CO-EXISTENCE OF PARTICULAR AREAS IN GLOBAL DEVELOPMENT IN EARLY AGE – RISK AND PROTECTIVE PERSPECTIVE

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Abstract: The aim of the research: provide empirical evidence of overlapping of developmental domains, with regard not only to the strong highlighted comorbidity of neurodevelopmental disorders, difficulties and delays in preschool age, rather to highpoint overlapping in view of major everyday activities of the children; strengths in order to find and support the gifts of the child, so that stimulating activities and games in the kindergarten and the family environment maximized the child's developmental potential. By using the IDS-P (Krejčířová, 2018) 39 children in Slovak kindergartens was tested, by data collection in direct personal contact. The aim covers the correlations of the measured areas, identification of predictors of the domain cognition, which proved to be the most saturating the Global developmental level. The output was a stepwise linear regression model that identified three indicators from the field of social-emotional and personality development: tenacity of effort, delayed reward and social-emotional competence, the impact of which is statistically significant and explains almost 50% of the variability of the developmental level of cognition. Based on the provided empirical evidence, we can assume that the developmental level of cognition reflects the support and building of competences in these areas, which is the basis of pre-academic and later academic skills.

Keywords: development, developmental domains, cognition, social skills, overlapping of domains, preschool age, common neurodevelopmental core, IDS-P

1 Introduction

Research-based findings that point to the necessity of viewing theoretically defined developmental domains as one neurodevelopmental unit (APA, 2013; Davidson et al., 2014; Diamond, 2000; Flavell et al, 2001; Soska & Adolph, 2014) are not sufficiently reflected in practice. The tools used include individual developmental areas (domains), they also summarize the measure of the overall developmental level - either with one data, in some cases as a percentile expression of the level of development, there is an intelligence quotient, or by determining the norm and risk band. Many tools provide the possibility of displaying or numerically expressing the development profile - that is, they describe the areas of development separately (Krejčířová, 2018; Říčan, 2006; Svoboda, 2022).

The overall clinical picture depends on the expertise, experience and skills of the assessing expert (Langmeier & Krejčířová, 2006; Vágnerová, 2012), including within the framework of outputs from measurable diagnostic tools (Svoboda, 2022; Valachová, 2009), and within the framework of the professional assessment of the overall clinical picture of the child (Francéz et al, 2022; Říčan, 2006), also in the framework of parental and teachers provided with regard to understanding the developing level seen f.eg. in the cognitive flexibility for improving their emotionality (Mengxia, 2024). The practice still reflects the status of measurable findings as higher, more valuable, as they are more accurate in detecting and measuring defined constructs and evidence of results. The complexity of the image of the child's development, requiring the expertise of the assessor (Zero to Three, 2016), is a kind of supplement to these measurements. It is not understood as higher quality supported by measurable partial results. Cognitive and social skills and emotional self-expertise are united in play, which is the natural major activity of children at early age (Kaizar & Alordiah, 2023), there is the possibility for observing the ko-existence of the researched areas of development and maturity of individual skills.

At the same time, practice still reflects findings in terms of difficulties and shortcomings more significantly (APA, 2013; Říčan, 2006; Svoboda, 2022; WHO, 2019). It is important to pay attention to the particular components of development, like cognition and emotionality, especially in their mutuality, from an early age precisely because of the substantiated overlap into older age and academic skills and results (Goméz et al., 2024). Identifying and measuring a child's strengths is still in a significantly lower position compared to identifying weaknesses, even in the case of an assessment of the overall developmental level, ideally a profile of the overall developmental level.

This paper contributes to empirical evidence of the mutuality of individual developmental domains and aims to point out that the internal developmental context and interconnectedness of developmental domains should be understood not only as a potential risk of a cascading nature (Biotteau et al., 2017; Downing and Caravolas, 2022; Harbourne et al., 2014; Varuzza et al., 2023) (which is also indisputable), but also the protective potential of those areas of development that are stronger, less or not at all disturbed by the neurodevelopmental specificity of the child (Diamond, 2000; Flavell, 2001; Wiesen et al., 2016; Wu et al., 2017).

These identified strengths, less or unaffected by neurodevelopmental deficits, are a potential basic starting point for shaping intervention activities. It is not only about the overall developmental domain, which can be strong, it is also important to perceive individual smaller skills that are strong and, above all, in line with the child's interests and thus have the potential to become motivators and helpful mechanisms even for areas that are more challenging for the child, or in areas where development progresses more slowly, and because with certain difficulties/restrictions.

2 Methods

2.1 Research sample and procedure

39 children in the addressed kindergartens in western Slovakia took part in the research. On the basis of informed consent, the children participated in the research in the form of standardized activities of the IDS-P intelligence and development scale, by data collection in direct personal contact. There were 20 girls and 19 boys, attending kindergartens in the capital city 21 and outside the capital city 18. In the context of age, the chronological age in months was used, for identifying the score of the developmental level, the age was from 37 to 71 months ($M = 61.28$; $SD = 8.88$). The level of correlation was signed like strong $r \geq .5$; medium $r \geq .3$ and light $r < .03$, using Pearson´s and Spearman's correlation in behalf of normality of data. Used simple linear regression and stepwise linear regression was reported in statistical importance and percentage of variation.

2.2 Measures

In the research study, the collection of basic sociodemographic data regarding age, gender, area of residence, number of siblings and birth order was applied. The Czech version of the Intelligence and Development Scale for Preschoolers (IDS-P) (Krejčířová, 2018) was used to collect data related to the areas of development, capturing the overall level of development consisting of the areas of cognition (7), psychomotor skills (3), social-emotional competence (1), logical-mathematical thinking (1), speech (3) and verbal thinking (2). Each of the areas is composed of a different number of corresponding subtests (data in parentheses). The achieved level of development of individual areas is determined by converting the average score to a weighted score in the context of chronological age and reflects the level of development in the given area relative to the population norm according to the data of the authors of the tool. Areas supplementing the overall picture of the participant focused on the child's approach to the test situation were evaluated with a rough score based on the degree of fulfilment of the criteria that were the subject of investigation in the given area. These were the areas of delayed reward, enjoyment of performance, persistence of effort, and theory of mind. In the context of the research study, we perceive these variables as part

of social-emotional and personal maturation, therefore we examine them together with the variable social-emotional competence.

3 Results

IBM SPSS Statistics 23.0 software was used to analyse the data. The first area of research was the finding of correlations between single development domains and areas. Pearson's (for variables with normal data distribution) and Spearman's (for variables not meeting the criterion of normal data distribution) correlation coefficient was used to determine the relationships between developmental areas. The variable Cognition identified as the most saturating Global developmental level by correlation (rs= 836; p < 01), which was supported by the high statistical significance (p < .01) and verified by simple linear regression determining the variability of 70% of the variance of Global developmental level, which can be explained by the variable Cognition on level of statistical significance (p<.001). A simple linear regression was used to determine the degree of dispersion of individual areas of development, which can be used to statistically explain the value of the Cognition variable. The next and aimed step was the identification and analysis of stepwise linear regression models. Correlation of single developmental areas

3.1 Relationship between individual developmental areas

The first area of research was the relationships between the developmental areas of Cognition (C), Psychomotor Skills (PM), Socio-Emotional Competence (SEC), Logical-Mathematical Thinking (LMT), Speech (S), Verbal Thinking (VT), and variables capturing the child's approach to the test situation: Delayed Reward (DR), Joy of Achievement (JA), Persistence of Effort (PE), and Theory of Mind (TM) (Table 1). The results show strong, statistically significant relationships between Cognition (C) and Verbal Thinking (r = .687; p < .01), C and Logical-Mathematical Thinking (rs = .670; p < .01), C and Delayed Reward (rs = .647; p < .01), C and Speech (r = .585; p < .01), C and Joy of Achievement (rs = .528; p < .01), and C and Persistence of Effort (rs = .511; p < .01). Similarly, there was a strong, statistically significant relationship between Logical-Mathematical Thinking (LMT) and Speech (rs = .646; p < .01), LMT and Verbal Thinking (rs = .557; p < .01), and LMT and Delayed Reward (rs = .533; p < .01). Another strong relationship was identified between Psychomotor Skills and Delayed Reward (rs = .616; p < .01). There was also a strong relationship between the variables Persistence of Effort (PE) and Joy of Achievement (rs = .605; p < .01) and between PE and Delayed Reward (rs = .506; p < .01), with the relationships being statistically significant.

Table 1a Correlation matrix of developmental domains

	C	PM	SEC	LMT	S
C	-				
PM	.438**	-			
SEC	.463**	.149	-		
LMT	**.670****	.464**	.229	-	
S	.585**	.261	.473**	**.646****	-
VT	**.687****	.366*	.266	.557**	**.622****
DR	**.647****	**.616****	.205	.533**	.347*
JA	.528**	.192	.378*	.298	.375*
PE	.511**	.417**	.299	.418**	.423**
TM	.233	.089	.128	.206	.149
OD	.836**	.568**	.614**	.814**	.817**

Notes: C - cognition; PM - psychomotor skills; SEC - socio-emotional competence; LMT - logical-mathematical thinking; S – speech; VT - verbal thinking; DR - delayed reward; JA - joy of achievement; PE - persistence of effort; TM - theory of mind; OD - overall development

Table 1b Correlation matrix of developmental domains

	VT	DR	JA	PE	TM
C					
PM					
SEC					
LMT					
S					
VT	-				
DR	.490**	-			
JA	.238	.428**	-		
PE	.221	.506**	**.605****	-	
TM	.130	.230	.129	.217	-
OD	.796**	.586**	.448**	.492**	.216

Notes: C - cognition; PM - psychomotor skills; SEC - socio-emotional competence; LMT - logical-mathematical thinking; S – speech; VT - verbal thinking; DR - delayed reward; JA - joy of achievement; PE - persistence of effort; TM - theory of mind; OD - overall development

3.2 Prediction of Cognitive Skills

Predictors of individual developmental areas influencing the level of development of cognitive skills (Cognition (C)) were determined using linear regression analysis. Based on the results, we can deduce the regression values that most significantly predicted the level of development of cognitive skills, which were the areas of Verbal Thinking, Logical-Mathematical Thinking, and Persistence of Effort. Other significant predictors included Speech, Delayed Reward, and Socio-Emotional Competence.

The achieved level of VT is a significant predictor of Cognition (p < .001) and explains 47.2% of the variability achieved in the level of Cognition. The achieved level of LMT also significantly (p < .001) explains slightly less — 41.7% of the variability of the variable Cognition. The third most significant predictor of the level of Cognition development was Persistence of Effort, which explains 40.5% of the variability at high significance (p < .001). Areas that explain a slightly smaller portion of the variability of the Cognition variable were Speech, explaining 34.2% of the variability (p < .001), Delayed Reward explaining 28.6% of the variability (p < .001), and Socio-Emotional Competence explaining 21.4% at (p < .001) (Table 2).

Table 2a Simple linear regression

Predictor:	**PM**		**LMT**		**S**		**VT**	
	R^2	**Sig.**	**R^2**	**Sig.**	**R^2**	**Sig.**	**R^2**	**Sig.**
Dependent variable: Cognition	.192	.005	**.417**	<.001	**.342**	<.001	**.472**	<.001

Table 2b Simple linear regression

Predictor:	SEC		DR		JA		PE		TM	
	R^2	**Sig.**	**R^2**	**Sig.**	**R^2**	**Sig.**	**R^2**	**Sig.**	**R^2**	**Sig.**
Dependent variable: Cognition	.214	.003	**.286**	<.001	.213	.003	**.405**	<.001	.038	.234

Considering the possible use of several measured areas that capture not only cognitive but also personal development and the maturation of the child, we decided to examine them by creating stepwise regression analysis models to more precisely determine which variables and in what combination and sequence have the potential to predict the level of cognitive development. By applying stepwise linear regression analysis, we identified a simple single-component model A, containing the variable

Persistence of Effort, which mirrors our findings from the previous simple linear regression analysis. Model B, containing two components, showed the inclusion of PE and DR as a model explaining 43.2% of the variability at the significance level of $p < .05$, (specifically $p = .025$), and the third and most accurate model C, which explains up to 49.9% of the variability (almost half) of the variable C, showing the level of development of cognitive skills, also at a significance level of $p < .05$, (specifically $p = .037$). This model includes PE, DR, and Socio-Emotional Competence.

Table 3 Stepwise linear regression

Dependent variable: Cognition		R^2	R^2	Sig.
Model A	PE	.588	.346	<.001
Model B	PE DR	.657	.432	.025
Model C	PE DR SEC	.707	**.499**	.037

4 Discussion and recommendations for practice

The aim of the research study was to identify overlapping developmental areas – domains and areas measured in the context of determining the overall developmental level of the child, its maturation, and the adequacy of developmental milestones in the context of chronological age.

4.1 Connections between individual developmental areas

The first set of hypotheses were assumptions about the existing relationship between developmental domains, and these hypotheses were confirmed. The relationships between developmental areas were medium to strong, with most also statistically significant. The strongest relationship was noted between the area of cognition and thinking subtests, but also between cognition and subtests assessing the child's approach to the test situation and socio-emotional competence. After a critical analysis of the data, we consider that the area of cognition contains the most subtests, which are averaged into a mean score, and we can also assume that this area is determined with the greatest accuracy due to the construction of the subtests.

We find the strong relationship between the area of speech, which is medium to strong with almost all areas of development, interesting, but the strongest is with logical-mathematical thinking, and secondarily with verbal thinking. We can assume that this finding may be related to the relatively small sample size and may change with the size and composition of the research sample. However, we can also consider the ability of logical reasoning used in understanding speech as well as in the expressive aspect of speech, with the application of grammatical rules and analytical-synthetic or causal relationships present in the language. The strong relationship observed between individual areas capturing the child's approach to the test situation – delayed reward, perseverance of effort, and joy of performance, we can assume, reflects the verification of their inclusion by the authors of the IDS-P tool into a common category and the empirical evidence of their connection also statistically. The most significant relationship among the areas of the child's approach to the test situation is the relationship of delayed reward with cognition and the relationship of delayed reward with psychomotor skills, from which we can infer delayed reward as one of the elements whose maturation significantly overlaps with significant indicators of overall development (cognition and psychomotor skills). Other findings also support this (Diamond, 2000; Harbourne et al., 2014; Mischel et al., 1989; Murray et al., 2007; Soska & Adolph, 2014; Varuzza et al., 2023; Wiesen et al., 2016; Wu et al., 2017), which supports the assumption of a common neurodevelopmental basis for these areas. The assumption was not confirmed for the variable assessing the level of developmental maturity of the theory of mind in preschoolers. The relationships of the theory of mind with developmental domains and with areas of the child's approach to the test situation were weak to negligible, statistically insignificant, which contradicts the claims of authors who consider the emerging ability to understand another person's perspective as one of the indicators of the level of thinking development and overall developmental level (de Villiers et al., 2014; Jenkins & Astington, 1996; Wellman, 2010). We consider a possible consequence of this that the theory of mind was examined by a single task and the scoring was not very diversified, resulting in lower accuracy of findings. Given the assumptions offered by the authors (Slade & Ruffman, 2010; Wellman, 2010), we consider it appropriate to explore this phenomenon more closely using more precise tools.

Cognition is one of the fundamental pillars of observed and measured skills in preschool age (Bednářová & Šmardová, 2021; Valachová, 2009), as developing cognitive skills significantly contribute to the level and development of pre-academic skills (Zelinková, 2001; Wirth, 2021), the development of abstraction ability (in preschool age based on exploration, verification of concrete experiences, but also significant connection of findings and creation of new solutions (Inhelderová & Piaget, 2014; Soska & Adolph, 2014) as a foundation for later academic skills (Inhelderová & Piaget, 2014; Langmeier & Krejčířová, 2006; Vagnerová, 2012). We confirmed this assumption by identifying cognition as the most significant predictor of overall development, considering (as mentioned above) the possible consequence that cognition is determined most accurately due to the test construction. Therefore, in the following research question, we focused on identifying developmental areas that predict the level of cognitive development.

Significant predictors of the level of cognition were areas focusing on other areas of thinking than those included in the area of cognition – verbal thinking and logical-mathematical, which is consistent with the view of pre-academic skills being categorized into logical-mathematical and verbal areas, as the success of children in preschool age in tasks and activities of this kind is a prerequisite for the development of cognitive level (Jerusalem & Klein-Heßling, 2002) and we can assume that their development supports the development of general cognitive skills needed for overall success in later academic environments.

We consider the identification of predictors of cognition from the group of emotional-personality assumptions significant, as these are often present and observed in processes in kindergarten and home environments during preschool age (Flavell et al., 2001; Pons et al., 2004; Widen & Russell, 2002). By creating a stepwise linear regression model, we identified that the child's ability to delay reward and thus understand temporal connections and succession, as well as internal regulation, along with perseverance demonstrated in the effort made during longer systematic work, and socio-emotional competence shown in the ability to recognize emotions on displayed faces and understand and explain displayed social situations, to which various authors have paid attention from different perspectives (Denham, 2003; Hašto, 2019). With a model including these three areas, we can explain almost half of the variability in the level of cognitive development. Consistent with several authors (Gergerly & Watson, 1996; Rose et al., 2018) on the influence of these also developing areas (McCabe & Altamura, 2011) on the level of cognitive development, we can view them as important in the context of the social environment that children encounter at the beginning of preschool age (when entering kindergarten) and which provides them with opportunities to develop and apply skills acquired in early development and family background. In accordance with our finding, it is necessary to look at the research of the developmental domains, as well as their practical inclusion in everyday direct work with children in early age and their developmental supportive interventions, as mutually influencing and conditioning factors, whose level of

development and maturity is directly related to learning as a process and later success in school (Gómez, 2024).

4.2 Recommendations for Practice and Long-term Research Goals

From the above, it follows that the assumption of a common neurodevelopmental basis of individual developmental domains can be considered empirically supported. We supplement this picture with areas that can be applied and observed in the usual family environment and kindergarten environment. This allows us not only to predict the area of cognition and overall development, but also to perceive them as preventive supportive elements that can be observed and examined but specifically integrated into children's activities in the form of play, as the highest form of children's learning and work. Direct activities recommended for kindergartens and stimuli for family games and activities not only towards skills commonly known to support pre-academic development (drawing, construction, counting), but specifically activities aimed at personality development, understanding one's own and others' emotions, the ability of reflection and self-reflection, the ability to regulate, the ability to name observed and experienced phenomena, both in direct contact with peers or other children, in contact with competent pedagogical or non-pedagogical staff (e.g., school psychologist) and last but not least with parents and the family circle.

In future research plans, we intend to use tools whose accuracy in determining the developmental level of motor, communication, cognitive, social, and emotional-personality skills will be comparable with a more balanced number of items, thus obtaining more accurate data on the developmental level in individual areas.

The long-term research goal is to expand the research sample and report results with regard to individual sub-components of developmental domains that could be identified as potential protective pillars of the pedagogical approach in kindergarten, the parental approach in the natural family environment, and the natural strengths of the child, which can be developed and utilized not only to increase the developmental level of other aspects but also to enhance the overall psychological well-being and personal comfort of the child and thus also their family.

Given the lack of research conducted in very early age (born – 3) with infants and toddlers, and in area how primary caregivers and early childhood psychologists support emotional competence of children (Housman, 2017) and thus contribute to the development of cognition and other developmental components (Davidson et al., 2014; Gómez et al., 2024; Kaizar et al., 2023; Mengxia, 2024); it is crucial to develop, research and implement programs as early as possible, at an age when it is possible and feasible in our conditions, as this research also shows, i.e. from the age of 3, when children enter the preschool education environment. Working with children before this age requires that pediatrics are open to cooperation with developmental psychologists and parents, which presupposes functional interdepartmental cooperation and an understanding of the overlap of patterns and skills of early childhood and the home environment (Ministry of Social Affairs and Family) into the school environment (Ministry of Education) and the overlap with overall psychological, psychosomatic and physical health (Ministry of Health).

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Primary Paper Section: A

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