

**PRRAEPGDA 2020**  
**Personal and Regulatory Resources in Achieving Educational and Professional Goals in the Digital Age**

**SELF-REGULATION, TEST ANXIETY, RELIABILITY AND SUCCESS IN THE FINAL EXAM: STRUCTURAL MODEL**

Tatiana Gennadijevna Fomina (a)\*, Elena Valeryevna Filippova (b),  
Varvara Ilyinichna Morosanova (c)  
\*Corresponding author

(a) Psychological Institute of the Russian Academy of Education, Mokhovaya st. 9, bld.4, Moscow, 125009, Russia, tanafomina@mail.ru

(b) Psychological Institute of the Russian Academy of Education, Mokhovaya st. 9, bld.4, Moscow, 125009, Russia, profstest@gmail.com

(c) Psychological Institute of the Russian Academy of Education, Mokhovaya st. 9, bld.4, Moscow, 125009, Russia, morosanova@mail.ru

***Abstract***

The article presents the empirical study results providing reliable data on the role of conscious self-regulation as a significant resource for successful completion of final exams by the Russian school students (N = 231). Participants completed self-reported measures of the self-regulation, test anxiety, personality features. The study also has taken into account the students' results of the Unified State Exam in mathematics. Structural equation modelling was employed to examine the relationships among regulatory, personality, test anxiety characteristics and exam success and reliability of the students' academic results in mathematics. The obtained model analysis shows that reliability of educational activities is primarily associated with pupils' self-regulation reliability and their test anxiety level. At the same time, a successful exam result is determined by the high general level of the learning activity self-regulation and a low test anxiety level. Extraversion affects academic success and reliability indirectly - through self-regulation and anxiety. The research results have confirmed the hypothesis that conscious self-regulation acts as a system-forming factor among significant non-cognitive predictors of the academic success and reliability of students in examination testing situations. Regulatory characteristics to some extent make it possible to compensate for and overcome certain limitations of the temperamental characteristics as well as mediate the test anxiety impact on exam success. The study results provide important data for developing programs of the students' self-regulation training for the high-stakes tests.

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**Keywords:** Self-regulation, test anxiety, exam performance.



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## **1. Introduction**

Up to date educational practice is now almost impossible without specialized forms for assessing the students' knowledge and competencies. Today, students of all educational levels take part in assessment procedures: from the All-Russian Verification Tests in primary school up to the Unified State Exam (USE) in the high school. Test technologies implemented in the USE are the basic form of the school final exams, and their results determine the possibility of entering a university. This fact significantly increases the importance of the USE for students and leads to high psychological tension in the final exam, that doesn't allow successful demonstrating their knowledge. In this regard, there is a need not only for the subject training for examination tests in the USE format, but also for developing certain psychological competencies in the students to ensure stable exam results, to independently build optimal strategies for exam preparation taking into account individual characteristics, and cope with test anxiety.

Considering the factors influencing academic achievement and exam results, the researchers were mostly focused on the cognitive characteristics (Fonteyne et al., 2017). Yet, in recent years, increasing attention has been paid to the non-cognitive factors of academic success. The studies demonstrated significant positive effects of self-efficacy, motivation, and self-regulation on the academic achievement (Lee & Stankov, 2018; Richardson et al., 2012). Test anxiety turned to be the most powerful negative predictor of achievement, whereas 15 % to 22 % of modern students demonstrate a high level of this characteristic (Thomas et al., 2018; Von der Embse et al., 2018). At the same time, test anxiety also negatively affects students' motivation, self-efficacy, and academic self-esteem (Roick & Ringeisen, 2017).

This fact urges demand for studying internal psychological resources for reducing anxiety in exam situations. Currently, more and more studies appear considering, among the factors of academic achievement, various types of psychic self-regulation (Baumeister, 2018; Zimmerman & Schunk, 2011). Recent studies have shown that exam results are largely influenced by motivational self-regulation as well as optimal exam preparation strategies (Eckerlein et al., 2019).

We consider the learning activity self-regulation as a cognitive-personal system of conscious advancing educational goals and managing their achievement. In our empirical studies we demonstrated that conscious self-regulation contributes significantly to academic performance and mediates the impact of cognitive and personality predictors on academic achievement (Morosanova & Fomina, 2017). We also revealed that reliability of conscious self-regulation serves as the psychological basis for reliability of students' actions in situations of knowledge testing and is actually a universal regulatory resource ensuring examination success (Morosanova & Filippova, 2019; Morosanova et al., 2020).

## **2. Problem Statement**

The Unified State Exams in Russian schools are considered to be the high-stakes tests. Their result determines the possibility of obtaining a higher education. Educational practice has shown that one of significant factors of success in passing the tests is the ability of students to cope with test anxiety. As a rule, psychological preparation for exams includes recommendations for reducing anxiety. At the same time, in our opinion, equally essential is to actualize students' internal resources - and their development

and improvement, in addition to reducing anxiety, will contribute to the development of confidence and self-efficacy. Such resources include conscious self-regulation. Studying the mechanisms of the self-regulation influence on the test anxiety, academic success and performance reliability in exam situations is an urgent task of modern research. This knowledge allows planning and implementing in educational practice the effective technologies of psychological training of students for participating in high-stakes tests.

### **3. Research Questions**

The present study was aimed to answer the questions significant for the educational system. Firstly, how the conscious self-regulation of learning activity is associated with the final examination success? Secondly, which regulatory characteristics make a significant contribution to the reliability of students' actions in exam situations? Thirdly, how the specificity of the learning activity self-regulation is associated with the students' test anxiety level and their personality features?

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

The study had its purpose to create and analyze a generalized model of the regulatory and intrapersonal predictors of successful performance and reliability of students' educational results in situations of the final exam testing. This task was the logical conclusion of our research work on summarizing the main results obtained in the framework of the study of conscious self-regulation as a pupils' significant resource for successful completion of the final exams.

### **5. Research Methods**

#### **5.1. Participants**

The study involved high school students in Grade 11 of the Russian state schools in Moscow city aged from 16 to 18 years ( $M = 17.31$ ,  $SD = 0.48$ , 53 % males). The total number of participants in the sample was 231. A survey of students was conducted individually and/or in group form. At the end of the academic year, the Unified State Exam results were collected after the school testing as well as the data on annual algebra achievement.

Parental and school consent was obtained for all participants. Analysis was carried out on the depersonalized data. The study was conducted in accordance with the Helsinki Declaration. Ethical agreement and consent for access to school were provided by the Psychological Institute of the Russian Academy of Education.

#### **5.2. Measures**

##### **5.2.1. Self-regulation**

For the assessment of conscious self-regulation, the Self-Regulation Profile of Learning Activity Questionnaire (SRPLAQ) was used (Morosanova & Bondarenko, 2017). It includes 67 statements describing typical situations of achieving educational goals and generates ten scales: planning (e.g., I often try to set a certain amount of time needed to complete the learning task); modeling (e.g.,

Unexpected changes in the timetable throw me off my stride); programming (e.g., When preparing for a test (exam), I usually think over the order of studying the material); results evaluation (e.g., Even when I'm tired, I tend to study until I'm satisfied with the result); flexibility (e.g., If I need to get prepared for a lesson, I can work even in an uncomfortable and unfamiliar situation); independence (e.g., I use every opportunity to make reports in class); reliability (e.g., I do not postpone preparing for the lessons even if I'm tired or feel sick); responsibility (e.g., I do not give up preparing for the lessons even if I have to choose between studying and spending time with my peers); social desirability (e.g., I always admit my mistakes); and the general level of self-regulation as a cumulative scale. Coefficients of internal consistency of items for each scale range from 0.58 to 0.76, indicating an overall reasonable homogeneity of the items in each scale.

### **5.2.2. Test anxiety**

For measuring the students' anxiety arising in situations that assess their knowledge, skills and competencies, the Russian adaptation of Spielberger Test Anxiety Inventory (TAI) was used (Spielberger et al., 2004). The TAI is a psychometric scale for measuring individual differences in test anxiety as a situation-specific personality trait. It includes 20 statements. Respondents are asked to answer how often they experience anxiety symptoms before, during and after exams. The TAI technique allows for evaluating three indicators: test anxiety (20) and its two main components – worry (8) and emotionality (8). The Cronbach's internal reliability coefficient obtained in our study was 0.87 for the emotionality scale and 0.92 for the worry scale.

### **5.2.3. Personality**

Russian version of Eysenck Personality Inventory (EPI) was used to assess extraversion and neuroticism. The Cronbach's internal reliability coefficient obtained in our study was 0.86 and 0.93 accordingly.

### **5.2.4. Academic achievement and final exam scores**

We used the students' annual marks in mathematics (algebra) and results of the Unified State Exam in mathematics as measures of mathematical achievement. Russian schools assess students' performance using a 5-point system, with grade 5 indicating excellent performance, 4 – good performance, 3 – satisfactory performance, 2 – bad performance (fail), and 1 – very bad fail. Most students receive grades of 3 – for the year, with grade 2 being extremely rare, and grade 1 being practically unused. Unified State Exam grades (score on a 0 – 100 scale) for mathematics were obtained from the school records.

### **5.2.5. Data analysis**

Structural equation modeling (SEM) was used to test our empirical model. All SEM analyses were conducted using AMOS (SPSS 26). Model fit was estimated with the following primary fit indices: Chi-square test of model fit ( $\chi^2$ ), root mean square error of approximation (RMSEA) including 90 % confidence intervals (90 % CI), comparative fit index CFI, GFA, AGFI.

## 6. Findings

Data analysis was performed by means of structural equation modeling (SEM) using the IBM SPSS AMOS 26 computer program. Figure 1 presents an a priori hypothetical model. It includes two latent variables: Self-Regulation (SR) and Test Anxiety as well as three explicit variables: USE result in math, a student's performance reliability measure calculated on the basis of the student's exam score matching his/her annual achievement on the subject («Exam Reliability»), and an indicator of extraversion as a personality trait («Extraversion»). Introducing each variable in the model, we considered its correlations with other variables, including the factors of the measuring model. Correlations of the variables are given in Table 1.

**Table 1.** Bivariate intercorrelations among the study variables (N = 231)

Model Variables		F1 SR	F2 Test Anxiety	USE result in math	Exam Reliability	Extraversion
F1 SR	r	1	-.332**	.278**	.125	-.182**
	p		.000	.000	.058	.006
F2 Test Anxiety	R	-.332**	1	-.337**	-.508**	-.192**
	p	.000		.000	.000	.003
USE result in math	r	.278**	-.337**	1	.499**	.044
	p	.000	.000		.000	.508
Exam Reliability	r	.125	-.508**	.499**	1	.105
	p	.058	.000	.000		.072
Extraversion	r	-.182**	-.192**	.003	.105	1
	p	.006	.003	.044	.072	

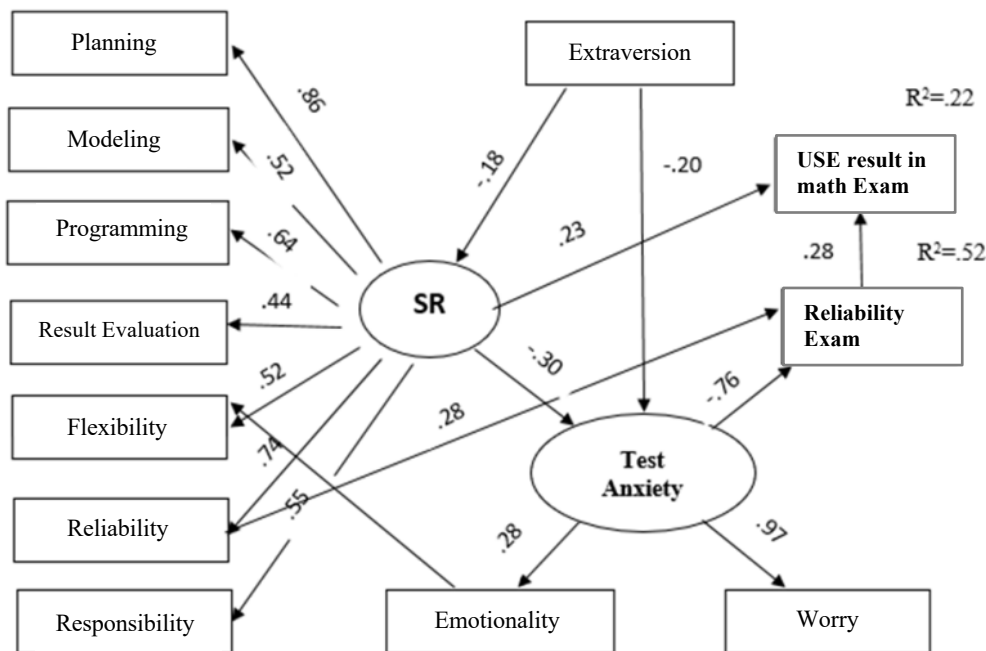
The latent variable SR corresponds to the «General level of self-regulation», which manifests itself in explicit variables represented by the regulatory parameters (Planning, Modeling, Programming, Evaluation, Flexibility, Reliability, Responsibility). The latent variable «Test Anxiety» manifests itself in explicit variables - indicators of Worry and Emotionality. It can be noted that regulatory variables almost equally load the «General SR» factor, whereas «Test anxiety» factor is heavily loaded with «Worry» variable (this is indicated by a higher regression weight of this variable).

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.

Test anxiety has a negative impact on academic results in all types and forms of the students' knowledge assessment. The nature of anxiety is largely determined by the personality factors. Studying significant resources that help students cope with anxiety symptoms is the basis for effective psychological interventions in preparing students for exams. In this study, we summarized our data on the relationships between conscious self-regulation, test anxiety, personality characteristics, and exam performance.

Structural equations modeling made it possible to create a model of regulatory and personality predictors of exam success and reliability on the example of USE in mathematics, taking into account the direction of cause-and-effect relationships. According to the model obtained, the reliability of educational

results is primarily associated with self-regulation reliability and test anxiety levels of students. At the same time, exam success is determined by the general level of learning activity self-regulation as well as the test anxiety level. As for the temperamental features, extraversion affects exam success and reliability indirectly, through the factor of self-regulation. Extraversion, being directly not linked to success and reliability, is at the same time negatively associated with anxiety. These results are in line with the other researchers' conclusions that extraversion is either not directly related to the academic success, or these connections are weak and are not reproduced in all samples (Chamorro-Premuzic & Furnham, 2003; Nofle & Robins, 2007). There are also research data showing that extraversion is negatively associated with test anxiety (Chamorro-Premuzic et al., 2008). The relationship between extraversion and the self-regulation also looks natural. Personality and temperamental dispositions largely determine individual typical, stylistic patterns of regulating goal-achievement and modulate the individual profile of self-regulation (Morosanova & Konož, 2001). However, their manifestation may vary depending on degree of a subject's activity (agency) in the process of achieving the accepted goals. Students with higher self-regulation of their learning activities demonstrate less anxiety in the knowledge testing situations, higher values of conscientiousness and openness to new experience (Dörrenbächer & Perels, 2016).



Note. Significant effects shown as standardized coefficients; SR – self-regulation

**Figure 1.** Structural equation modeling

## 7. Conclusion

Thus, the results obtained suggest that self-regulation (both the general level of its development and its particular components) can act as a system-forming factor among the other significant non-cognitive predictors of academic success and reliability in examination testing situations. On the one hand, conscious self-regulation of the learning activity allows for compensating and overcoming some

limitations of the personality temperamental characteristics. On the other hand, – it acts as a mediator of the test anxiety impact on exam results. Analysis of the students' regulatory and intrapersonal characteristics can become the basis for assessing effectiveness of the psychological tools developed for reducing exam tension and predicting examination success.

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