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The Zone of Actual and the Zone of Proximal Development Measured through Preschool Dynamic Assessment as Predictors of Later School Performance – a Longitudinal Study*

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The goal of the study was to examine whether the zone of actual (ZAD) and the zone of proximal development (ZPD) in children, measured through preschool dynamic assessment, could be used as predictors of later school performance. A longitudinal study was conducted. The participants were 114 students from the "Stevan Čolović" primary school in Arilje (54 boys, and 60 girls), Serbia. The findings generally confirm that measures from preschool dynamic assessment can be used as predictors of later school performance. ZAD was shown to be a better predictor than ZPD. ZPD is an independent predictor only for performance in language and mathematics tests in a final trial test. Affective-motivational scaffolding is a better predictor than cognitive scaffolding. These results are considered in the context of Vygotsky's theory and also in that of dynamic assessment procedures. Theoretical and practical implications for future studies of affective-motivational and cognitive factors as predictors of school performance are being considered.

Keywords: dynamic assessment, affective-motivational and cognitive factors, zone of proximal development, school performance

Highlights:

- Measures from preschool dynamic assessment can be used as predictors of later school performance.

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- Independent performance on the TIP–1 test or ZAD is a better predictor of later school performance than ZPD.
- Depending on different indicators of school performance during primary school ZPD can be used as a significant independent predictor.
- In terms of ZPD, affective-motivational scaffolding is a better predictor of later school performance than cognitive scaffolding.

Different authors in the field of dynamic assessment use this broad concept as an umbrella term for a variety of procedures and techniques related to the interventions provided during the assessment of cognitive functions (Elliott, 2003; Stacey, 2016; Lidz, 1991; Sternberg & Grigorenko, 2002). Testing intelligence by means of standardized tests during psychometric procedures is part of the nomothetic approach, while dynamic assessment is part of the idiographic approach (Haywood & Lidz, 2007). This concept is situated within the broad discussion about the relationship between assessment and intervention (Poehner, 2008), and the authors question how far can we go, whether the gap between intervention and assessment has been overcome, or whether the difficulty of reaching a consensus remains (Lidz & Haywood, 2014; Stringer, 2018; Elliott et al., 2018).

Since there are different definitions of this concept, the common issues are the active intervention of the examiner and the assessment of the examinee's reactions, as well as the focus on the child's modifiability or ability to learn with help and the child's ability to transfer new learning to related problems (Haywood & Lidz, 2007). Interventions during assessment may be either flexible and responsive (the clinical approach, interaction procedures or "cake" format), or standardized and quantitative (intervention procedures or the "sandwich" format) (Stacey, 2016; Poehner, 2008; Sternberg & Grigorenko, 2002), and assessment may involve domain general or domain specific materials (Feuerstein et al., 1979; Lidz, 1991; Lauchlan & Elliott, 2001; Stacey, 2016).

In her attempt to find an appropriate definition of dynamic assessment, Stacey (2016) offers an overview of different definitions (Lidz 1991; Waters & Stringer, 1997; Deutsch & Raynolds, 2000; Elliott, 2000; Tzuriel, 2000b; Lauchlan & Elliott, 2001; Elliott, 2003; Yeomans, 2008; Lidz, 2014 according to Stacey, 2016). Summarizing all of them she offers her own as follows: „Dynamic assessment describes approaches to assessment that focus on illuminating the cognitive processes and affective factors impacting on a child's performance through the child and assessor working together on a task. Integral to the assessment is the active role of the assessor in trying to create the optimum conditions for the child to learn both content needed for the task and more general processes that can be applied to both the task and beyond. Working in this way allows the assessor to gauge the child's responsiveness

to support and to use these observations to subsequently inform tailored intervention in the classroom which will help the child learn more effectively" (Stacey, 2016, p. 21.).

According to the consensus of different authors (Stringer, 2018; Grigorenko, 2009), the theoretical framework for dynamic assessment is, on the one hand, based on the socio-constructivist understanding of learning and development as defined in the cultural-historical theory of Vygotsky (1977) and the concept of the zone of proximal development. On the other hand, the basis of dynamic assessment lies in the approach of Raven Feuerstein (Feuerstein et al., 1986; Feuerstein et al., 2010; Tzuriel, 2014; Grigorenko, 2009), who originally developed the theory of structural cognitive modifiability and the related concept of mediated learning experience (MLE).

In accordance with the sociocultural approach to development (Vigotski, 1977), which advocates that higher psychological functions are developed through social interaction, and the concept of the zone of proximal development which emphasizes that the level of development a child is able to reach with the help of an adult is indicative of their future self-achievement, under the dynamic assessment paradigm researchers assume that cooperation with the examiner is crucial in guiding and observing development. Dynamic assessment reflects Vygotsky's view that the assessment of both the zone of actual (ZAD) and the zone of proximal development (ZPD) is necessary for a complete understanding and prediction of a child's future development. The notion of scaffolding or providing support through a mentoring process across several types of support given to a child in order to complete a task (simplifying the task, motivating the child, focusing the child's attention on certain aspects of the task, putting the task in a context more familiar to the child, using language that is understandable to the child or by using technical tools) is of great importance in terms of understanding the diagnostics of development for dynamic assessment (Poehner, 2008; Wood et al., 1976; Van de Pol et al., 2010).

Although Feuerstein's approach to dynamic assessment was developed independently of Vygotsky's theory, certain authors point out similarities with it (Feuerstein et al., 1979; Feuerstein et al., 1986; Feuerstein et al., 2010; Poehner, 2008). The main idea or belief on which his theory is based is that there is a difference between performance and potential and that it is possible to intervene and change the course of development of human cognitive abilities, and the key component is mediation. Adult members of the community mediate the world to their young through language, gestures, and rituals, and by including them in various ways in daily activities; mediated learning influences the development of the basic structures and principles of thought, perception, and problem-solving necessary for effective learning (Poehner, 2008; Glazier-Robinson & Lidz, 1986).

Scarr (1981) argued that any measurement of cognitive functioning also includes the measurement of non-intellectual factors such as cooperation, attention, perseverance and social responsiveness to the test situation.

Achievement on an intelligence test reflects three different factors: cognitive processes, academic achievement unrelated to formal cognitive traits and motivational factors which include a wide range of personality variables (Zigler & Butterfield, 1968). The effects of non-intellectual factors are particularly significant during the assessment of the cognitive development of children from marginalized and socio– disadvantaged groups, minority groups, and children with disabilities, when there are racial, gender or linguistic differences between the respondents and examiners and therefore the approach of dynamic assessment is promising (Tzuriel et al., 1988; Haywood & Lidz, 2007; Stringer, 2018; Tovilović & Baucal, 2007).

Stacey (2016) indicates that very few dynamic assessment approaches specifically address the assessment of affective factors which influence achievement such as children's emotional reactions and attitudes which can have a positive or negative effect on their learning. A review of 31 studies (Tiekstra et al., 2014) examining the consequent validity of dynamic assessment revealed that in only two procedures did the researchers explicitly address affective-motivational strategies during their interactions. They concluded that most of the tests apply cognitive and/or metacognitive strategies during the learning phase, whereas motivational factors never play a major role, and this is an interesting finding given that they are known to be motivational factors which interact with the learning process and test results (Lidz & Macrine, Ryba, 1998; Meijer, 2001 according to Tiekstra et al., 2014).

Emotional and motivational characteristics such as perseverance, self-esteem, and integration toward goals are better predictors than IQ scores in determining the actualization of abilities in the professional lives of gifted persons (Terman and Oden, 1947 according to Tzuriel et al., 2011). Examining the differences in the cognitive modifiability, emotional-motivational factors and changes in behaviour patterns during dynamic assessment between gifted and non-gifted children the authors concluded that the issue of the relationship between emotional-motivational factors and cognitive functioning requires further research, particularly among gifted children (Tzuriel et al., 2011). Research findings have shown that there is a positive correlation between academic ability and social-emotional factors (Lubinski & Benbow, 2000). Various researchers associate cognitive development and school performance with different non-intellectual factors such as intrinsic motivation (Haywood, 1971), locus of control (Stipek & Weisz, 1981; Findley and Cooper, 1983 according to Tzuriel et al., 1988), motivation for achievement (Alschuler, 1973; McClelland, 1961 according to Tzuriel et al., 1988), and anxiety (Kirkland, 1971 according to Tzuriel et al., 1988).

It has been shown that the affective-motivational aspect of social interaction is helpful in encouraging children to use their intellectual capacities (Baucal, 2003); that it is necessary to combine both qualitative and quantitative measures in order to gain a clear picture of the differences in ZPD among different children (Luković, 2011; Luković et al.., 2013); that dynamic assessment is useful for educational psychologists (Vulić et al., 2014); and that it is necessary

to use different combinations of motivational and cognitive support for different children (Nedić et al., 2015).

The goal of this study was to examine whether the measures from preschool dynamic assessment, ZAD and ZPD, can be used as predictors of later school performance. The second aim was to examine two levels of scaffolding, motivational-affective and cognitive, as predictors of later school performance.

Method

Sample

The participants in the study were 114 students in the eighth grade of the "Stevan Čolović" primary school in Arilje (54 boys and 60 girls), Serbia. The socio-demographic characteristics of the participants are presented in Table 1 in order to describe our sample.

Table 1
The socio-demographic characteristics of the participants

Variable		Sample 1	Sample 2
Socioeconomic status	Below average	5 (4.35)	4 (3.48)
	Average	105 (91.30)	17 (14.78)
	Above average	5 (4.35)	94 (81.74)
Mother's education	Faculty, MA, PhD	11 (9.57)	18 (15.65)
	College	4 (3.48)	15 (13.04)
	High school	4 (3.48)	7 (6.09)
	Vocational high school (3 or 4 years)	82 (71.30)	72 (62.61)
	Primary school	14 (12.17)	3 (2.61)
Father's education	Faculty, MA, PhD	6 (5.22)	10 (8.70)
	College	7 (6.09)	10 (8.70)
	High school		4 (3.48)
	Vocational high school (3 or 4 years)	86 (74.78)	85 (73.91)
	Primary school	16 (13.91)	6 (5.22)
Mother's vocation	Unemployed	30 (26.09)	6 (5.22)
	Independent businesswoman	14 (12.17)	18 (15.65)
	Works in a private company	50 (43.48)	69 (60.00)
	Works in a state firm	21 (18.26)	22 (19.13)
Father's vocation	Unemployed	25 (21.74)	4 (3.48)
	Independent businessman	21 (18.26)	33 (28.70)
	Works in a private company	55 (47.83)	47 (40.87)
	Works in a state firm	11 (9.57)	25 (21.74)
	Retired	1 (.87)	1 (.87)
	Other	2 (1.74)	2 (1.74)

Instruments

During preschool testing, TIP–1 (Ivić et al., 2004) was adapted to create an instrument for dynamic assessment. This test measures general intelligence, and the best subtests are:

Knowledge (r = .71), Verbal Abilities (r = .67), Logical Operations (r = .66), Memory Subtest (r = .52) and Perceptual Reasoning (r = .42). Based on the child's achievement in these subtests it is possible to detect individual differences and to provide a prognosis of school performance. When considering the metric characteristics of this test, it is said to be a discriminatory test, the distribution of the results in the suburban and urban sample are within the normal distribution, the Cronbach's alpha coefficient of reliability (α = .79) indicates that the test is sufficiently homogeneous, and the coefficient of validity indicates that TIP–1 clearly predicts general academic achievement (overall school performance) (r = .61) and also the grades for language (r = .69) and mathematics (r = .44) at the end of the first grade, and further, overall school performance (r = .61), and the grades for language (r = .49) and mathematics (r = .54) at the end of the first semester of the second grade.

Procedure

All of the children were tested with TIP–1 and their independent achievement represents the zone of actual development. During the testing, the examiners immediately evaluated the children's answers and then returned to the tasks the children were unable to solve alone. The examiners offered the children two types of support in order to complete the tasks: motivational-affective support, and, if this type of support was not effective, some form of cognitive support was given. Different levels of support were designed for each of the 95 tasks in the test (Luković et al., 2013). In other words, the dynamic assessment sandwich format for procedures was implemented through standardized instructions and the interventionist approach to dynamic assessment was applied (Stacey, 2016; Poehner, 2008; Sternberg & Grigorenko, 2002; Feuerstein et al., 1979).

During the preschool testing the TIP–1 test was administered, which was extended into an instrument for dynamic assessment of the ZPD in children. Additional instructions were formulated for each task on two levels, motivational-affective and cognitive, which were available to the examiners in situations when the children were unable to complete the tasks independently. In that way, the data about the ZAD, i.e., independent performance on the TIP-1 test, and the ZPD, which was measured on the basis of tasks solved in cooperation with a more knowledgeable adult, were obtained for every child in accordance with Vygotsky's socio-cultural theory (Luković et al., 2013).

School performance was assessed via the average mark at two time points: at the end of the first semester in the fourth grade (the last grade of the first cycle of primary education) and at the end of the first semester in the eighth grade which is the last grade of elementary school. We also used the grades in the main subjects at elementary school as indicators of school performance: language and mathematics at the end of the first semester in the eighth grade. As one more indicator we used the performance in three independent final trial tests at the end of elementary school: language, mathematics and the combined test that examines the respondents' knowledge of the contents covered by primary school courses in history, geography, biology, chemistry and physics.

Indicators of school performance: 1) The average mark at the end of the first semester in the fourth grade. This average grade in the Serbian education system is teacher-based and includes the average of grades for different subjects. In our sample there were six classes of students, so these average marks were obtained by six different teachers. Since they apply the same tests when evaluating students' performance, we can say that these measures are comparable, although there may be some variance due to differences in the teachers' perceptions of their students. Previous research has shown that teachers' perceptions of current student performance depend largely on their previous performance and that teacher expectations predict future student achievement (Jussim et al., 1996); 2) The average mark at the end of the first semester in the eighth grade. In the Serbian education system, in the eighth

grade, students have different teachers for each subject they study in primary school, however, although in our sample they were divided into six classes, they have the same teachers for almost every subject; 3) The grades for the main subjects at elementary school: language and mathematics at the end of the first semester in the eighth grade. All of the students have one teacher who teaches language, and another one who teaches mathematics; 4) Performance in three independent final trial tests at the end of elementary school: language, mathematics and the combined test which examines the respondents' knowledge of the contents covered by primary school courses in history, geography, biology, chemistry, and physics.

Taking into consideration that different teachers evaluate students in different grades and in different classes (Jussim et al., 1996) and that teachers' perceptions are an important factor that influences the formation of students' grades, we used the additional measures of the students' achievements in the final trial test. This test is a more objective measure as the grading scale is the same for each student and its subtests are based on standards that are defined for each subject in the Serbian education system.

Results

First of all, the descriptive statistics for the key variables are presented in Table 2. Then, Table 3 shows the inter-correlations and the multicollinearity between the predictor variables.

Table 2
Descriptive statistics for the key variables

Variable	*M*	*SD*	*Min*	*Max*
ZAR	41.61	6.46	24	57
ZNR	1.02	.27	.36	1.80
Motivational-affective scaffolding	.65	.31	0	1.60
Cognitive scaffolding	.36	.14	.12	.73
Performance in the language final trial test	11.51	3.92	2	19.00
Performance in the mathematics final trial test	9.37	3.74	2	18.50
Performance in the combined final trial test	10.20	3.33	2.5	19.50
Average mark in the first semester of the fourth grade	4.38	.711	2	5
Average mark in the first semester of the eighth grade	3.49	1.322	1	5
Grade for language	4.09	.868	2	5
Grade for mathematics	3.83	.949	2	5

Table 3
Inter-correlations and multicollinearity between the predictor variables

Variables	1	2		Collinearity statistics	
				Tolerance	VIF
1 ZNR	1	.39		.85	1.18
2 ZAR		1		.85	1.18
Variables	1	2	3	Collinearity statistics	
				Tolerance	VIF
1 ZAR	1	.28	.17	.67	1.49
2 Motivational-affective scaffolding		1	–.45	.70	1.43
3 Cognitive scaffolding			1	.82	1.23

As can be seen in Table 3 the tolerance and VIF values are within the permissible limits, and the predictors of ZAR and ZNR are moderately related, as is ZAR with motivational-affective and cognitive scaffolding. Secondly, we calculated partial correlations between the ZAD and ZPD of the child, as well as two levels of scaffolding, with all the indicators of school performance already mentioned above controlling the ZAD (Table 4). The zero-order correlations are also presented in Table 4.

Table 4

The partial correlations between the ZAD and ZPD of the child, two levels of scaffolding: motivational-affective and cognitive, and all measures of school performance

	2	3	4	5	6	7	8	9	10	11
1 ZPD	.89**	.03	.27**	.15	.23*	.21*	.26**	.29**	.25**	.39**
2 motivational-affective scaffolding	1	-.43**	.21*	.17	.17	.18	.27**	.34**	.31**	.26**
3 cognitive scaffolding		1	.06	-.08	.08	.02	-.07	-.16	-.19	.20
4 average mark in the fourth grade			1	.53**	.81**	.75**	.31**	.33**	.44**	.45**
5 average mark in the eighth grade				1	.56**	.52**	.64**	.53**	.48**	.25**
6 grade for language					1	.73**	.43**	.46**	.45**	.39**
7 grade for mathematics						1	.38**	.52**	.46**	.42**
8 performance in the language final trial test							1	.68**	.56**	.23*
9 performance in the mathematics final trial test								1	.61	.29**
10 performance in the combined final trial test									1	.32**
11 ZAD										1

Zero-order correlations

ZAD AS CONTROL VARIABLE	2	3	4	5	6	7	8	9	10
1 ZPD	.89**	-.05	.11	.06	.10	.06	.19	.21*	.15
2 motivational-affective scaffolding	1	-.51**	.11	.11	.08	.09	.23*	.28**	.25**
3 cognitive scaffolding		1	-.03	-.13	.01	-.07	-.12	-.23*	-.27**
4 average mark in the fourth grade			1	.48**	.77**	.70**	.24**	.24**	.35**
5 average mark in the eighth grade				1	.52**	.48**	.61**	.49**	.44**
6 grade for language					1	.68**	.38**	.39**	.37**
7 grade for mathematics						1	.32**	.46**	.38**
8 performance in the language final trial test							1	.66**	.53**
9 performance in the mathematics final trial test								1	.57**
10 performance in the combined final trial test									1

Note. $*p < .05$, $**p < .01$.

Table 4 consists of two parts. We can see that the first part shows the zero-order correlations of the variables without controlling the influence of some of them. The lower part of the table shows the correlations with variables controlled by the influence of the ZAD variable because many correlation coefficients have decreased and some are no longer statistically significant.

The control of the variable related to ZAD has a medium influence on the ratio of the variables in the matrix.

From both matrices it can be seen that the correlation of cognitive assistance with all the variables is very weak. The ZAD of the child shows positive but weak correlations with ZPD, the average mark in the fourth grade, grades in the subjects of language and mathematics in the eighth grade, and performance in the combined final trial test. Further, ZAD positively correlates with low intensity with motivational-affective scaffolding, the average mark in the eighth grade and performance in the language and mathematics final trial tests.

The ZPD of the child positively correlates with low intensity and statistical significance with all of the indicators of school performance with the exception of the average mark in the eighth grade.

We calculated the correlations between the ZAD of the child, and two levels of scaffolding with all of the indicators of school performance separately. ZAD shows positive and medium correlations with the average marks in the fourth grade, the marks for language and mathematics and performance in the combined final trial test. Further, ZAD positively correlates with low intensity with the average mark in the eighth grade, and performance in the language and mathematics final trial tests.

Motivational-affective scaffolding positively correlates with medium intensity with performance in the mathematics and combined final trial tests. It shows positive and low correlations with the average marks in the fourth and eighth grades, the grades for mathematics and performance in the language final trial test.

Cognitive scaffolding has a low and negative correlation with performance in the mathematics and combined final trial tests.

Finally, the data were analyzed using multiple stepwise linear regressions with the ZAD and ZPD of the child as predictors and all the indicators of school performance as criteria. The second stepwise linear regression was used with ZAD and two levels of scaffolding: motivational-affective and cognitive as predictors and all the indicators of school performance as criteria.

The series of stepwise regression analyses for each criterion (all measures of school performance), and the predictors (ZAD, ZPD), show that ZAD turned out to be a better predictor for explaining most criterion variables: the average mark in the first semester of the fourth grade ($R^2 = .18$, $\beta = .42$, $p < .001$), the average mark in the first semester of the eighth grade ($R^2 = .06$, $\beta = .25$, $p = .01$), the grade for language ($R^2 = .14$, $\beta = .38$, $p < .001$), the grade for mathematics ($R^2 = .16$, $\beta = .40$, $p < .001$), and performance in the combined final trial test ($R^2 = .09$, $\beta = .30$, $p = .01$).

ZPD proved to be a better predictor of performance in the language final trial test (R^2 = .06, β = .25, p = .01) and performance in the mathematics final trial test (R^2 = .08, β = .29, p = .01).

The results of the stepwise regression analysis with school performance (all measures of school performance) as a criterion, and ZAD, motivational-affective and cognitive scaffolding as predictors are presented in Table 5.

Table 5

The results of the stepwise regression analysis with school performance as a criterion, and ZAD, motivational-affective and cognitive scaffolding as predictors

	Predictors								
	ZAD			Motivational-affective scaffolding			Cognitive scaffolding		
Criterions	R^2	β	p	R^2	β	p	R^2	β	p
Average mark in the first semester of the fourth grade	.18	.42	.00						
Average mark in the first semester of the eighth grade	.06	.25	.01						
Grade for language	.14	.38	.00						
Grade for mathematics	.16	.40	.00						
Performance in the language final trial test				.07	.26	.01			
Performance in the mathematics final trial test				.11	.33	.01			
	ZAD and Motivational-affective scaffolding jointly R^2 = .15								
		.20	.03		.28	.01			
Performance in the combined final trial test				.10	.31	.00			
	ZAD and Motivational-affective scaffolding jointly R^2 = .15								
		.24	.01		.25	.01			

Table 5 shows that ZAD is the best predictor for most of the criteria (the average mark in the first semester of the fourth grade, the average mark in the first semester of the eighth grade, grade for language and grade for mathematics).

Motivational-affective scaffolding is the best predictor of performance in the language final trial test.

The best predictor for performance in the mathematics final trial test and the combined final trial test is motivational-affective scaffolding and ZAD jointly. It explains 15% of the variance both when the criterion is the mathematics test score and when the criterion is a combined test score, which is 4% (for mathematics) and 5% (for the combined test) more variance explained than when only the motivational-affective scaffolding is a predictor.

Discussion

First of all, our findings generally confirm that preschool dynamic assessment measures can be used as predictors of later school performance. As can be seen from the section above, we used different measures as indicators of school performance from different time periods. Taking into account the average mark in the fourth grade we can predict 18% of variance based on the measures gained through preschool dynamic assessment by ZAD in comparison with 6% of variance for the average mark in the eighth grade, 14% for the average mark for language and 16% for mathematics in the eighth grade and 9% of variance in the combined final trial test. Considering the prediction of the average grade at two different points of time during elementary school we can see that ZAD can be used as a predictor of these indicators of school performance. Further, ZPD independently predicts 6% of variance for the language and 8% of variance for the mathematics final trial tests.

When it comes to finding the best model for predicting school performance, the stepwise method indicated that ZAD makes the most statistically significant contribution to predicting school performance with 18% of variance for the average mark in the fourth grade and 5% in the eighth grade, and 14% of variance for the average grade for language and 16% for mathematics in the eighth grade. Motivational-affective scaffolding proved to be the best in predicting language success in the final test and explains 7% of variance. The ZAD and motivational-affective scaffolding proved to be better predictors in the explanation of performance in the mathematics final trial test, as well as the combined test, and explains 15% of the variance in both cases.

Also, partial correlations show that ZAD correlates with medium or low intensity with all indicators of school performance. Additionally, ZPD correlates with the average mark in the fourth grade, although with low intensity, and also with all other indicators with the exception of the average mark in the eighth grade.

Performance in the final trial tests could be considered as the most objective measure of school performance when compared with other measures such as marks in the main subjects and average grades. Different factors influence students' grades during the evaluation process in elementary school. Final trial tests, based on common standards for each subject, are important for students because they are used for entry to high schools in the Serbian education system, and we can presume that the students were highly motivated and also well prepared for these tests.

In the context of dynamic assessment and Vygotsky's theory we can say that certain aspects of social interaction between children and more knowledgeable adults may predict the future performance of the child even four or eight years later, irrespective of what the child is capable of doing alone (Baucal, 2003).

We can also discuss these findings in the context of the validity of the TIP–1 test, since they are consistent with previous results which confirm its validity in terms of the indicators of school performance during the first four

grades of elementary school (Ivić et al., 2004). Our results additionally support TIP–1 as a predictor of average school performance in the fourth and even the eighth grade (and further as a predictor of grades for language and mathematics in the eighth grade, as well as performance in two trial final tests).

Secondly, ZAD is a better predictor of later school performance than ZPD. ZPD can be used as an independent predictor for performance in the language and mathematics final trial tests (6% of variance could be explained in the language and 8% in the mathematics final trial tests by ZPD alone), but not in the combined test. Taking into account the partial correlations, ZPD shows a weak correlation with all the measures of school performance and not only with the average mark in the eighth grade, as mentioned above. These results could be said to be of theoretical value since they are in accordance with the notion of social interaction as defined in Vygotsky's theory on the one hand, and contribute to the attempts to measure the effectiveness of scaffolding on the other (Vigotski, 1977; Wood et al., 1976; Van de Pol et al., 2010). These results support the concept of mediation as defined in the Feuerstein approach (Feuerstein et al., 1979; Feuerstein et al., 1986; Feuerstein et al., 2010; Poehner, 2008). Similar results were obtained and discussed in Baucal (2003).

We may conclude that ZPD can be used as a predictor of later school performance, measured across indicators such as performance in the language and mathematics final trial tests eight years later, independently of ZAD. However, ZAD is generally a better predictor than ZPD when taking into account other indicators such as grades. The question of why ZPD is not a better predictor thus arises. Based on Vygotsky's theory, we might have expected ZPD to be a better predictor of a child's performance than ZAD. Nevertheless, we must take into account that in this study we used measures gained through a preschool test to predict school performance four and eight years later, and not the proximal independent performance of the child. Vygotsky reported that not only did the size of the children's ZPD turn out to correlate well with their success in school (children with a large ZPD were more successful than those with a small ZPD), but that ZPD size was actually a *better* predictor of school performance than IQ (Poehner, 2008; Chaiklin, 2003). ZPD provides better indications for predicting and understanding future cognitive development than measures based on independent achievement, which is ZAD, because they represent the capacities that are based on functions that have already maturated (Chaiklin, 2003). Although ZPD refers to proximal development and reflects the effects of the experimenter's intervention over a short period of time, here we can see that it might be relevant for cognitive development far beyond that of proximal development. We must also emphasize that in this study we considered ZPD only as a measure of children's capacities, and not as a direct predictor of later school performance.

This could also be linked to the nature of the indicators of school performance since the final trial test may be assumed to be a more objective indicator of the students' later performance than school grades. Considering performance in the final trial tests on its own, we can see that ZAD predicts

9% in the combined test, and ZAD in combination with motivational-affective scaffolding proved to be a significant predictor for mathematics and combined tests at 15%, but is not a significant predictor of the language test. On the other hand, ZPD predicts 6% of the variance for the language test, and motivational-affective scaffolding explains 7%. If we observe the mathematics test on its own, ZAD with motivational-affective scaffolding as a model proved to be a significant predictor at 15%, while ZPD predicts 8% of variance. Taking only performance in the final trial tests, into account there are no differences between ZAD and ZPD as predictors.

Bearing in mind that ZAR is a better predictor of student performance measured through students' grades in their main subjects and their average grades than ZPD, we can discuss these results in the context of the teachers' assessment of the students. This result is in line with previous studies that show that students' grades are influenced by teachers' perceptions of their previous achievement and that teacher expectations predict student achievement (Jussim et al., 1996), or, based on our results, we can say that the teachers' approach during student assessment is *less dynamic*. On the other hand, we can see that ZPD is a better predictor of students' performance in the final trial tests which are based on standards defined in the Serbian education system. Future studies should take different factors that affect students' achievement in school into consideration, such are their previous achievement, teachers' perceptions, students' motivation and others.

Here, we also must take into account that we used TIP–1, which consists of very heterogeneous tasks, as an instrument during preschool testing. Future studies need to consider different indicators of children's performance not only during preschool testing, but also in their later performance. Furthermore, four different groups of children were identified during the preschool dynamic assessment based on their levels of ZAD and ZPD: low ZAD – high ZPD, low ZAD – low ZPD, high ZAD – low ZPD, and high ZAD – high ZPD (Luković, 2011; Luković et al., 2013). It is the obligation of future studies to explore the existence of any differences between these different groups of children according to the prediction of later school performance and also based on other variables that could be significant during dynamic assessment. In other words, it might be important to take a different approach into consideration, to implement interventions during assessment that could be more flexible and responsive such as in a clinical approach or interaction procedures (the "cake" format) (Feuerstein et al., 1979; Stacey, 2016; Poehner, 2008; Sternberg & Grigorenko, 2002).

Finally, in terms of ZPD, the first level of scaffolding, that of affective-motivational, is a better predictor of later school performance than the second level of cognitive scaffolding. Based on what children are capable of achieving by means of affective-motivational scaffolding during preschool testing we can predict 7% of variance for the language test, while affective-motivational scaffolding combined with ZAD explain 15% of variance for the mathematics and combined trial final tests. Although cognitive scaffolding is not a significant predictor, it shows a weak correlation with performance in the mathematics and

combined final trial tests. This result is in line with previous research and the affective-motivational level of social interaction with children is thus important because it supports and encourages them to use their individual cognitive capacities (Baucal, 2003). Other authors also emphasize the effects of non-intellectual factors as significant during the assessment of a child's cognitive development (Tzuriel et al., 1988; Haywood & Lidz, 2007). Further, Vygotsky (1977; 1996) also stated that the main task of his further research should be the analysis of the emotional-motivational sphere (Vygotski, 1996). He stated that thought is not yet the last resort, and that we must take into account that thought has its origins in the motivating sphere of consciousness, a sphere that includes our inclinations and needs, our interests and impulses, and our affect and emotion. An affective and volitional tendency stands behind thought (Vygotski, 1977). Vygotsky compares thought to a hovering cloud that gushes a shower of words, and to extend this analogy, he compares the motivation of thought to the wind that puts the cloud in motion.

We also must take into account the research design since affective-motivational scaffolding was always offered to the child first in order to try to solve the task again. It could be suggested that in future research these two levels of scaffolding need to be randomized.

Conclusion

It is important to emphasize that this longitudinal study in the field of dynamic assessment is, to our knowledge, the first such study conducted in Serbia. From our findings it can be concluded that ZAD and ZPD measured through preschool dynamic assessment can be used as predictors of school performance in the fourth and eighth grades of primary school measured through different indicators. Further, motivational-affective scaffolding offered by more knowledgeable adults in social interaction with children during preschool testing can be used as predictor of performance in the final trial tests at the end of elementary school. These results are considered not only in the context of Vygotsky's theory, but also in the context of dynamic assessment with an attempt to examine their theoretical and practical implications.

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Zona aktuelnog i zona narednog razvoja merene dinamičkom procenom na predškolskom uzrastu kao prediktori kasnijeg školskog postignuća – longitudinalna studija

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Cilj ovog istraživanja je da se ispita da li zona aktuelnog i zona narednog razvoja deteta merene postupkom dinamičke procene u predškolskom uzrastu mogu biti prediktori kasnijeg školskog postignuća. Sprovedena je longitudinalna studija. Učestovavalo je 114 učenika osnovne škole "Stevan Čolović" iz Arilja, Srbija (54 dečaka i 60 devojčica). Rezultati generalno potvrđuju da se mere dobijene u postupku dinamičke procene u predškolskom uzrastu mogu koristiti kao prediktori kasnijeg školskog postugnuća. Zona aktuelnog razvoja je bolji prediktor od zone narednog razvoja. Zona narednog razvoja je nezavisni prediktor samo kada je reč o jezičkom i matematičkom postignuću na probnom završnom ispitu. Afektivno-motivacioni nivo pomoći (eng. scaffolding) je bolji prediktor od kognitivnog nivoa pomoći. Ovi rezultati se razmatraju u kontekstu teorije Vigotskog, ali isto tako i u kontekstu procedura dinamičke procene. Razmatraju se teorijske i praktične implikacije za buduće studije afektivno-motivacionih i kognitivnih faktora kao prediktora školskog postignuća.

Ključne reči: dinamička procena, afektivno-motivacioni i kognitivni faktori, zona narednog razvoja, školsko postignuće

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