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SELF-REGULATION, PERSONALITY FACTORS, ACADEMIC MOTIVATION, MATH ACHIEVEMENT IN MIDDLE AND SENIOR SCHOOL

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Abstract

The purpose of the present study is to investigate the regulatory, motivational and personal predictors of academic achievement of students in different grades of secondary and senior school and carry out comparative analysis. The study involves 7-11-grade students of Russian secondary schools (N=660). We use the following methods: the Self-Regulation Profile of Learning Activity Questionnaire, the Academic Motivation Scale for Schoolchildren (AMS-S) and the Russian version of the "Big Five Questionnaire - Children (BFQ-C)". The data obtained in the study allow creating five structural models of the relationship of regulatory, motivational and personal characteristics with academic achievement of the 7-11-grade students. Comparative analysis reveals the age-related specificity of the models corresponding to different age groups. The models differ in the composition of components, nature of connections (direct/indirect), and value of the contribution of different factors to academic performance. Analysis of this specificity in the 7-11-grade students highlights two certain trends related to age characteristics of the students, their personal goals, and educational tasks. During the 7th–9th grades, the system of predictors is differentiated and complicated, whereas in the 10th and 11th grades this system is "folded" being reduced to only those resources that lead to the maximum possible results. The interpretation of the revealed differences is presented, taking into account the age features and specific actual tasks of the educational activity.

Keywords: Self-regulation, academic motivation, personality characteristics, achievement.

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1. Introduction

Investigation of the contribution of regulatory, motivational and personal characteristics of students to their academic success in different periods of schooling is an actual task of empirical research. Step-by-step complicating educational tasks, secondary school requires from students the autonomy in implementation of their learning activity, as well as the actualization of self-processes: self-regulation, self-esteem, self-efficacy, etc. (Alves-Martins et al., 2002; Cleary et al., 2009; Eccles et al., 2002; Graham et al., 2005). Researchers show that the role of self-regulation and motivation in the students' academic achievement changes during the schooling process and especially stress the importance of these changes in the transition age (Graber, Brooks-Gunn, 1996; Urdan et al., 2006). The authors point out the need for a deeper understanding the relationship between self-regulation and motivation (Wolters, 2003) as during the transition period one can observe the overall decrease in the internal academic motivation of students - a significant predictor of educational achievement (Gottfried et al., 2001; Gillet et al., 2012; Lepper et al., 2005). The problem of students' internal motivation sources at different stages of schooling as well as clarifying its connection with other predictors of school success, still needs clarification.

Unlike motivation and self-regulation, personality dispositions represent more stable individual characteristics, and, respectively, their role in predicting academic achievement of students is more persistent (Caprara et al., 2011; Chamorro-Premuzic et al., 2003; Poropat, 2009). Conscientiousness has been considered as the basic trait of the Big Five, the most closely linked to the will to achieve (Conard, 2006; Dumfart et al., 2016). At the same time, there is evidence that self-regulation can act as a mediator of the personal dispositions influence on the academic achievement (Bidjerano et al., 2007), and conscientiousness, in turn, is a predictor of internal motivation of schoolchildren (McGeown et al., 2014).

We consider self-regulation of the educational activity as an integrative cognitive-intrapersonal construct. On the one hand, it represents a cognitive system of information processing (including Goal planning, Modeling of significant conditions, Programming of actions and Results evaluation), and, on the other hand, it is represented by the peculiarity of instrumental personality-regulatory properties: Flexibility, Independence, Reliability, Responsibility, etc. This structure of conscious self-regulation emphasizes the meta- nature of this psychological means of mobilizing and integrating both cognitive and personal resources to solve learning problems (Morosanova, 2013). Within the framework of our research domain, we presented numerous studies demonstrating the direct and indirect effects of the conscious self-regulation on the students' academic achievement (Morosanova et al., 2015, Morosanova et al., 2016; Fomina et al., 2017).

We consider academic motivation from the standpoint of the self-determination theory (Ryan et al., 2000) where, taking into account the students' degree of activity, the external and internal motivation is differentiated. Internally motivated behavior is based on the need to be a competent and self-determinated subject of activity.

2. Problem Statement

During the middle school period a certain decline in academic performance and academic motivation is observed. At the same time, students are exposed to more complex and diverse learning tasks. This requires involvement of the conscious self-regulation resources for their solution. In this regard, the actual

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task is to study the structure, specifics and dynamics of the relationship between regulatory, motivational, and personal predictors of students' academic achievement in this period. We believe that this specificity varies in the students of different school grades.

3. Research Questions

The study is to answer the following questions. What are the regulatory, personal and motivational predictors of academic success and the structure of their interrelations among 7-11-grade students? What is their specificity depending on the schooling stage and age characteristics of adolescents? What are the main trends in the determination of academic achievement by non-cognitive predictors for pupils of the 7th-11th grades?

A number of subordinate tasks have been set.

- Creating structural models of the relationship between regulatory, motivational, personal characteristics and academic achievement for the students at different schooling stages.

- Comparative analysis (based on the models) of the identified links specificity and the value of self-regulation, academic motivation, and personal dispositions contribution to academic achievement.

- Revealing the main tendencies in the formation of conscious self-regulation of the educational activity in 7-11th grade students.

4. Purpose of the Study

The present study aims to identify and compare the regulatory, motivational, and personal predictors of the academic achievements of students in different grades of secondary and senior schools.

5. Research Methods

5.1. Participants

660 pupils of 7-11th grades of Russian schools took part in the study. The basic programme of the secondary school was implemented in 6-9th grades. The sample distribution: grade 7 (N=175, M=12.9, σ=0.45), grade 8 (N=142, M=13.8, σ=0.39), grade 9 (N=130, M=14.9, σ=0.44), grade 10 (N=86, M=15.9, σ=0.47), grade 11 (N=105, M=16.8, σ=0.45).

5.2. Measures

«Self-Regulation Profile of Learning Activity Questionnaire» (Morosanova et al., 2015) was used to assess regulatory features. SRPLAQ included 67 statements that describe typical situations concerning achieving learning goals. These statements were grouped into the following 10 scales, each composed of 9 items: planning, modelling, programming, results evaluation, flexibility, independence, reliability, responsibility and social desirability. General level of conscious self-regulation is also estimated by summing up the scores (maximum 58).

"Academic Motivation Scale - School (AMS-S)" (Gordeeva et al., 2017) based on the Academic Motivation Scale (AMS) (Vallerand et al., 1992.). The technique included 8 scales: 3 scales for internal motivation (motivation of knowledge, achievement, and self-development), 4 external motivation scales (motivation of self-esteem, introjected regulation, motivation for parents' respect, external regulation), and

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the lack of motivation scale. This technique corresponded to the current understanding of motivation phenomenon and had a good reliability and validity parameters.

Russian adaptation of the «Big Five Questionnaire – Children (BFQ-C)» - designed to measure personality traits in the children of primary and secondary school age: «Neuroticism», «Extraversion», «Openness», «Agreeableness» and «Conscientiousness» (Malykh et al., 2015). The Questionnaire consists of 62 statements. Reliability of scales in our sample: Extraversion α =0,809, Agreeableness α =0,774, Conscientiousness α = 0,870, Neuroticism α =0,743, Openness α = 0,702.

6. Findings

6.1. Structural models of relationships between the regulatory, motivational, and intrapersonal characteristics and academic achievement of the 7-11th grade students.

Using AMOS (SPSS 22) we examined our hypothesized structural models of regulatory, intrapersonal, and motivation predictors of academic achievement (in Maths) in the middle and senior school. Based on the previous studies (Bidjerano et al., 2007; Komarraju et al., 2009; Ning et al., 2012), we hypothesized that self-regulation and motivation affect academic performance in mathematics directly, while the personality traits - indirectly by means of self-regulation and motivation.

Self-regulation in our models is represented as a latent factor «SR» determined by cognitive processes (Goal planning, Modelling of significant conditions, Programming of actions, Results evaluation) and instrumental regulatory-intrapersonal features (Flexibility, Independence, Reliability, Responsibility). The latent factor «PERSON» is determined by the variables of the «Big Five». All the variables of academic motivation (motivation of knowledge, achievement, and self-development), motivation of self-esteem, introjected regulation, motivation for parents' respect, external regulation, and the lack of motivation scale form a latent factor «MOTIV». Since the general level of conscious self-regulation is changing nonlinearly in 6-11th grades, with a certain «drop» in the 7-8th grades, it was impossible to construct a general model for all 5 grades. Therefore, the structural modelling was carried out for each grade separately. Table 1 shows that indices for the five structural equation models (7, 8, 9, 10, 11th grades) demonstrate a satisfactory fit to the empirical data.

Table 01. Fit indices for the structural equation models of the study variables

Structural models	CMIN/df	GFI	CFI	RMSEA	PCLOSE
Model 1: 7th grade	1.42	.98	.98	.049	.46
Model 2: 8th grade	1.46	.94	.93	.057	.34
Model 3: 9th grade	1.46	.94	.97	.058	.32
Model 4: 10th grade	1.22	.95	.97	.051	.45
Model 5: 11th grade	1.45	.97	.97	.054	.37

Analysis of the models has shown that academic achievement in mathematics depends on regulatory, motivational, and intrapersonal variables. However, the volume of their contribution and the nature of the contribution (direct and indirect) have some age specificity, which required special consideration.

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6.2. Comparative analysis of the interrelations of self-regulation, motivation, personality traits and their contribution to academic achievement in mathematics for 7-11th grade students.

First, we inspected the way (direct or indirect) in which the variables affect academic achievement in mathematics.

Figure 1 shows that in the 7th grade self-regulation and achievement motivation directly influence academic performance (β = .14, ρ <.05), (β = .11, ρ <.05), respectively), whereas personality dispositions, in particular «Openness» - have an indirect influence (β = .37, ρ <.01), mediated mainly by the conscious self-regulation. This fact confirms the previously obtained results.

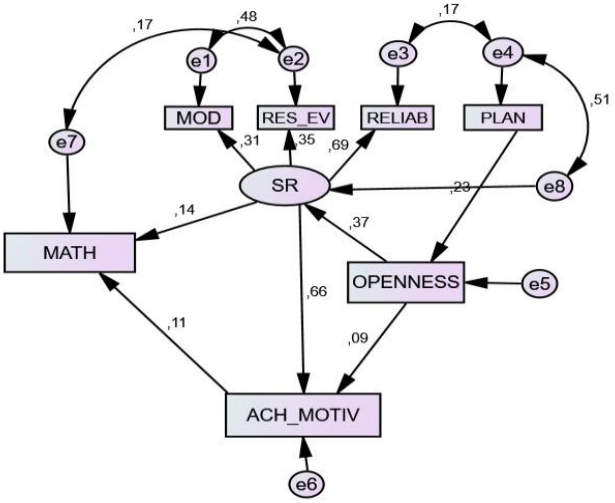

Figure 01. Structural equation model for 7th grade. Standardised path coefficients are shown. SR=self-regulation, MOD=Modelling, RES_EV=Results Evaluation, RELIAB=Reliability, PLAN=Planning, ACH_MOTIV=Achievement Motivation, MATH=Year Grade in MathsType your title here]

Structural equation model for 8th and 9th grades have a similar structure. This congruence of the models can be explained by the similarity of age problems to be solved by adolescents during this period.

Figure 2 shows that in the 8th grade the pattern of the academic performance determination varies. Self-regulation plays a key role both in academic achievement (β=.39, ρ < .01), and in maintaining the motivation (β = .58, ρ <.01). Similarly, it affects the manifestations of Agreeableness, Conscientiousness and Openness to experience (β = .23, ρ <.01). Motivation also makes a significant contribution to these personal dispositions (β = .56, ρ <.01).

The model for 9th grade is in the main similar, the trends revealed in the 8th grade being preserved. The obtained models reflect a well-known characteristic of adolescence: students are focused not so much on achieving educational goals as on the development of one's own personality. Reflexive processes, self-awareness, self-development become the leading motives of behavior. While in the 6th and 7th grades the aspiration for adulthood looks like a willingness to be a good student, then in the 8-9th grades academic success is manifesting itself in different aspects of mental development, primarily - in the emergence of reflection. Not less significant at this age is the inclusion in the peer group, e.g. classmates, which is facilitated by the personality trait of Agreeableness. However, in the 9th grade model, its significance decreases compared to 8th grade. Besides, there exist some changes in the pattern of self-regulation

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determination by the personality traits: Conscientiousness contributes to self-regulation (β = .09, ρ <.05), and the achievement motivation contributes to the Openness to experience (β = .29, ρ <.01). The contribution of motivation to academic success is almost equal to that one of self-regulation (β = .29, ρ <.01). (β = .28, ρ <.01), respectively). Thus, the Model constructed for the 9th grade, reflects the new challenges facing the students in this year. In particular, the focus on personal development, being characteristics for 8th grade, is replaced by the task of successful passing the final exams to obtain a certificate for the main course of secondary school, which is given to Russian schoolchildren after the 9th grade.

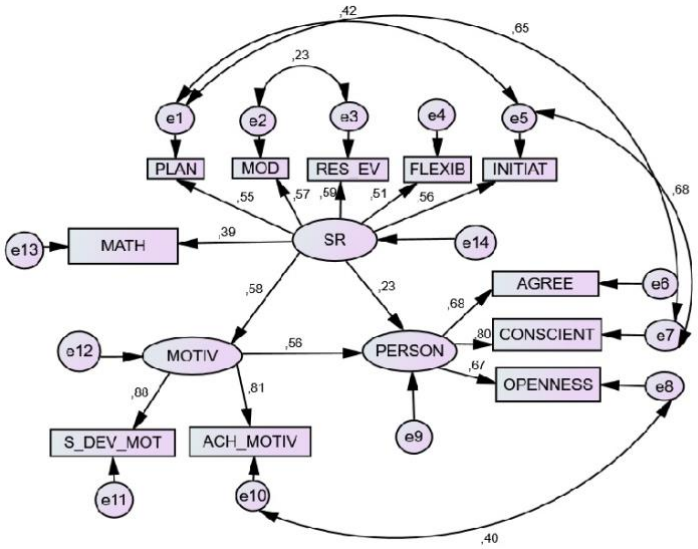

Figure 02. Structural equation model for 8th grade. Standardised path coefficients are shown. SR=Self-regulation, MOD=Modelling, AGREE=agreeableness, CONSCIENT=conscientiousness, RES_EV=Results evaluation, FLEXIB=Flexibility, PLAN=Planning, INITIAT=Initiativity, ACH_MOTIVE=Achievement Motivation, S_DEV_MOT= Self-development Motivation, MATH=Year Grade in Maths.

Structural equation models for the 10th and 11th grades are similar to each other. These senior grades represent the final stage of the secondary school education. Successful passing the Unified State Exam becomes a priority task. The students are interested in obtaining secondary school certificate with good marks, profession choice guidance, planning their further adult life. In this article we present only the model for the 11th grade as most clearly reflecting these trends (Figure 3). The most interesting, in comparison with the 7th, 8th, 9th grades, is the difference in the nature of the self-regulation contribution to academic achievement - it changes. While in the 10th grade a small direct influence is still preserved (β = .10, ρ <.05), then in the 11th grade self-regulation has a highly significant indirect effect on academic achievement mediated by the achievement motivation (β = .53, ρ <.001). Conscientiousness contributes to self-regulation, and it's easy to explain: conscientious pupils plan their goals and objectives, program actions to achieve their goals, feedback helps them to achieve good results on time and without errors, forming and maintaining a regulatory-intrapersonal quality of responsibility. As for neuroticism, its positive role is typical particularly for the middle and senior school students. According to the researchers, this can be

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explained by the fact that during the adolescent crisis anxiety (being characteristic of neurotics) can play an organizing and mobilizing role.

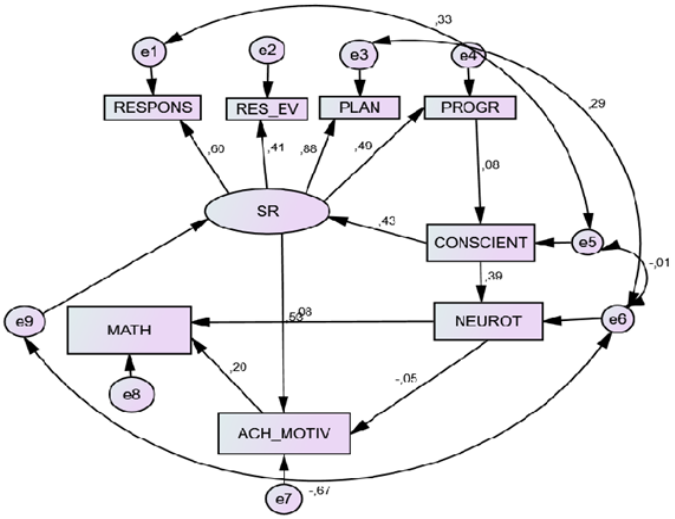

Figure 03. Structural equation model for the 11th grade. Standardised path coefficients are shown. SR=self-regulation, CONSCIENT= conscientiousness, NEUROT= neuroticism, RESPONS=Responsibility, RES_EV=Results evaluation, PROGR=Programming, PLAN=Planning, ACH_MOTIVE=Achievement Motivation, S_DEV_MOT= Self-development Motivation, MATH=Year Grade in Maths

6.3. The main tendencies in the academic achievement determination by non-cognitive predictors for pupils of 7-11th grades.

Self-regulation. The changes of self-regulation contribution to academic performance take place in two stages. During the 7th-9th grades, this system is differentiated and complicated on account of the contribution of the regulatory and intrapersonal properties of Reliability, Flexibility, and Initiative emerging and developing at this age. The indicators of Results Evaluation invariably make the most significant contribution depending on the ability of the student to compare information about the achieved results with subjectively accepted criteria of the learning activities success. In fact, it is a feedback concerning the results of actions to achieve the learning goal. Butler and Winne define feedback in learning activity as information that allows the student to confirm, amplify, modify, regulate, and restructure already existing data. The researchers underline that feedback can be relevant both to the subject area and to ideas of students about themselves or tasks, and cognitive strategies (Butler, Winne 1995). Studies have confirmed that feedback enhances academic achievement, supports academic motivation (Wigfield, et al., 2011) and self-regulation (Zimmerman, et al, 2001).

In the 10-11th grades, the indicators of planning goals and programming of actions, as well as the regulatory-intrapersonal property of Responsibility, make the greatest contribution to academic performance, which may be related to the focus of regulation on professional self-determination and success in the unified state examinations. Analysis of the personality traits contribution to academic achievement confirms the above trend.

As for the personality traits, our study demonstrated that in the 7-9th grades, an indirect contribution to academic performance is being made by Openness, Conscientiousness and Agreeableness, and in the 10-11th grades – by Conscientiousness, which does not require special interpretation and is confirmed in

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the numerous studies. The contribution of Neuroticism to achieving educational goals was discussed in the above paragraph.

Motivation. An invariably significant positive predictor of academic performance is the motivation for achievement as well as the other internal and external motivation forms, depending on the stage of age development. In the 8th grade - it is the motivation for self-development, in the 10th grade, where there are no final exams - introjected motivation, and in the 11th grade, the motivation for achievement again plays a leading role in achieving educational goals.

7. Conclusion

The study has revealed the interrelationships of certain regulatory, motivational, and intrapersonal characteristics with academic achievement in the 7-11-grade students of Russian schools.

Structural models of these relationships demonstrate age-related specificity for the students of the 7th, 8th-9th and 10th-11th grades.

Two main tendencies of academic success determination are described, related with changing educational and personal tasks. In the 7th-9th grades, the system of predictors is differentiated and complicated. In the 10th-11th grades, it is "folded", and the students use only those resources that lead to the maximum possible results.

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