for improving executive functions that appear justified and those that, despite much hype, do not. *Developmental Cognitive Neuroscience*, Volume 18, Pages 34-48. <https://doi.org/10.1016/j.dcn.2015.11.005>
- Gatíal, V., Juhásová, A., & Süttö, L. (2023). *Exekutívne funkcie, vedecké myslenie a kognitívna reflexia ako determinanty profesijných kompetencií učiteľov v pregraduálnej príprave a v praxi* [Executive functions, scientific thinking and cognitive reflection as determinants of teachers' professional competencies in pre-graduate training and in practice]. Nitra: Univerzita Konštantína Filozofa v Nitre.
- Gunzenhauser, C. and Nückles, M. (2021). Training Executive Functions to Improve Academic Achievement: Tackling Avenues to Far Transfer. *Frontiers in Psychology*. 12:624008. doi: 10.3389/fpsyg.2021.624008
- Hen, M., & Sharabi-Nov, A. (2014). Teaching the teachers: Emotional intelligence training for teachers. *Teaching education*, 25(4), 375-390. <https://doi.org/10.1080/10476210.2014.908838>
- Herwig, U., Kaffenberger, T., Jäncke, L., & Brühl, A. B. (2010). Self-related awareness and emotion regulation. *NeuroImage*, 50(2), 734-741. <https://doi.org/10.1016/j.neuroimage.2009.12.089>
- Juhásová, A. & Gatíal, V. (2019). *Exekutívne funkcie a rizikové správanie dospievajúcich* [Executive functions and risky behavior in adolescents]. Nitra: UKF.
- Juhásová, A., Gatíal, V. & Mesíková, A. M. (2022). Executive Functions in the Context of Professional Competencies of Future Teachers. *TEM Journal*, 11(4), 1702-1708. DOI: 10.18421/TEM114-35.
- Kovalčíková, I. (2016). *Diagnostika a stimulácia kognitívnych a exekutívnych funkcií žiaka v mladšom školskom veku* [Diagnosis and stimulation of cognitive and executive functions in early school-aged children]. Prešov: Vydavateľstvo Prešovskej univerzity, 264 p. ISBN 978-80-555-1719-3

- Lyon, G. R. (1994). *Frames of Reference for the Assessment of Learning Disabilities: New Views on Measurement Issues*. Paul H. Brookes Publishing Co., PO Box 10624, Baltimore, MD 21285-0624.
- Magnusson, K. (n.d.). *Visualizing statistical concepts: NHST simulator*. <https://rpsychologist.com/d3/nhst/>
- Morgan, P. L., Farkas, G., Hillemeier, M. M., Pun, W. H., & Maczuga, S. (2019). Kindergarten children's executive functions predict their second-grade academic achievement and behavior. *Child development, 90*(5), 1802-1816. <https://doi.org/10.1111/cdev.13095>
- Moriguchi, Y., Chevalier, N., & Zelazo, P. D. (2016). Development of executive function during childhood. *Frontiers in psychology, 7*(6). <https://doi.org/10.3389/fpsyg.2016.00006>
- Pavlov, I. (2013). *Štandardizácia profesijných kompetencií učiteľov (východiská a perspektívy)* [Standardization of teachers' professional competencies (starting points and perspectives)]. Prešov: Škola plus s.r.o.
- Roloff, J., Klusmann, U., Lüdtke, O., & Trautwein, U. (2020). The predictive validity of teachers' personality, cognitive and academic abilities at the end of high school on instructional quality in Germany: A longitudinal study. *Aera Open, 6*(1), 1-17. <https://doi.org/10.1177/2332858419897884>
- Rueda, M. R., Paz-Alonso, P. M. (2013). *Executive Function and Emotional Development*. In: *Encyclopedia on Early Childhood Development*, Edition: Montreal, Quebec, Publisher: Centre of Excellence for Early Childhood Development and Strategic and Knowledge Cluster on Early Child Development, Editors: R.E. Tremblay, M. Boivin, R.V. Peters, pp.1-7
- Spiegel, J. A., Goodrich, J. M., Morris, B. M., Osborne, C. M., & Lonigan, C. J. (2021). Relations between executive functions and academic outcomes in elementary school children: A meta-analysis. *Psychological bulletin, 147*(4), 329. <https://doi.org/10.1037/bul0000322>
- Strait, J. E., Dawson, P., Walther, C. A., Strait, G. G., Barton, A. K., & Brunson McClain, M. (2020). Refinement and psychometric evaluation of the executive skills questionnaire-revised. *Contemporary School Psychology, 24*, 378-388. <https://doi.org/10.1007/s40688-018-00224-x>
- Vandenbroucke, L., Spilt, J., Verschueren, K., Piccinin, C. & Baeyens, D. (2018). The Classroom as a Developmental Context for Cognitive Development: A Meta-Analysis on the Importance of Teacher-Student Interactions for Children's Executive Functions. *Review of Educational Research*, vol. 88, no. 1, pp. 125- 164.
- Verešová, M., Rapsová, L., & Krause, R. (2023). *Osobnosť a motivácia k voľbe povolania ako prediktory profesijných kompetencií učiteľov v pregraduálnej príprave a v praxi* [Personality and motivation to choose a profession as predictors of professional competencies of teachers in pre-graduate training and in practice]. Nitra: Univerzita Konštantína Filozofa v Nitre.
- Veteška, J., & Tureckiová M. (2008). *Kompetence ve vzdělávání* [Competence in education]. Praha: Grada Publishing, a. s.
- Zelazo, P. D., Blair, C. B. & Willoughby, M. T. (2016). *Executive function: Implication for education*. Washington, DC: National Centre for Education Research. 148 p.

About the Contributor(s)

Viktor Gatíal, PhD., is a professor at the Department of Pedagogical and School Psychology, Faculty of Education, Constantine the Philosopher University in Nitra. He mainly teaches subjects such as Developmental Psychology, Work Psychology, Career Counseling, Psychodiagnostics. Research focus: Cognitive development of pupils and students, Personality and quality of teachers, Risky behavior of adolescents. He is the author of several monographs, textbooks and publishes in scientific journals.

Email: vgatíal@ukf.sk

ORCID: <https://orcid.org/0000-0002-6693-2930>

Andrea Šášíková is a high school teacher of psychology and pedagogy and a classroom teacher at the Blessed Laura Secondary Vocational Pedagogical School in Trnava, Slovak republic.

Email: sasikovaandrea@gmail.com

Publisher's Note: *The opinions, statements, and data presented in all publications are solely those of the individual author(s) and contributors and do not reflect the views of Universitepark, EDUPIJ, and/or the editor(s). Universitepark, the Journal, and/or the editor(s) accept no responsibility for any harm or damage to persons or property arising from the use of ideas, methods, instructions, or products mentioned in the content.*

Appendix

Results of the Normality Distribution Testing

Didactic competencies	Kolmogorov-Smirnov test of normality		
	statistics	df	sig.
PPL	,130	128	<,001
IL	,126	128	<,001
CCD	,208	128	<,001
DE	,172	128	<,001
SR	,240	128	<,001

df – degrees of freedom, sig. – signification, PPL – Preparation and Planning of the Lesson, IL – Implementation of the Lesson, CCD – Classroom Climate and Discipline, DE – Diagnostics and Evaluation, SR – Self-reflection

Executive functions	Kolmogorov-Smirnov test normality		
	statistics	df	sig.
Planning	,138	128	<,001
Time management	,188	128	<,001
Organization	,273	128	<,001
Emotional regulation	,325	128	<,001
Behavioural regulation	,209	128	<,001

df – degrees of freedom, sig. – signification

Didactic competencies	gender	Kolmogorov-Smirnov test of normality			Shapiro-Wilk test of normality		
		statistics	df	sig.	statistics	df	sig.
Executive functions							
PPL	men				,886	35	,002
	women	,149	93	<,001			
IL	men				,922	35	,017
	women	,153	93	<,001			
CCD	men				,914	35	,010
	women	,224	93	<,001			
DE	men				,889	35	,002
	women	,187	93	<,001			
SR	men				,889	35	,002
	women	,244	93	<,001			
Planning	men				,948	35	,095
	women	,149	93	<,001			
Time management	men				,881	35	,001
	women	,187	93	<,001			
Organization	men				,812	35	<,001
	women	,242	93	<,001			
Emotional regulation	men				,835	35	<,001
	women	,325	93	<,001			
Behavioural regulation	men				,929	35	,025
	women	,222	93	<,001			

df – degrees of freedom, sig. – signification, PPL – Preparation and Planning of the Lesson, IL – Implementation of the Lesson, CCD – Classroom Climate and Discipline, DE – Diagnostics and Evaluation, SR – Self-reflection

Didactic competencies	stage of education	Shapiro-Wilk test of normality		
		statistics	df	sig.
Executive functions				
PPL	pre-school	,907	39	,004
	primary	,844	43	<,001
	secondary	,919	46	,004
IL	pre-school	,951	39	,086
	primary	,863	43	<,001
	secondary	,938	46	,016
CCD	pre-school	,882	39	,001
	primary	,883	43	<,001
	secondary	,944	46	,028
DE	pre-school	,943	39	,047
	primary	,942	43	,030
	secondary	,925	46	,006
SR	pre-school	,908	39	,004
	primary	,854	43	<,001
	secondary	,876	46	<,001
Planning	pre-school	,959	39	,169
	primary	,948	43	,051
	secondary	,923	46	,005
Time management	pre-school	,927	39	,015
	primary	,897	43	,001
	secondary	,911	46	,002
Organization	pre-school	,779	39	<,001
	primary	,856	43	<,001
	secondary	,876	46	<,001
Emotional regulation	pre-school	,782	39	<,001
	primary	,810	43	<,001
	secondary	,846	46	<,001
Behavioural regulation	pre-school	,900	39	,002
	primary	,909	43	,002
	secondary	,910	46	,002

df – degrees of freedom, sig. – signification, PPL – Preparation and Planning of the Lesson, IL – Implementation of the Lesson, CCD – Classroom Climate and Discipline, DE – Diagnostics and Evaluation, SR – Self-reflection