

**PRRAEPGDA 2020****Personal and Regulatory Resources in Achieving Educational and Professional Goals in the Digital Age****REGULATORY PREDICTORS OF LINGUISTIC COMPETENCIES  
AND ACADEMIC ACHIEVEMENT IN NATIVE LANGUAGE  
AMONG SECONDARY SCHOOL STUDENTS**

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***Abstract***

The article considers the problem of conscious self-regulation and executive functions as different level regulatory predictors of the pupils' success in mastering their native language at school. In empirical study implemented on a sample of 7-9 grade students of the Russian Federation (N = 286) the data were obtained on the conscious self-regulation ("Self-Regulation Profile of Learning Activity Questionnaire – SRPLAQ"), executive functions (Inhibition, Switching, Working memory updating) as well as the Russian language competences in punctuation, spelling, morphology, syntax, semantics, vocabulary, and style. The authors created an empirical model of the regulatory predictors of the language competencies and academic achievement in the mother tongue using structural equation modeling. The model made it possible to confirm that executive functions to a greater degree determine the level of the language competencies development in schoolchildren, whereas the conscious self-regulation makes a significant contribution to their annual assessment in the Russian language. At the same time, executive functions and conscious self-regulation are also interconnected. Executive functions are associated with academic performance indirectly, through the language competencies. The obtained results contribute to scientific ideas about the role of different level regulatory resources in providing academic achievements in mastering the mother tongue at school. The data can also be used to design psychological and pedagogical interventions aimed at the development of both language competencies of students and conscious self-regulation of their learning activity.

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**Keywords:** Conscious self-regulation, executive functions, language competencies.



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## 1. Introduction

The problem of the relationship between different levels of regulation today is of particular importance. Until recently, the studies of conscious self-regulation (as a meta-level of organization of behavior and activity) and its individual cognitive processes (executive functions) went in parallel. However, more and more scientists point to the need of studying the regulatory characteristics of different levels coherently, taking into account their individual specific impact on the productive aspects of activities. Finding solution to the problem of identifying regulatory mechanisms for mastering the native language during the schooling period cannot but follow this trend. Educators and psychologists agree that mastering the native language norms should go hand in hand with development of the regulatory competencies (Rutherford et al., 2018). However, regarding the regulatory predictors, the opinions of researchers diverge. Some studies demonstrate the leading role of executive functions (EF), i.e., the basic cognitive and neurophysiological level, in successful mastering the native language (Baddeley, 2012; Velichkovsky et al., 2019; Verbitskaya et al., 2017; Vitiello & Greenfield, 2017); other studies convincingly prove the priority of conscious self-regulation in this issue (Morosanova et al., 2019). This problem does not exist for the primary school students whose conscious self-regulation is only in the process of formation. However, the question remains, what level of self-regulation is more significant for academic achievements in the middle school: neurophysiological or conscious metacognitive?

The present study analyzes a multi-level system of the cognitive and intrapersonal regulatory resources. Conscious self-regulation (SR) of achieving educational goals is the controlling mechanism for mobilizing all other types of individual resources (cognitive, motivational, intrapersonal) to achieve a result. It is actually a meta-resource, and its existence and development significantly affect the results of achieving any goal (Morosanova, 2015). The success, reliability, productivity and the final result of actions to achieve the goal depend on the degree of development of operational-regulatory processes and regulatory-personal properties. The higher the level of the conscious SR development, the easier is mastering new kinds of activity, the higher stability in stressful conditions.

The basic regulatory level is represented by EF, that is, the regulatory mechanisms of the neurocognitive level. EF are a system of cognitive processes ensuring achievement of significant goals in complex dynamic conditions. Their common feature is rootedness in the activity of the prefrontal cortex. The results of studies in neurophysiology, neuropsychology, and psycholinguistics indicate the existence of relationships between EF and language, speech, and brain functions (Kaushanskaya et al., 2017; Marslen-Wilson & Tyler, 2007; Utekhin & Chernigovskaya, 2019), reveal the role of these functions in learning writing (Berninger et al., 2017). Recently, papers have appeared analyzing the relationship of EF with vocabulary and phonetics knowledge (Allan & Lonigan, 2011), performing tests in the native language (Best et al., 2011). The semantic and cognitive levels, as shown in various studies, are interrelated (Bridgett et al., 2013; Hofmann et al., 2012), but the strength of this relationship and its characteristics are still poorly understood.

In this study, we used Miyake's approach considering three basic EF: switching, inhibition, and updating the working memory (Miyake et al., 2000). Our research data show that conscious SR and EF differ significantly in their contributions to various indicators of success in the Russian language. Thus, individual differences in EF can reduce the effectiveness of SR (Hofmann et al., 2012). Data have been

obtained that the mutual determination of EF and SR largely determines the features of conscious, purposeful and self-regulated cognitive activity of children in different ages (Roebers, 2017).

As indicators of success in mastering the native language, we consider not only academic assessments, but also the level of the language competencies development in various sections of the Russian language (spelling, punctuation, vocabulary, syntax, etc.) Language competencies (LC) are a dynamic unity of 3 components: speech experience, knowledge of the language, linguistic intuition («language sense»). The evidence that possession of LC indicates the mastery of the linguistic norms (Bozhovich, 2016) is the basis for using these indicators to assess academic success in Russian at school. We have already shown that annual assessments of academic performance are largely determined by the general level of conscious SR development, while EF mainly contribute to the LC development (Morosanova et al., 2019). However, it is not possible to identify direct and indirect contributions of the regulatory indicators of different levels and evaluate the size of these contributions without building a structural model (Roebers & Feurer, 2016).

## **2. Problem Statement**

The relevance of the problem of studying the relationship of meta-cognitive levels of regulation and EF is determined by the fact that, on the one hand, researchers acknowledge the existence of relationships between them, and on the other hand – there are no sufficient empirical evidence for this. These links are not always obvious, because they are often complex and are mediocre in nature. Using structural equation modeling to identify hidden relationships is the way to overcome these contradictions.

## **3. Research Questions**

The study was designed to answer the following questions. 1. Which specific features characterize the contribution of regulatory predictors of different levels to the pupils' academic performance and their LC development at the middle stage of schooling? 2. Are there any peculiarities in the SR and EF joint determination of success in mastering the native language? 3. Is there a relationship between EF and conscious SR?

## **4. Purpose of the Study**

The purpose of this study was to test an empirical model of the relationship between the regulatory predictors of different levels (conscious SR, EF) and success in mastering the native language, assessed through indicators of academic performance and the level of LC development in the secondary school students.

## **5. Research Methods**

The study was performed on a sample of the state secondary school students from Moscow and Moscow Region aged 13 – 15 years (N = 286): 7th - graders (N = 147, mean age 13 ± 0,5 years) and 9th

- graders (N = 139, mean age  $15 \pm 0.5$  years). Gender was distributed almost evenly within the sample (50.3 % female).

For assessment of the conscious SR development the «Self-Regulation Profile of Learning Activity Questionnaire – SRPLAQ» was used (Morosanova & Bondarenko, 2015). SRPLAQ items describe typical situations concerning achieving educational goals. These statements are grouped into the following scales: planning, modelling, programming, results evaluation, flexibility, independence, reliability, responsibility. An integrative indicator - General SR level is also estimated by summing up the scores.

We used three standard tasks for the assessment of basic EF (Miyake et al., 2000). To assess inhibition, we used the Eriksen Flanker task. To assess switching we used the Letter-Number task with predictable task changes. To evaluate working memory updating, we used the N-Back task (Velichkovsky et al., 2019). As a result of the factor analysis of the primary data, 10 indicators were formed: Interference suppression and working memory, Attention switching accuracy, Working memory updating accuracy, Working memory updating speed, Attention switching speed, Conflict adaptation, Interference suppression, Cognitive flexibility, Total error correction, Error correction in working memory. To evaluate success in mastering the Russian language as an academic discipline, an annual school assessment in the Russian language (Year score) was used.

We used two tasks for LC diagnostics (Bozhovich, 2016). We factorized the results of these tasks to reduce the analyzed parameters (spelling, punctuation, syntax, style, vocabulary, etc.) and identify latent factors characterizing various LC aspects. As a result, four indicators were obtained: Language proficiency, Literacy, Word structure, Sentence structure. The «Language proficiency» indicator reflects the level of mastering the Russian language and the ability to apply it depending on the situation, largely intuitively without relying on knowledge of the rules formalized in textbooks. It includes stylistic, semantic, and lexical competencies, and it largely characterizes the poorly formalized concept of a «language sense». The second indicator – «Literacy» includes competencies in spelling, punctuation, semantics, and syntax. Formal literacy is associated with knowledge of linguistic norms and ability to apply the relevant rules studied in school in written language. Thus, mastery in punctuation implies the ability to conduct parsing during writing, as a result of which syntactic constructions (for example, participial phrases, rows of homogeneous members) must be recognized and their boundaries defined. «Word structure» indicator includes morphology (a section of the linguistic system that defines grammatical classes of words in a language - parts of speech, their formation and inflection) and spelling. Obviously, we are talking about LC that involves mastering the skill of structural analysis, in this case at the word level. «Sentence structure» indicator is determined, first of all, by the competence in syntax - the grammar section that studies the structure of connected speech and includes two main parts: 1) the doctrine of the phrase (word combinations) and 2) the doctrine of the sentence. It seems logical to include punctuation in this factor, since it is a question of ability to make up a sentence agreed at the level of words and phrases from the words appropriate in meaning. The detailed identification of these indicators has been described previously (Morosanova et al., 2019; Velichkovsky et al., 2019).

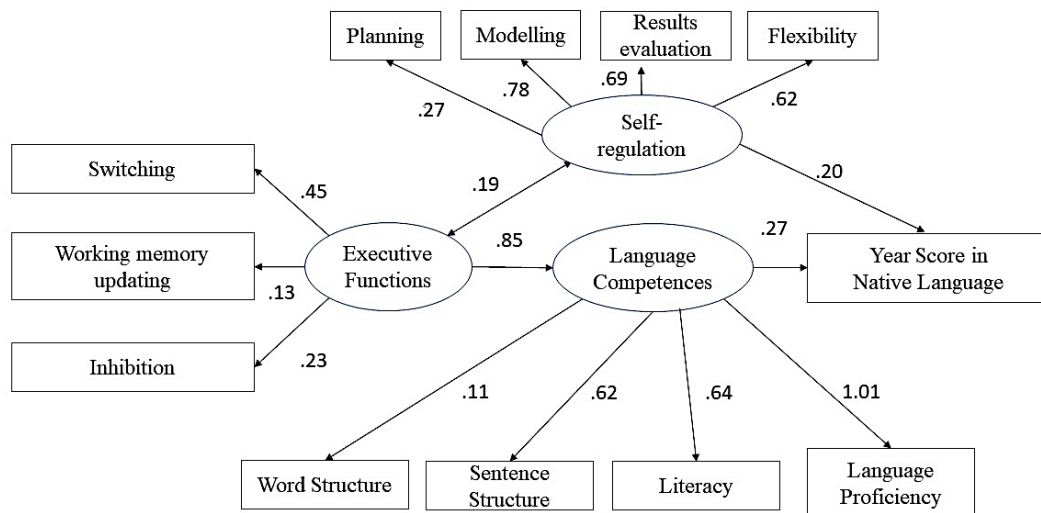
Data analysis. Structural equation modelling (SEM) was used to test the empirical model. All SEM analyses were conducted using AMOS (SPSS 23). Model fit was estimated with the following primary fit

indices: Chi-square test of model fit, root mean square error of approximation (RMSEA) including 90 % confidence intervals (90 % CI), Comparative Fit Index (CFI), Goodness-of-Fit Index (GFI).

## 6. Findings

At the stage of model building, we relied upon the previously obtained data on the identified predictors of success in mastering the Russian language in secondary school (Velichkovsky et al., 2019). These data allowed us to suggest that conscious SR affects the annual assessment in the Russian language directly, and EF – indirectly, contributing to the mastery of language competencies. The indicator of academic performance in the Russian language (Year score) was used as a dependent variable in the model, indicators of SR, LC and EF were used as independent variables. Conscious SR is represented by the latent factor «Self-regulation», which is loaded with four regulatory indicators (Planning, Modelling, Results evaluation, Flexibility). The latent factor «Language competences» includes competencies in various sections of the native language: Word Structure, Sentence Structure, Literacy, Language Proficiency. The latent factor «Executive Functions» is formed by the indicators of Switching, Working memory updating, Inhibition.

The structural equation modelling (SEM) results using the AMOS 23 computer program confirmed the statistical validity of this model. To evaluate the model, we used the following indices of agreement and their admissible values for accepting the model as appropriate for the data: Chi-square / df < 2;  $p > 0.05$ ; GFI > 0.95; AGFI > 0.9; CFI > 0.95; RMSEA < 0.05 (Figure 1).



Note: CMIN/df = 1.06,  $p = .371$ , GFI = .966, CFI = .955, RMSEA = .16, PCLOSE = .959

**Figure 1.** Structural model of regulatory predictors of success in Russian language in secondary school

The resulting model made it possible to establish the specifics of determining success in mastering the mother tongue by the regulatory predictors: conscious SR and EF. Conscious SR makes a direct

contribution to the annual assessment in the Russian language ( $\beta = .20$ ), EF influences it indirectly through LC ( $\beta = .85$ ), whose contribution, in turn, is very significant ( $\beta = .27$ ). Language competencies are represented by all four indicators, the most significant of which – Language proficiency – makes the most significant contribution to LC. Language proficiency expresses a «language sense» since it includes the high-level semantic indicators of written language proficiency associated with the stylistically and lexically correct organization of sentences. Studies of the interconnections of EF with various aspects of LC indicate their significant dependence (Ober et al., 2020). For example, phonological awareness and ability to store speech sounds in working memory are closely related (Lonigan et al., 2009). At the same time, it has been shown that academic skills requiring more complex coordination (e. g., with understanding) are more associated with conscious regulation.

Conscious SR in this model is represented by the regulatory processes of Planning goals, Modelling conditions relevant for achieving goals and Evaluating results, as well as intrapersonal property of Flexibility. Allen, Snow, and McNamara pointed out the importance of flexibility for successful mastering the native language norms: more competent writing is associated with higher flexibility, which, in turn, is a function of individual differences associated with written skills, such as, for example, vocabulary and erudition (Allen et al., 2015). In addition, researchers have shown that children characterized by higher SR levels in preschool and primary school age have a higher vocabulary, phonological awareness, and literacy (Skibbe et al., 2019).

A positive answer is obtained to the third research question about the existence of relationship between EF and conscious SR. Using the model, we confirmed the relationship between conscious SR and EF and evaluated its strength ( $\beta = .19$ ). It's worth saying that this value was obtained on a sample of the middle school pupils. Similar studies for the subject «Native language» in a sample of middle and high school students are very rare (Norman & Furnes, 2016). A particular task of the future research is considering more detailed aspects of this relationship, as researchers agree that SR and EF are closely related ontogenetically (Roebbers & Feurer, 2016).

Thus, the results of structural modeling gave us reason to confirm the hypothesis about the level nature of the regulatory predictors of academic success in the native language. The conscious semantic and cognitive levels, as shown in various studies, are interconnected (e.g., Welsh & Peterson, 2014). The obtained results develop scientific ideas about the contribution of regulatory predictors to academic performance and are in good agreement with a few foreign research data concerning the conscious SR influence on the level of mastering the native language (Skibbe et al., 2019).

## 7. Conclusion

The research results revealed a significant contribution of conscious self-regulation to academic achievement in the native language. It is shown that the basic neurophysiological level of self-regulation, represented by executive functions, acts in two ways. On the one hand, EF are largely responsible for mastering linguistic competencies in specific sections of the native language; this allows EF to contribute to the annual school assessment in this subject. On the other hand, EF are interconnected with conscious self-regulation of educational activity, due to which they indirectly influence academic performance. The results can be used to design and implement psychological and pedagogical interventions aimed at the

development of both language competencies of students and conscious self-regulation of their learning activity.

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