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Russian Psychological Journal

Russian Psychological Journal is a peer-reviewed open access journal that publishes original research papers on all aspects of psychology.

It was founded by the Russian Psychological Society in 2004.

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All manuscripts submitted to the journal undergo a double-blind peer review process involving at least two experts.

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Russian Psychological Journal accepts theoretical, methodological and empirical contributions relating to scientific research results and achievements in implementation of these results and other innovations in the field of psychology.

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Adaptive Potential of Students of Different Age Groups During a Pandemic

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Abstract
Introduction. This paper demonstrates the importance of studying adaptive potential in students during a pandemic and its parameters as a basis for mental health and psychological well-being. The authors describe the structure and key parameters of adaptive potential in their relation to hardiness. This study aimed to investigate associations of psychological flexibility as a predictor of adaptability with other manifestations of adaptation mechanisms. This paper brings new insights into the dynamics of adaptability at different stages of adolescence. **Methods**. The study sample comprised 67 students aged 18 to 24 years (Mean ± SD = 20.7 ± 1.8). Diagnostic instruments: (a) the Hardiness Survey by S. Muddy, (b) Young Schema Questionnaire, YSQ-S3R, (c) Ways of Coping Questionnaire, WCQ, by R. Lazarus, and (d) Clinical Questionnaire for Detection and Evaluation of Neurotic States by K. K. Yakhin and D. M. Mendelevich. All statistical analyses were performed using IBM SPSS Statistics 27 software. Methods of mathematical statistics: Pearson's correlation coefficient, parametric Student's t-test, and Mann–Whitney U-test for independent samples. **Results and Discussion**. Correlation analysis showed the existence of strong inverse correlations of hardiness with maladaptive schemas, including 'vulnerability', 'distrust', 'submission', 'failure', 'rigid standards', 'dependence/helplessness', and 'defectiveness', as well as neurotic states and coping strategies. Therefore, the authors identified two contradictory trends in adaptation to the COVID-19 pandemic in different age groups. The scales of early maladaptive schemas (EMS) and coping strategies have numerous positive correlations, except for the 'decision planning' strategy, which correlates negatively with certain schemas. The authors consider EMS as a manifestation of psychological rigidity, which reduces adaptive potential. The absence of pronounced maladaptive schemas increases adaptive potential. There is a positive age-related dynamics in the development of individual adaptation capabilities. The resistance indicator increases and the EMS manifestation decreases with age.

Keywords
hardiness, maladaptive schemas, coping strategies, adaptive potential, psychological flexibility, adaptation mechanisms, students, age-related dynamics, COVID-19 pandemic, correlation analysis

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Highlights

- The structure of adaptive potential is formed by high rates of hardiness and manifestations of psychological (cognitive and behavioral) flexibility.
- Adaptive potential increases with age. At different ages, the mechanisms of adaptation are different.
- Indicators of psychological well-being increase with age. The trend towards neurotic defensive reactions decreases; psychological flexibility increases due to the formation of cognitive and behavioral flexibility.
- Preventive and corrective work aimed at the formation of flexible cognitive attitudes and the expansion of the repertoire of behavioral responses contributes to the development of individual adaptive potential.

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Kulikova, T. I., & Filippova, S. A. (2022). Adaptive potential of students of different age groups during a pandemic. *Russian Psychological Journal*, *19*(1), 6–18. https://doi.org/10.21702/rpj.2022.1.1

Introduction

The COVID-19 pandemic has changed many areas of human activity and has also created massive psychological challenges. The response of populations to the pandemic has played an important role in the emergence and wide spread of adjustment disorders (Enikolopov, Boiko, Medvedeva, Vorontsova, & Kaz'mina, 2020). Researchers both in Russia and abroad point to an increase in the number of anxiety factors, changes in individuals' habitual behavior (Chertovikova, 2018; Quansah et al., 2022). Periods of self-isolation in a pandemic situation were associated with considerably increased levels of stress, anxiety, and depression, which represent internal conditions that directly and adversely affect the general well-being of an individual (Makarova & Tsvetkova, 2020; Almondes et al., 2021; Nash, 2021). For example, a study of emotional exhaustion in Chilean students during the pandemic showed that 15 % of students had serious mental health problems; moderate depression increased from 17.7 % to 20.7 %, severe depression increased by 5.2%, severe anxiety increased from 16.7 % to 26.4 %, and severe stress increased from 9.4 % to 15.9 % (Martinez-Libano, Yeomans, & Oyanedel, 2022). Emotional exhaustion refers to a situation that negatively affects an individual's life and that is characterized by a considerable decrease in psychological well-being (Chertovikova, 2018; Eidel'man, 2016; Hendriksen et al., 2021; López-Valenciano, Suárez-Iglesias, Sanchez-Lastra, & Ayán, 2021).

The authors have examined individuals' adaptive capabilities (Karapetyan & Glotova, 2018) and adequate attitudes to the current situation, even in a pandemic (Malykh & Sitnikova, 2021), as determinants of psychological well-being. In both evolutionary and psychological terms, an indicator of an individual's well-being is their ability to adapt to environmental conditions (Aleksandrova, 2004). The high adaptive potential is due to the breadth of the range of cognitive, emotional, and behavioral responses. Having an extensive repertoire of reactions and the ability to switch flexibly between them, it becomes possible to satisfy the conditions and requirements of the current situation to the maximum. Psychological (cognitive and behavioral) flexibility promotes adaptation while psychological (cognitive and behavioral) rigidity reduces individual adaptive capabilities.

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Cognitive flexibility is an individual's ability to quickly change the habitual way of thinking, abandon habitual but ineffective behavioral patterns, and adapt behavior and style of thinking to the environment. Cognitive rigidity, on the contrary, is understood as an individual's inability to change ideas about the environment in accordance with its real changes and, as a result, the use of inadequate stereotypical forms of behavior in a particular situation (Yashin, 2015).

In a previous study (Filippova, Pazukhina, Kulikova, & Stepanova, 2019), the authors have found that rigidity negatively correlates with the indicators of hardiness, while the lack of personal flexibility positively correlates with hardiness and a tendency to form neurotic defensive reactions. The authors conclude that the rigidity of personality traits reduces adaptive potential, while neurotic reactions can be considered as a transient (and successful) mechanism of adaptation to the environment increasing hardiness. In this study, we also rely on the key ideas of the cognitive-behavioral approach that the condition for successful adaptation is the flexibility of perception, thinking, and behavior, whereas the rigidity of cognitive and behavioral patterns affects adaptive mechanisms and hardiness.

During the period of university studies, which covers different periods of adolescence, there is an increased emotional excitability (imbalance, mood swings, anxiety, etc.) (Dontsov & Dontsova, 2013; Beiter et al., 2015; Quansah et al., 2022). The age crisis is complicated by the specifics of the student's life situation, which requires the preparedness and ability of students to cope with various personal, academic and social problems (Krasnova-Gol'eva & Kholmogorova, 2011; Valenti & Faraci, 2021).

A comparative analysis of psychological maladjustment among students of the system of secondary vocational education and higher professional education has made it possible to state that the severity of symptoms of emotional maladaptation in university students is higher compared to secondary vocational education students. According to the authors, an important aspect of psychological maladjustment is social anxiety (Gorchakova et al., 2013), which is based on "an increase in social responsibility, the need to follow social norms, an increase in needs against the background of a lack of opportunities to satisfy them, a change in priorities in the motivational sphere, etc." (Dontsov & Dontsova, 2013, p. 42). This can have a serious negative impact on the adaptation process, as well as on the student's quality of life (Aleksandrovskii, 2012; Petrova & Nazarenko, 2021).

During this period the most relevant behavioral methods to overcome emerging difficulties associated with both external and internal specific requirements are coping strategies. People use these strategies to cope with stress, including the one caused by the pandemic, as well as personal resources that affect the mechanism of the adaptation process, forming associations with symptom complex of hardiness and neurotic reactions.

The adaptation potential is a hierarchical structure, the formation of which is laid in the early stages of embryogenesis. CNS properties create canvas for emotional and behavioral response to frustration and stress. The highest level of the adaptation process is personal. It is formed on the basis of the interaction of the individual with the environment. Under the influence of similar conditions, various individuals can have similar beliefs and behavioral patterns formed. The author of the scheme therapy Jeffrey Young called them early maladaptive schemas (hereinafter referred to as EMS) (Young, Klosko, & Weishaar, 2003).

A number of works of modern Russian researchers show the EMS relationship with psychological well-being (Bogdanov, Galimzyanova, Kas'yanik, Romanova, & Zavarzina, 2019; Tikhomirova &

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Grishina, 2016), depressive disorders and addictions (Kadyrov & Mironenko, 2017), and personality disorders (Kholmogorova, 2014). They also show the dynamics of the severity of EMS at different stages of adulthood (Galimzyanova, Kas'yanik, & Romanova, 2016).

We deem it to be relevant in the established pandemic conditions to consider the structure of the adaptive potential of students at different stages of youth in the context of its dependence on cognitive and behavioral flexibility/rigidity.

This *study aims* to evaluate the adaptive potential of students during the COVID-19 pandemic period and to characterize the dynamics and mechanisms for adaptation of students in different age groups.

Methods

A total of 67 TSPU students at the age of 18 to 24 participated in our study of the adaptive potential of students during the pandemic. The average age of the subjects was 20.7 ± 1.8 years, and the median age was 21 years. The criterion for dividing the subjects into two groups was the median value of age: group 1 – age ≤ 21 years and group 2 – age 22+. We divided the subjects into two age groups and analyzed the differences between them in terms of the studied indicators.

The following psychological assessment tools: (a) the Hardiness Survey by S. Muddy (Leont'ev & Rasskazova, 2006), (b) Young Schema Questionnaire, YSQ-S3R, modified by P. M. Kasyanik and E. V. Romanova, (c) Ways of Coping Questionnaire, WCQ, by R. Lazarus, and (d) Clinical Questionnaire for Detection and Evaluation of Neurotic States by K. K. Yakhin and D. M. Mendelevich. All statistical analyses were performed using IBM SPSS Statistics 27 software. Descriptive statistics methods were used; the data were presented as mean and standard deviation (Mean ± SD), quartile measurement (Me [Q1; Q3]). We also calculated the asymmetry coefficient (As) and excess kurtosis (Ek) to assess the normality of the distribution. In order to establish the tightness of the connection between the studied parameters the study used Pearson's correlation coefficient (r). The parametric Student's t-test and the Mann–Whitney U test for independent samples were used as a method for comparing quantitative indicators.

Results and Discussion

The primary descriptive analysis of the entire sample (n = 67) was carried out without division into groups in order to obtain comprehensive information about the data of the empirical study, the distribution and homogeneity of the data, the presence of errors and outliers, and the possibility of using parametric analysis methods.

The study carried out the analysis of the obtained data on the S. Muddy's vitality test in two ways using a parametric (Student's t-test) and a non-parametric test (Mann–Whitney U test). As a result, we found that between the two experimental groups (≤ 21 and 22+) there were differences in the indices of the structural components of hardiness (p-value < 0.001). The average score on the 'hardiness' scale in both the first and second groups was in the range of the average value, the median indicators were also close to the average value in both groups. Thus, the adaptive potential of the sample during the pandemic can be generally characterized as quite high.

The study found the dynamics of hardiness indicators at different stages of adolescence (Pearson's coefficient). Structural components of hardiness (involvement and risk acceptance) in different age groups had different levels of manifestation: involvement and age had a positive relationship (r = 0.428; p < 0.001), risk acceptance and student age had a weak positive relationship

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(r = 0.271; p < 0.001). We also found the internal consistency of the involvement and risk-taking scales (r = 0.885; p < 0.001).

Using the regression analysis, we obtained a model of the dependence of hardiness on age (without division into groups), which is characterized by a non-linear change in the hardiness index (Fig. 1).

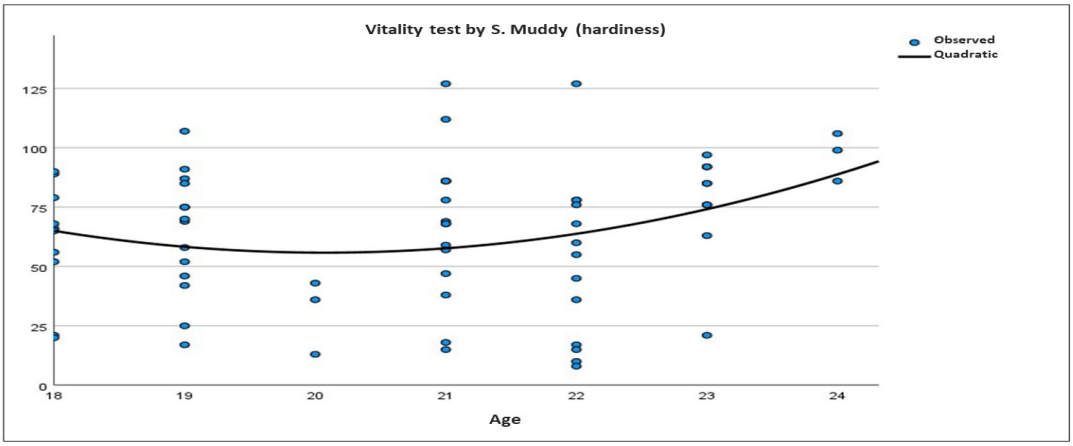

Figure 1. Regression model of hardiness versus age (without division into groups)

We found that the period from 18 to 21 years of age has a slight decrease in the indicators of students' hardiness, but at the age of 22+ there is an increase and then a gradual increase in hardiness.

To determine the dominant neurotic states according to the Clinical Questionnaire by K. K. Yakhin and D. M. Mendelevich, we performed a descriptive analysis of the results of the entire sample (n = 67) without division into groups (Table 1).

Table 1

Descriptive analysis of the results of the sample (n = 67) without division into groups according to the Clinical Questionnaire by K. K. Yakhin and D. M. Mendelevich

Scale name	Mean ± SD	Me[Q1; Q3]	min; max
Anxiety	1.32 ± 4.25	1.52 [–1.33; 4.68]	–7.11; 8.62
Neurotic depression	–0.09 ± 4.92	1.16 [–3.1; 3.41]	–12.86; 8.15
Asthenia	2.44 ± 4.33	3.07 [–0.06; 5.45]	–9.07; 9.67

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Table 1

Descriptive analysis of the results of the sample (n = 67) without division into groups according to the Clinical Questionnaire by K. K. Yakhin and D. M. Mendelevich

Scale name	Mean ± SD	Me[Q1; Q3]	min; max
Conversion disorders	0.89 ± 4.49	2.15 [–2.92; 4.33]	–9.04; 7.03
Obsessive-phobic disorders	–0.28 ± 3.96	–0.22[–2.29; 2.02]	–10.6; 6.28
Autonomic disorders	2.13 ± 7.58	3.08 [–3.5; 8.52]	–16.33; 14.28

According to the values of the mean and median indicators, the study identified two dominant scales – 'neurotic depression' and 'obsessive-phobic disorders'. Comparing the distribution of two age groups according to the selected scales (Fig. 2, 3), it is possible to see that the main part of the group of students aged 22+ is concentrated on both scales within the boundaries of the 'boxes' from –2.52 to 4.75, while the main part the age group of students ≤ 21 ranges from –11.25 to 6.72. Obviously, the degree of data scatter in the 22+ group is less than in the group ≤ 21. Thus, the group of students aged ≤ 21 (especially those aged 19–20 years) is prone to the formation of neurotic reactions.

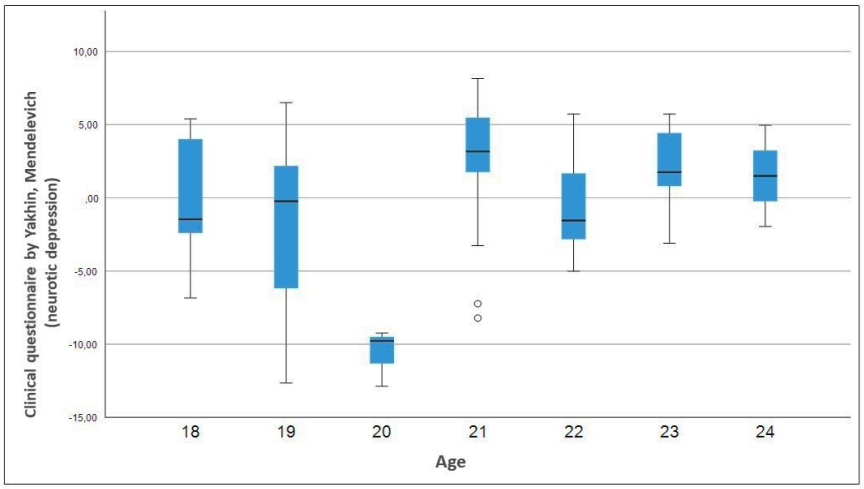

Figure 2. The manifestation of indicators in students of different age groups on the scales of 'neurotic depression' and 'obsessive-phobic disorders'

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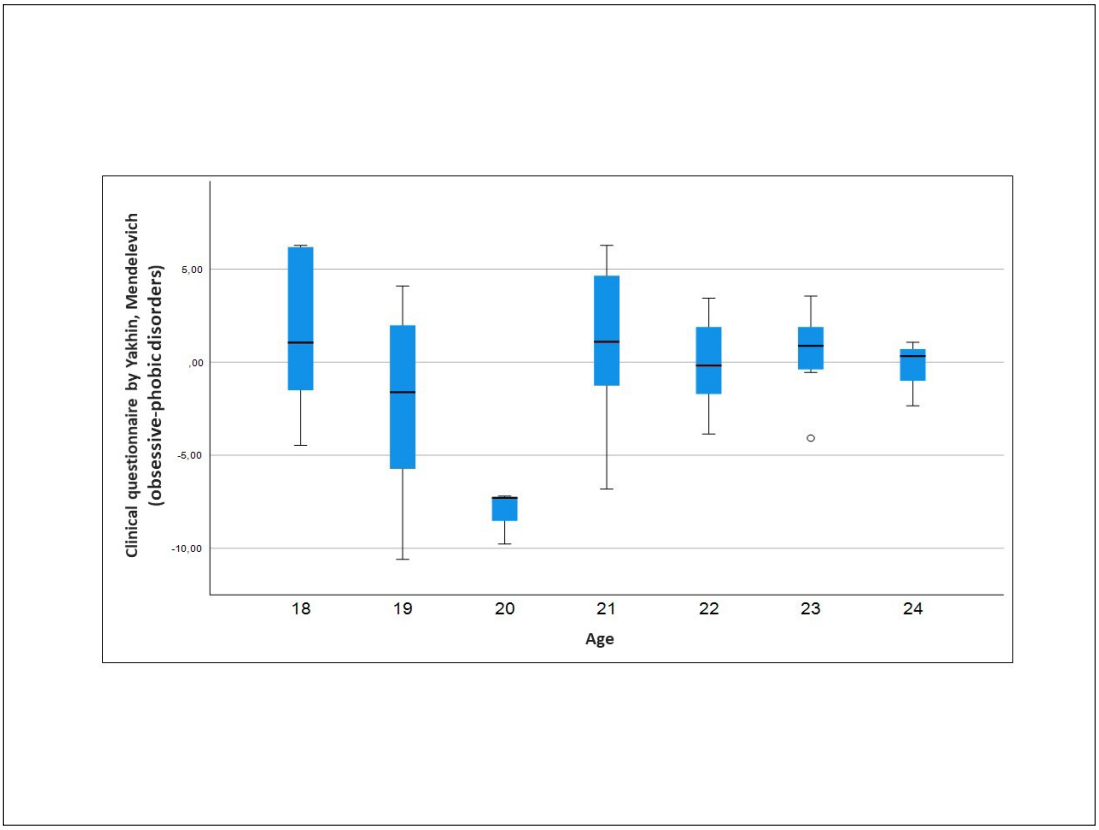

Figure 3. The manifestation of indicators in students of different age groups on the scale of 'obsessive-phobic disorders'

Despite the fact that the tendency to develop neurotic reactions falls under the clinical diagnosis of neurosis, we should take into account the positive correlation of these reactions with hardiness parameters and the negative correlation with EMS. Consequently, it is possible to consider neurotic reactions as a transient, leveling with age, mechanism of adaptation to external conditions.

Based on the enlarged categories (domains) of maladaptive schemas identified by Young (Young et al., 2003), we identified four significant ones among the respondents, including breakdown of ties and rejection (BTR), impaired autonomy (IA), focus on others (F/O) (impairment of the need for self-esteem and self-acceptance), and hypervigilance and inhibitions (HI) (impairment of the need to freely express individual needs and emotions).

The most prominent maladaptive categories were 'breakdown of ties and rejection' (BTR) and 'hypervigilance and inhibitions' (HI). In these categories, we found 14 statistically significant connections between individual schemas (with coefficients $r = 0.271 \div 0.709$, at $p < 0.01$ and $p < 0.05$). The connections found indicate the internal consistency of the test, as well as the totality of the maladaptive mentality – maladaptive attitudes in a certain area (domains) do not exist in isolation from others.

Based on the results of the summary report on observations ($n = 67$), we constructed a chart of the age dynamics of the manifestation of maladaptive schemas among students (Fig. 4).

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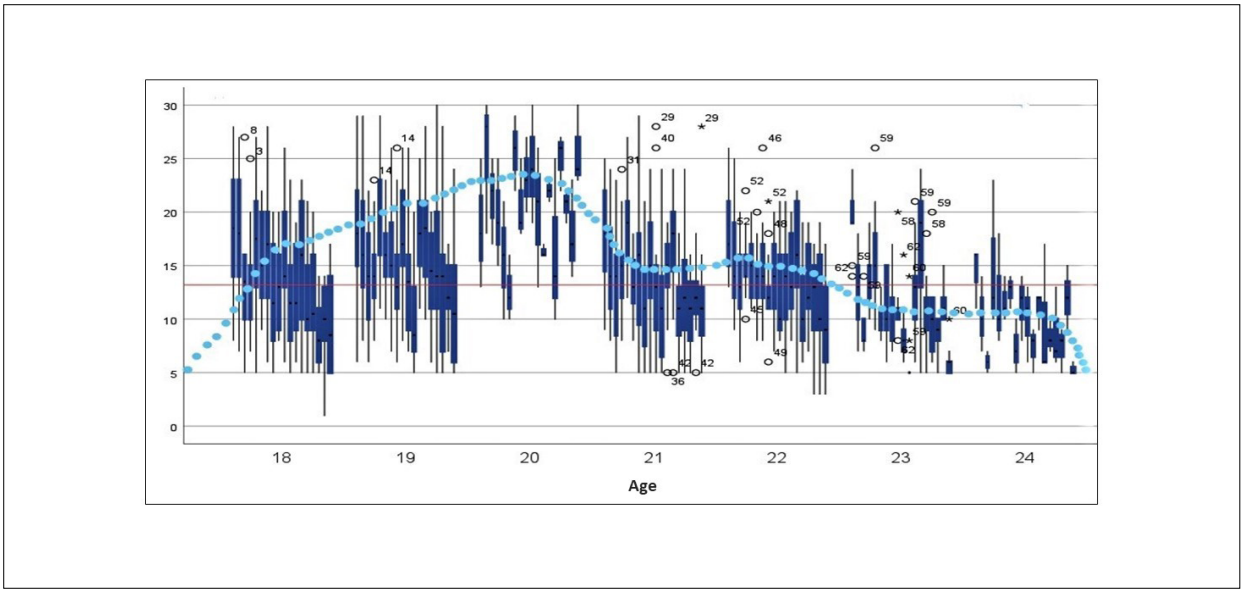

Figure 4. Chart of the age dynamics of the severity of maladaptive schemas among students

We found that the greatest manifestation of maladaptive schemas falls on the age of 19-20 years and significantly exceeds the median values; in the period of 21–22 years of age there is an 'equalization' and in 23–24 years – a decrease in the severity of EMS in students.

The age dynamics of EMS is consistent with the data on the dynamics of hardiness and the dynamics of neurotic reactions, which suggests that the adaptive capabilities of students increase with age.

Correlation analysis (r-Pearson's coefficient) shows numerous connections between the scales of EMS, hardiness, neurotic states, and coping strategies (Table 2).

Table 2
Correlations between indicators of hardiness, maladaptive domains, coping strategies, and neurotic states

Maladaptive domains		Hardiness parameters				Neurotic states	
		Iv	C	Ra	Hd	Nd	OPs
BTR	S2		–0.519**			–0.515**	–0.702**
	S7	–0.575**	–0.652**	–0.595**	–0.326*	–0.638**	–0.620**
	S10					–0.682**	–0.524**

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Table 2
Correlations between indicators of hardiness, maladaptive domains, coping strategies, and neurotic states

Maladaptive domains		Hardiness parameters				Neurotic states	
		Iv	C	Ra	Hd	Nd	OPs
IA	S4	–0.538**	–0.638**	–0.520**		–0.623**	–0.491**
	S6	–0.470**	–0.606**	–0.527**		–0.571**	–0.605**
	S5				–0.575**		–0.367*
F/O	S3	–0.475**	–0.661**	–0.543**	–0.425**	–0.620**	–0.709**
HI	S8		–0.529**		–0.530**	–0.565**	–0.693**
	S9	–0.369*	–0.649**	–0.376*	–0.348*	–0.602**	–0.454**
	S2	–0.492**	–0.690**	–0.589**	–0.385**	–0.727**	–0.586**
Coping strategies	Sc		–0.435**	–0.353*	–0.375*	–0.624**	–0.518**
	Ar		–0.375*			–0.350*	–0.357*
	F/A		–0.564**	–0.357*	–0.447**	–0.582**	–0.659**
	Pr			0.336*			
Neurotic states	Nd	0.448**	0.642**	0.567**	0.404**		
	OPs	0.388**	0.600**	0.522**	0.448**		

Notes: 1. The table uses the following abbreviations: *BTR* – breakdown of ties and rejection; *IA* – impaired autonomy; *F/O* – focus on others; *HI* – hypervigilance and inhibitions; *S1* – rigid standards; *S2* – distrust; *S3* – vulnerability; *S4* – suppression of emotions; *S5* – submission; *S6* – negativism/pessimism; *S7* – alienation; *S8* – failure; *S9* – dependence/helplessness; *S10* – defectiveness; *Sc* – self-control; *Ar* – acceptance of responsibility; *F/A* – flight/avoidance; *Pr* – positive revaluation; *Nd* – neurotic depression; *OPs* – obsessive-phobic syndrome; *Iv* – involvement; *C* – control; *Ra* – risk acceptance; *Hd* – hardiness.

2. * Correlation is significant at the *0.05* level; ** Correlation is significant at the *0.01* level.

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We considered the dominant schemas, strategies and states in the sample. EMS, as well as coping strategies, had strong negative relationships with hardiness. At the same time, neurotic states positively correlated with hardiness and negatively correlated with EMS and coping. Obviously, neurotic states have a positive effect on the adaptation process.

In addition, the EMS scales and coping strategies had numerous positive relationships ($p < 0.01$), with the exception of the 'decision planning' strategy, which had negative relationships with some schemas found in the sample ($p < 0.01$; $p < 0.05$). The observed correlations give grounds to consider EMS and coping as manifestations of psychological rigidity that reduce the potential of an individual's hardiness. In other words, it is possible to argue that the presence of strict, rigid rules and attitudes that determine the behavior of an individual in a stressful situation reduces adaptive capabilities.

The process of adaptation to the conditions of the pandemic at student age can be described as successful; the level of adaptation increases with age. Sensitivity and a tendency to neurotic defense mechanisms ensure psychological flexibility in early adolescence; it is ensured by cognitive and behavioral flexibility at older ages.

Adaptive mechanisms of the neurotic type can be considered as transient states, characteristic, to a greater extent, of early youth; they bring psychophysiological discomfort, which increases the likelihood of seeking specialized help.

Psychological rigidity can be identified using the EMS questionnaire and coping strategies; both are manifestations of rigid beliefs and rules that reduce the range of behavioral response to the current situation. An exception (in our sample) is the 'solution planning' coping strategy, which probably allows taking into account the current environmental parameters and individual resources.

Manifestations of maladaptive schemas at the subjective level are not perceived as sharply as neurotic ones. Rigid attitudes and beliefs are assessed as normative. There may be no critical attitude towards them.

Conclusion

Thus, we may conclude that individuals characterized by cognitive and behavioral flexibility and those characterized by cognitive and behavioral rigidity are prone to the manifestation of opposite adaptive tendencies. The adaptation process proceeds more successfully in individuals characterized by cognitive and behavioral flexibility, who do not have pronounced EMS. The adaptation process proceeds differently at different stages of adolescence.

EMS is the psychological rigidity of an individual's worldview and his/her self-image, the stagnation of adaptive mechanisms, and the complexity of rapid restructuring in changing conditions. This fact explains the complexity of forming the intention to seek psychological help and formulating a request.

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Author Contribution

T. I. Kulikova developed the research concept, supervised the study, analyzed and interpreted the results, prepared and edited the text of the manuscript.
S. A. Filippova carried out the empirical study, collected the data, worked with sources, and wrote the overview part of the article.

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Moral Orientations as a Factor in the Development of Ideas About Ideal Fatherhood Among Students

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Abstract

Introduction. For the period until 2025, the most important goals and concerns of the state youth policy of the Russian Federation should be focused on instilling traditional family values, ensuring a positive attitude towards family and marriage among young people, as well as creating the image of a successful young family focused on having many children. The implementation of these goals raises the question of what determinants contribute to the formation of harmonious, complete, and adequate ideas about fatherhood among student youth. **Methods**. This study reports and generalizes the content of the related psychological and pedagogical literature. The Personal Moral Self-determination questionnaire by A. E. Vorob'eva and A. B. Kupreichenko was used to determine a dominant moral orientation. The study used the following psychological assessment instruments to diagnose the content characteristics of ideas about ideal fatherhood: (a) Osgood's semantic differential (a modified version), (b) the Incomplete Sentences Test, and (c) the Role Expectations and Claims in Marriage questionnaire by A. N. Volkova. Mathematical and statistical methods included criteria for comparing distributions, multiple regression analysis, and correlation analysis. **Results**. This study demonstrates for the first time a significant influence of moral personality orientations on the value of the 'ideal father' category for young men and women. This section includes a description of the content of ideas about ideal fatherhood depending on students' moral orientations and gender. **Discussion**. A comparative analysis of statistical data allows us to conclude that there are significant differences in the ideas about the ideal father depending on the moral orientation of young men and women. The presented data open the way for a number of promising directions of research in the subject area of the psychology of fatherhood, including 1) practice-oriented development of technologies for the formation of complete and adequate ideas about fatherhood by educating students with a humanistic and world-creating orientation; 2) identification of age-related differences in ideas about fatherhood depending on an individual's moral orientation to determine the age period as sensitive for the development of a value-positive attitude towards fatherhood among students.

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Keywords
ideas, image, fatherhood, ideal father, moral orientations, egocentric orientation, group-centric orientation, humanistic orientation, world-creating orientation, student youth

Highlights
- Moral orientations are predictors of the value of the 'ideal father' category. Young men have a significant influence of group-centric and world-creating orientation. Humanistic orientation is characteristic of young women.
- The fullness of young men's ideas about the ideal father is determined by a dominant moral orientation. With the severity of the world-creating orientation young men's ideas about the ideal father are characterized by the completeness of the formation of the cognitive component and the actualization of role claims in the parent-educational sphere.
- Young women's ideas about fatherhood are determined by moral orientations. The image of the ideal father contains the features that are characteristic of emotionally involved fatherhood (empathy, patience, role expectations in the emotional and psychotherapeutic sphere).

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Introduction
According to the order of the Government of the Russian Federation No. 2403-r of November 29, 2014 the provisions of the Fundamentals of the State Youth Policy of the Russian Federation for the period until 2025 are focused on strengthening traditional family values, forming the image of a successful young family living in a registered marriage, and developing positive parenting and psychological and pedagogical competence in the field of child-parental relations. However, there is an increasing trend of negative influence of LGBT community activists promoting same–sex marriage, gender inclusivity, gender reassignment, etc. on modern youth. The problem of instilling the values of family culture in the youth environment raises the question of what socio-psychological determinants contribute to the development of family self-determination, the formation of harmonious, complete and adequate ideas about motherhood and fatherhood which are the indicative basis of activity in the implementation of the parental function.

In recent years, a public demand has been formed to support the institution of fatherhood, the implementation of a system of measures for the formation of responsible and productive paternal behavior. In modern psychology, the relevant areas of research in the phenomenology of fatherhood are the following:
- reasons for the crisis of fatherhood and masculinity (Kon, 2009; Schoppe-Sullivan & Fagan, 2020; Petts, Shafer, & Essig, 2018);

– studying the father's influences, functions, and roles in child development and education (Garfield, Fisher, Barretto, Rutsohn, & Isacco, 2019; Cabrera, Volling, & Barr, 2018; Golombok et al., 2018; Tsvetkova & Rybakova, 2018);
– research of gender aspects of parenthood, i.e. identification of differences in the motivational-need, behavioral, and functional spheres of motherhood and fatherhood (Zinovieva, Kazantseva, Pleshkova, & Kostromina, 2019; Karabanova, 2015; Jeynes, 2016);
– determining the influence of fatherhood on the development of men's personality (Zakharova, 2015; Zavgorodnyaya, 2017; Saxbe, Rossin-Slater, & Goldenberg, 2018);
– identification of features of ideas about fatherhood and factors determining the content and structural characteristics of the image of the ideal father (Borisenko & Belogai, 2007; Vagapova, 2015; Zakharova, Karabanova, Starostina, & Dolgikh, 2019; Merzlyakova, Golubeva, & Bibarsova, 2020);
– development of technologies for social and psychological and pedagogical support of parents-fathers (Zagvyazinskii & Chekhonin, 2017; Borisenko, 2017; Semenova, Serebryakova, & Knyazeva, 2018; Golubeva & Merzlyakova, 2019).

Previous studies have suggested that the features of ideas about fatherhood (ideal father, I am a future father) are determined by gender (Vagapova, 2015; Merzlyakova, 2019), age (Borisenko & Belogai, 2007; Zakharova et al., 2019), the type of family self–determination (Merzlyakova & Bibarsova, 2018), and the structure of value-based orientations (Merzlyakova et al., 2020). In this article we consider moral orientations as a personal factor that determines the features of the image of the ideal father among students.

B. S. Bratus' distinguishes four levels in the personality structure: 1) egocentric level; 2) group-centric level; 3) prosocial or humanistic level; 4) spiritual or eschatological level (Bratus', 1993). A. B. Kupreichenko and A. E. Vorob'eva have developed diagnostic tools to determine which moral type is dominant – egocentric orientation, group-centric orientation, humanistic orientation, and world-creating orientation (Kupreichenko & Vorob'eva, 2013). The Justice – Caring questionnaire by S. V. Molchanov is designed to identify the orientation towards 'justice' or 'caring' when determining the level of development of moral judgments in accordance with the periodization of L. Kohlberg and K. Gilligan – N. Aizenberg (Molchanov, 2007). Numerous studies examined the features of moral orientation in primary school age (Karabanova, Kovaleva, Loginova, & Molchanov, 2014), differences in moral orientations among students in the field of economics, management, advertising, and psychology (Vorob'eva, 2016), the relationship of moral orientations and subjective well-being of youth of various ethnic groups (Bocharova, 2016).

This study aims to analyze the features of ideas about ideal fatherhood among students who differ in their moral personality orientations. We hypothesized that the features of ideas about ideal fatherhood are determined by gender and moral orientation. To verify this hypothesis, it is necessary to achieve the following objectives:

1) to determine the influence of the parameters of moral orientation on the development of ideas about ideal fatherhood by the value factor among young men and women to build a regression relationship between these characteristics;

2) to identify meaningful characteristics of ideas about ideal fatherhood depending on moral orientationы of young men and women.

Methods

To determine students' dominant moral orientations, we used the Personal Moral Self-determination questionnaire by A. E. Vorob'eva and A. B. Kupreichenko (Zhuravlev & Kupreichenko, 2007).

To identify the features of ideas about ideal fatherhood, we used the following psychological assessment instruments: (a) Osgood's semantic differential (a modified version) (Solomin, 2001), (b) the Incomplete Sentences Test (Yan'shin, 2021), and (c) the Role Expectations and Claims in Marriage questionnaire by A. N. Volkova (Volkova, 1990).

Mathematical and statistical methods were used during the analytical stage which made it possible to establish the reliability of the study results. All calculations were performed using the IBM SPSS Statistics 21. The analysis included descriptive statistics, Kolmogorov–Smirnov criterion for one sample, Shapiro–Wilkes criterion, Spearman rank correlation (rs), Pearson linear correlation (r), and multiple regression analysis.

Results

The sample comprised 490 students of Astrakhan universities, 126 (25.7 %) of whom were young men and 364 (74.3 %) of whom were young women.

To study the influence of the parameters of moral orientations on the idea of fatherhood by the value factor, we used multiple regression analysis which allowed us to model the dependence of the 'ideal father' variable on a number of predictors, including 'egocentric orientation', 'group-centric orientation', 'humanistic orientation', and 'world-creating orientation'. In the group of young men, the constructed regression model had a high level of significance because statistics of the F-criterion F = 4.661 at the p = 0.002 significance level. Table 1 shows that such variables as 'group-centric orientation' and 'world-creating orientation' make a significant contribution to the explanation of the response variance. The multiple regression model is adequate and explains more than 13 % of the total response variance. Consequently, moral orientations are one of the factors determining the development of the value of ideas about the ideal father among young men.

Table 1
Multiple regression analysis of the influence of moral orientations on the idea of ideal fatherhood among young men

Variables	B	SH_B	β	t	p
Constant	–0.143	0.099		–1.438	0.153
Egocentric orientation	–0.110	0.100	–0.097	–1.095	0.276
Group-centric orientation	–0.299	0.105	–0.272	–2.857	0.005

Table 1
Multiple regression analysis of the influence of moral orientations on the idea of ideal fatherhood among young men

Variables	B	SH_B	β	t	p
Humanistic orientation	0.000	0.102	0.000	0.004	0.996
World-creating orientation	0.385	0.103	0.391	3.731	0.000

Note: R = 0.365; R^2 = 0.134; F = 4.661; p = 0.002.

Similarly, in the group of young women the constructed regression model has a high level of significance: F = 4.548 at p = 0.001. The results presented in Table 2 indicate that the 'humanistic orientation' independent variable makes a significant contribution to the explanation of the variance of the 'ideal father' response. The multiple regression model is adequate and explains more than 4 % of the total response variance. Thus, moral orientations are one of the factors determining the development of the value of ideas about the ideal father among young women.

Table 2
Multiple regression analysis of the influence of moral orientations on the idea of ideal fatherhood among young women

Variables	B	SH_B	β	t	p
Constant	0.208	0.045		4.679	0.000
Egocentric orientation	–0.078	0.047	–0.091	–1.679	0.094
Group-centric orientation	–0.019	0.049	–0.022	–0.383	0.702
Humanistic orientation	0.136	0.062	0.149	2.174	0.030
World-creating orientation	0.057	0.061	0.062	0.937	0.349

Note: R = 0.220; R^2 = 0.048; F = 4.548; p = 0.001.

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The next step of the study was the analysis of the differentiation of the image of the ideal father depending on the moral orientation of young men and women. Using correlation analysis, we studied the relationship between the 'ideal father' variable and the content characteristics of the cognitive, emotional, and behavioral components of ideas about fatherhood. Further, as a result of the ranking procedure by the value of the correlation coefficient at the level of statistical significance, a hierarchy of meaningful characteristics in the ideas about the ideal father was established from the most important to the less significant.

Ideas about the ideal father among students with an egocentric personality orientation

We found that 19 young men (15.1 %) and 31 young women (8.5 %) had an egocentric personality orientation. Figure 1 demonstrates that the content and hierarchy of qualities in the image of the ideal father of young men and women do not coincide. Young men with an egocentric personality orientation have elements of cognitive and emotional components in their ideas of the ideal father. We observed the following hierarchy of content-based characteristics: 1) personal independence ($r_s = 0.764$ at $p < 0.001$); 2) positive attitude towards future children ($r_s = 0.708$ at $p = 0.001$); 3) industriousness ($r_s = 0.702$ at $p = 0.001$); 4) caring ($r_s = 0.675$ at $p = 0.002$); 5) patience ($r_s = 0.663$ at $p = 0.002$); 6) respect for others ($r_s = 0.631$ at $p = 0.004$); 7) balance ($r_s = 0.627$ at $p = 0.004$); 8) positive attitude towards family as a social institution ($r_s = 0.559$ at $p = 0.013$); 9) performance of duties ($r_s = 0.529$ at $p = 0.02$); 10) achievement ($r_s = 0.467$ at $p = 0.044$).

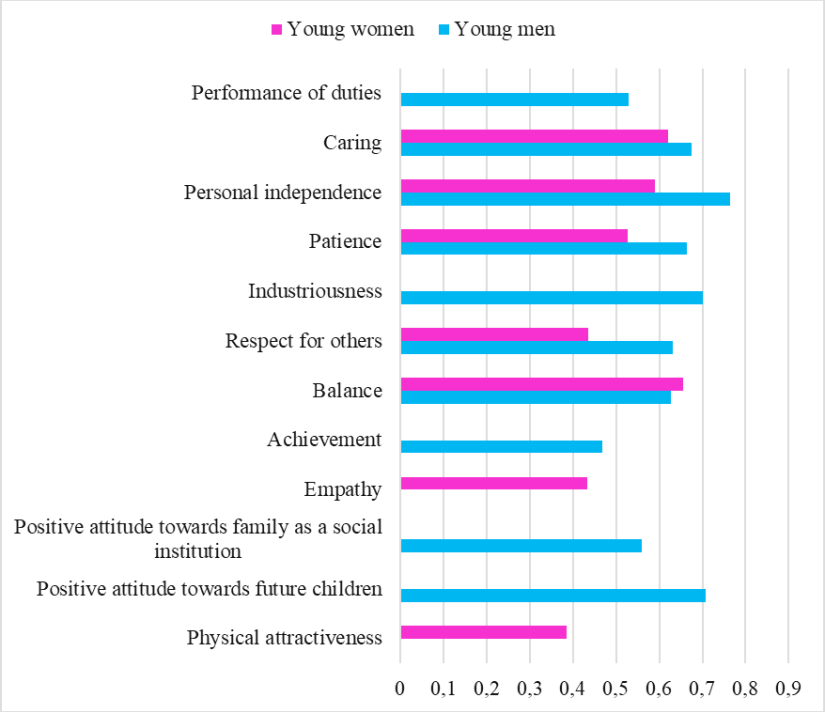

Figure 1. The image of the ideal father among students with an egocentric personality orientation, correlation coefficient

Among young women, the image of the ideal father consists of fewer content-based characteristics compared to young men; it includes elements of cognitive and behavioral components. The content-based characteristics form the following hierarchy: 1) balance (rs = 0.655 at p < 0.001); 2) caring (rs = 0.62 at p < 0.001); 3) personal independence (rs = 0.589 at p < 0.001); 4) patience (rs = 0.526 at p = 0.002); 5) respect for others (rs = 0.435 at p = 0.014); 6) empathy (rs = 0.433 at p = 0.015); 7) physical attractiveness (rs = 0.386 at p = 0.032).

When forming ideas about the ideal father, young women with an egocentric personality orientation are guided by the image of their father, as we found a significant positive correlation between these variables (rs = 0.474 at p = 0.007).

Ideas about the ideal father among students with a group-centric personality orientation

When analyzing the results, we identified 16 young men (12.7 %) and 34 young women (9.3 %) with a group-centric personality orientation. The band diagrams (Fig. 2) clearly show that the ideas about the ideal father of young men and women of this typological group do not coincide. Among young men, the image of the ideal father consists of 5 elements of the cognitive component which have the following hierarchy: 1) personal independence (r = 0.815 at p < 0.001); 2) industriousness (r = 0.676 at p = 0.004); 3) patience (r = 0.63 at p = 0.009); 4) caring (r = 0.529 at p = 0.035); 5) empathy (r = 0.517 at p = 0.04).

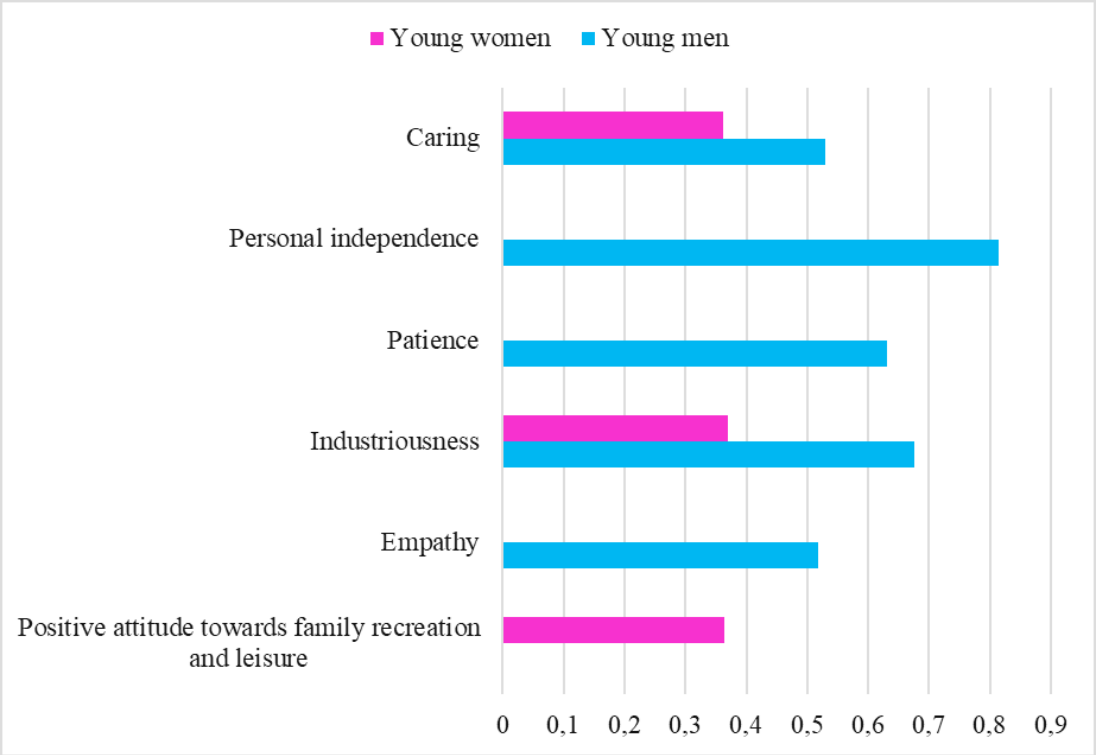

Figure 2. The image of the ideal father among students with a group-centric personality orientation, correlation coefficient

Young women's ideas about the ideal father contain elements of cognitive and emotional components. We observed the following hierarchy of content-based characteristics: 1) industriousness (rs = 0.369 at p = 0.032); 2) positive attitude towards family recreation and leisure (rs = 0.363 at p = 0.035); 3) caring (rs = 0.362 at p = 0.036).

Ideas about the ideal father among students with a humanistic personality orientation

In our study 17 young women (13.5 %) and 74 young women (20.3 %) had a humanistic personality orientation. The content characteristics and their hierarchy in the image of the ideal father of young men and young women do not coincide (Fig. 3). Young men's ideas about the ideal father contain 5 elements of the cognitive component. We observed the following sequence of qualities in the image of the ideal father: 1) performance of duties (r = 0.699 at p = 0.002); 2) caring (r = 0.696 at p = 0.002); 3) achievement (rs = 0.67 at p = 0.003); 4) industriousness (r = 0.649 at p = 0.005); 5) respect for others (r = 0.587 at p = 0.013). The positive correlation between the variables of 'my father' and 'ideal father' (r = 0.547 at p = 0.023) indicates that young men of this typological group are guided by the image of their own fathers.

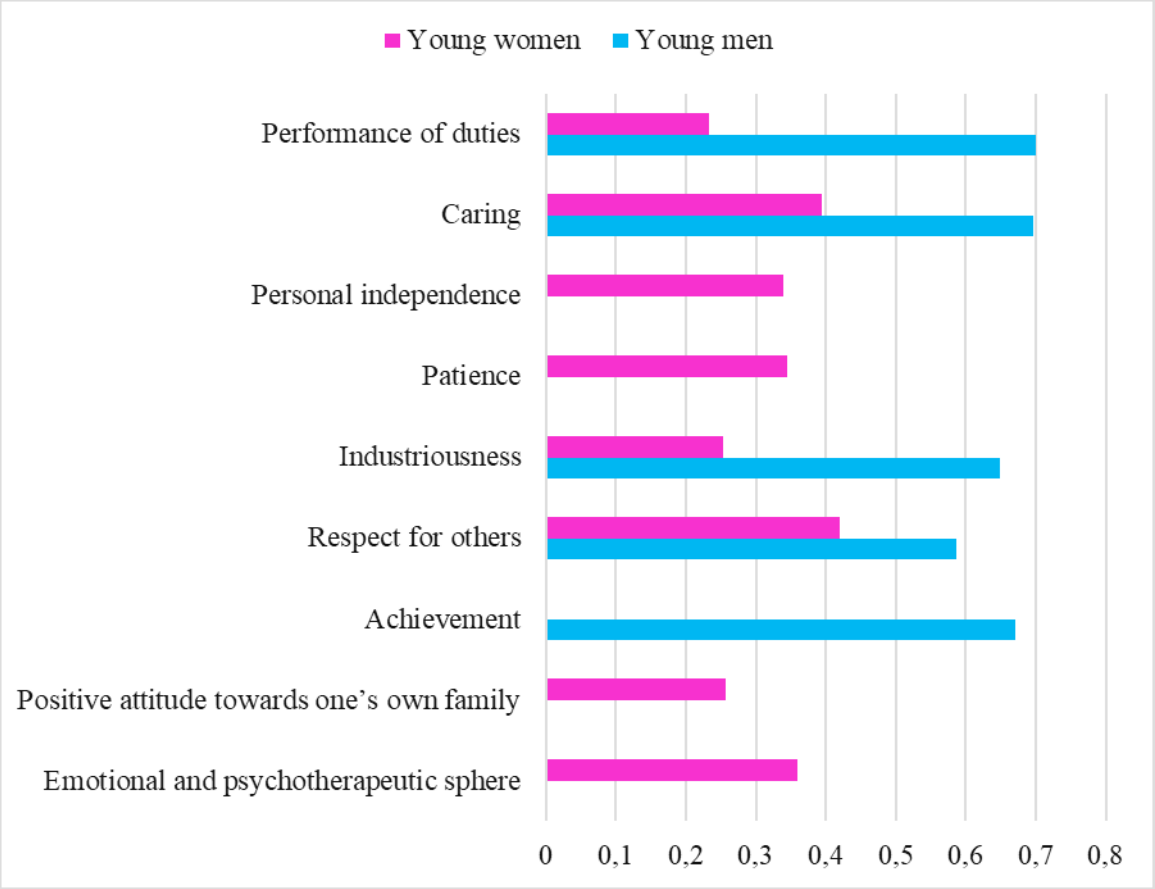

Figure 3. The image of the ideal father among students with a humanistic personality orientation, correlation coefficient

Young women's image of the ideal father contains a greater number of content-based characteristics than among young men and consists of elements of cognitive, emotional, and behavioral components. We revealed the following hierarchy of content characteristics: 1) respect for others (rs = 0.42 at p < 0.001); 2) caring (rs = 0.395 at p < 0.001); 3) role expectations in the emotional and psychotherapeutic sphere (rs = 0.359 at p = 0.002); 4) patience (rs = 0.345 at p = 0.003); 5) personal independence (rs = 0.339 at p = 0.003); 6) positive attitude towards one's own family (rs = 0.256 at p = 0.028); 7) industriousness (rs = 0.254 at p = 0.029); 8) performance of duties (rs = 0.233 at p = 0.046). The 'ideal father' variable positively correlates with the 'my father' variable (rs = 0.312 at p = 0.007), i.e. the image of the father is a guide in the formation of ideas about ideal fatherhood among young women with a humanistic personality orientation.

Ideas about the ideal father among students with a world-creating personality orientation

We found that 53 young men (42.1 %) and 160 young women (44 %) had a world-creating personality orientation. Figure 4 shows that the content and hierarchy of characteristics in the image of the ideal father of young men and women do not coincide. Among young men, we identified 11 elements of cognitive and behavioral components in the ideas of the ideal father. The following hierarchy of content-based characteristics was observed: 1) caring (rs = 0.716 at p < 0.001); 2) personal independence (rs = 0.53 at p < 0.001); 3) balance (rs = 0.522 at p < 0.001); 4) respect for others (rs = 0.499 at p < 0.001); 5) industriousness (rs = 0.48 at p < 0.001); 6) responsibility (rs = 0.46 at p = 0.001); 7) role claims in the parental and educational sphere (rs = 0.384 at p = 0.005); 8) achievement (rs = 0.364 at p = 0.007); 9) performance of duties (rs = 0.357 at p = 0.009); 10) empathy (rs = 0.338 at p = 0.013); 11) patience (rs = 0.319 at p = 0.02). When forming ideas about the ideal father, young men are guided by the image of their own fathers (rs = 0.47 at p < 0.001).

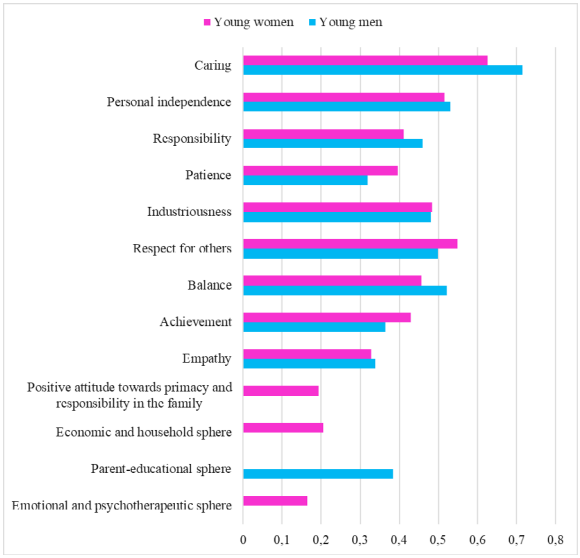

Figure 4. The image of the ideal father among students with a world-creating personality orientation, correlation coefficient

Compared to young men, the ideas about the ideal father among young women contain more characteristics and include elements of cognitive, emotional, and behavioral components. The meaningful characteristics of the image of the ideal father form the following hierarchical structure: 1) caring ($r_s = 0.626$ at $p < 0.001$); 2) respect for others ($r_s = 0.549$ at $p < 0.001$); 3) personal independence ($r_s = 0.515$ at $p < 0.001$); 4) industriousness ($r_s = 0.484$ at $p < 0.001$); 5) balance ($r_s = 0.457$ at $p < 0.001$); 6) achievement ($r_s = 0.43$ at $p < 0.001$); 7) responsibility ($r_s = 0.411$ at $p < 0.001$); 8) patience ($r_s = 0.396$ at $p < 0.001$); 9) performance of duties ($r_s = 0.382$ at $p < 0.001$); 10) empathy ($r_s = 0.328$ at $p < 0.001$); 11) role expectations in the economic and household sphere ($r_s = 0.206$ at $p = 0.01$); 12) positive attitude towards primacy and responsibility in the family ($r_s = 0.193$ at $p = 0.015$); 13) role expectations in the emotional and psychotherapeutic sphere ($r_s = 0.165$ at $p = 0.039$). The positive correlation between the variables of 'ideal father' and 'my father' ($r_s = 0.411$ at $p < 0.001$) means that when forming ideas about the ideal father young women are guided by their own fathers.

Discussion

The findings from this study obtained with the use of regression analysis indicate that moral personality orientations are a personal factor determining the value of ideas about the ideal father among modern students. Among young men, a significant contribution to the development of ideas about the ideal father (according to the value factor) is made by a group-centric and world-creating orientation. There is a humanistic orientation among young women. Thus, there are multidirectional trends in the formation of ideas about the ideal father among young men and women depending on moral personality orientation. In addition, the content-structural characteristics in the ideas about ideal fatherhood among young men and women with the same moral personality orientation do not coincide. This is consistent with research data that there is a gender specificity in the ideas about parenthood (Zakharova et al., 2019; Borisenko & Belogai, 2007; Merzlyakova et al., 2020).

In the conducted empirical research we managed to fix and analyze the differentiation of ideas about ideal fatherhood depending on moral personality orientations of modern youth. Caring is an invariant characteristic in the image of the ideal father. Students' ideas about the ideal father are dominated by the cognitive component; the content of the emotional and behavioral components has a mosaic character. Similar results were obtained earlier (Borisenko & Belogai, 2007; Merzlyakova et al., 2020).

In a group of young men, caring and industriousness are common personal qualities in the image of the ideal father. Among young men with an egocentric orientation, the image of the ideal father is complemented by elements of cognitive (performance of duties, personal independence, patience, respect for others, balance, and achievement) and emotional (positive attitude towards the family as a social institution and future children) components. Among young men with a group-centric orientation, the idea of the ideal father is complemented by such elements of the cognitive component as personal independence, patience, and empathy. Among young men with a humanistic orientation, the image of the ideal father contains such elements of a cognitive component as performance of duties, respect for others, and achievement. Among young men with a world-creating personality orientation, the ideas about fatherhood are characterized by the greatest fullness of the cognitive component and include all the studied qualities. The behavioral component of ideas about ideal fatherhood is actualized. The image of the ideal father

is complemented by role-playing claims in the parental and educational sphere, which speaks in favor of young men's desire to fulfill child rearing responsibilities. For young men with humanistic and world-creating personality orientations, their own fathers are a guide in the formation of ideas about ideal fatherhood.

In the ideas of the ideal father young women with egocentric, humanistic, and world-creating orientations have common elements of the cognitive component – personal independence, patience, and respect for others. Among young women with an egocentric orientation, the image of the ideal father is complemented by elements of cognitive (balance, empathy) and behavioral (physical attractiveness) components. Young women with a group–centric personality orientation have ideas about the ideal father that are characterized by such qualities as industriousness (in the cognitive component) and a positive attitude towards family recreation and leisure (in the emotional component). Among young women with a humanistic orientation the image of the ideal father additionally includes elements of cognitive (performance of duties, industriousness), emotional (positive attitude towards their own family) and behavioral (role expectations in the emotional and psychotherapeutic sphere) components. Among young women with a world-creating personality orientation the cognitive component of ideas about fatherhood includes all the parameters under consideration. There is an actualization of individual elements of emotional (positive attitude towards the primacy and responsibility in the family) and behavioral (role expectations in household and emotional-psychotherapeutic spheres) components. Young women with egocentric, humanistic, and world-creating personality orientations perceive their fathers as an example of ideal fatherhood.

We should note that in the image of the ideal father young men and women with egocentric and world-creating orientations have balance, patience, and empathy. At the same time, according to the results of an earlier study, students have a low level of emotional intelligence development (Merzlyakova & Bibarsova, 2020). The obtained research results stimulate the development of psychological and pedagogical support programs aimed at the development of emotional intelligence among students in the field of marital and family relationships.

Conclusion

Thus, in the conducted empirical research we tried to establish the objective dependence of ideas about ideal fatherhood (by the 'value' factor) on moral personality orientation among young men and women. The dominant moral personality orientation determines the content and hierarchical structure of the characteristics of the image of the ideal father among modern students. Basically, the cognitive component prevails in the notions of fatherhood. The greatest distinction of the emotional and behavioral components is the idea of the ideal father among young women. Young women with humanistic and world-creating orientations have a more differentiated image of the ideal father than young men with the same moral orientations.

Therefore, the initial hypothesis that the features of ideas about ideal fatherhood are determined by respondents' moral personality orientation and gender was generally confirmed. The results of this study provide the basis for the reasoned implementation of psychological and pedagogical work on the formation of complete and adequate ideas about the father's role which determine the implementation of parental behavior through the education of students of humanistic and world-creating personality orientations. The implementation of psychological and pedagogical support of the process of self-determination of students in the field of marital and

family relations is quite possible within the framework of the implementation of the discipline of Psychology of Family Self-determination (Golubeva & Merzlyakova, 2019), when planning and organizing educational activities in institutes of higher education in compliance with the provisions of Federal Law No. 304-FL of July 31, 2020, On Amendments to the Federal Law on Education in the Russian Federation on the Education of Students. Further work in this area should examine the content and hierarchical structure of the images of the ideal father and 'I am a future father' among young men, depending on moral personality orientation, as well as specific characteristics of ideas about fatherhood at different stages of age development.

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Author Contribution

S. V. Merzlyakova supervised the study, worked with sources, wrote the overview part of the article, contributed to study design, carried out statistical data processing, interpreted findings, and prepared the manuscript for publication.

N. V. Bibarsova selected study participants, contributed to data collection and statistical data processing, and prepared the manuscript for publication.

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Performance on State Exams in the Russian Language and Indicators of Cognitive Development: A Cross-Cultural Analysis of Relationships

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Abstract

Introduction. The relationship between indicators of cognitive development and the performance on state exams varies depending on whether or not the language of instruction is different from the student's native language, as well as the effectiveness of the national educational system. This study is a first attempt to examine universal and specific patterns of correlation between cognitive development and the success of learning the Russian language among native and non-native Russian-speaking students under different educational conditions. **Methods**. The study involved 899 public school graduates from the Kyrgyz Republic, the Republic of Moldova, and the Russian Federation. The language of instruction was Russian. The sample comprised native and non-native Russian-speaking students, of whom 63.7 % were females (mean age = 17.6 years, SD = 0.5). Statistical analysis was performed in the form of correlation analysis and ANOVA. **Results**. The findings indicated that the relationship between non-verbal intelligence and state exam performance is universal and manifests itself in various educational environments and language contexts. Along with intelligence, visuospatial working memory was only actualized in more favorable educational environments, when the student's native language was not different from the language of instructionat school. Information processing speed was of specific importance in the process of learning the Russian language by non-native Russian-speaking students, regardless of whether they were native speakers of Romance or Turkic languages. **Discussion**. The results were interpreted within the context of the resource theory of individual human achievements. The conclusion is drawn that the structure of the relationship between cognitive development and the performance in the Russian language state examinations differs for native and non-native Russian-speaking schoolchildren, even after eleven years of schooling in Russian.

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Keywords
cognitive development, learning success, Russian language, native language, language of instruction, state exam, information processing speed, visuospatial working memory, non-verbal intelligence, high school education

Highlights
- Information processing speed was of specific importance in the process of learning the Russian language by non-native Russian-speaking students, regardless of whether they were native speakers of Romance or Turkic languages.
- Non-verbal intelligence was interrelated with the score on the Russian language state exam in various educational environments, with stronger relationships observed for schoolchildren, whose native language was different from the language of instruction at school.
- Visuospatial working memory was actualized in the structure of interrelationships with state exam performance only in more favorable educational environments.

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Introduction
The study of performance in state examinations in the Russian language in various educational and cultural contexts is an urgent task aimed at solving the fundamental scientific problem of the relationship between development and learning, and is also associated with the socially significant task of teaching schoolchildren for whom Russian is a non-native language.

The present social situation makes relevant the scientific search for environmental conditions and individual resources that contribute to the successful education of non-native Russian-speaking schoolchildren as an integral part of global migration processes. However, it limits this search to the language context, as school education is conducted in Russian only in several countries, namely, the former republics of the Soviet Union (Verbitskaya, Zinchenko, Malykh, & Tikhomirova, 2017).

In these countries, as well as in the Russian Federation, the successful completion of the final Russian language exam is the most important educational stage in the life of a school graduate and determines his/her further educational trajectory (Verbitskaya, Malykh, Zinchenko, & Tikhomirova, 2015). Final exams in the Russian language, held in different countries, are standardized and, as a rule, are aimed at assessing the amount of school knowledge acquired by a graduate in accordance with the national educational standard.

Of all indicators of cognitive development that are important for successful learning of the Russian language, including as a non-native language, intelligence, information processing speed, and working memory are well studied (Zinchenko, Gaidamashko, Malykh, Kalmyk, & Tikhomirova,

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2020; Tikhomirova, Malykh, & Malykh, 2020; Huettig & Janse, 2016; Linck, Osthus, Koeth, & Bunting, 2014; Kempe, Brooks, & Kharkhurin, 2010; etc.).

Research almost unanimously reports on the paramount importance of intelligence in the formation of individual differences in schooling, including the Russian language (Verbitskaya, Malykh, & Tikhomirova, 2017; Deary, Strand, Smith, & Fernandes, 2007; and others). These data were confirmed in studies involving Russian schoolchildren and their Kyrgyz peers who study in Russian throughout their entire school period (Verbitskaya et al., 2017). It is noted that it is nonverbal intelligence, which is associated with the effective solution of tasks based on abstract stimuli that contributes to higher achievements in learning Russian as both a native and non-native language (Verbitskaya et al., 2017).

Working memory, according to studies and their meta-analyses, is important for the acquisition and improvement of oral and written skills both in the native language and in the study of a second language (Verbitskaya et al., 2020; Linck et al., 2014; Kempe et al., 2010; etc.). It was shown that a more developed visuospatial memory, which is associated with the ability to retain small fragments of information about the shape of stimuli and their localization in space, leads to more success in the acquisition of skills and the accumulation of knowledge related to language (Verbitskaya et al., 2020; Frenken et al., 2016).

Controversial results were obtained for information processing speed as an indicator of cognitive development in the context of its interrelationship with the learning success. On the one hand, the importance of individual reaction time during processing of syntactic units of language, the speed of retrieval from long-term memory, and further understanding of the meaning of this syntactic unit is postulated (Huettig & Janse, 2016). On the other hand, only indirect relationship between reaction time and overall academic success through higher-order cognitions are reported (Tikhomirova et al., 2020).

Formulation of the problem

However, the strength, and in some cases, the direction of the relationship between indicators of cognitive development and the learning success at school can change (based on teacher assessments and on individual results of standardized tasks in subjects). The effectiveness of the national educational system (Verbitskaya et al., 2020; Nisbett et al., 2012; Brouwers, Van de Vijver, & Van Hemert, 2009) and the coincidence of the students' native language with the language of instruction at school (Zinchenko et al., 2020; Verbitskaya et al., 2017; Oh, 2016) are cited as the main modulators of the correlation between cognitive development and learning success in school disciplines, including languages.

The quality of the national education system can lead to differences in the relationship between cognitive indicators and learning success, including learning language (Tikhomirova & Malykh, 2017; Tucker-Drob & Bates, 2016). Thus, according to a meta-analysis involving more than 240,000 respondents from 45 countries, such cross-cultural differences are associated with the specifics of national education systems to an even greater extent ($r = 0.25$ vs. $r = 0.16$; $p < 0.001$) than with social – economic status (Brouwers et al., 2009). Moreover, in studies involving Russian schoolchildren, it was shown that indicators of cognitive development turn out to be "sensitive" to varying degrees to the characteristics of the educational environment: from high educational influences on non-verbal intelligence to a minimum influence on information processing speed (Tikhomirova & Malykh, 2017). At the same time, the higher efficiency of the national education system and its

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uniformity lead to an increase in the role of the cognitive development of the student in the success of mastering the educational programs (Tucker-Drob & Bates, 2016).

Whether a student's native language does or does not coincide with the language of instruction at school plays an important role in shaping the relationship between cognitive development and academic success (Verbitskaya et al., 2017). Studies related to the specifics of learning Russian as a non-native language report a large increase in cognitive resources necessary to achieve academic success by schoolchildren for whom Russian is not their native language (Zinchenko et al., 2020). These data are explained in the context of the resource theory of individual human achievements, according to which the tightness and number of interrelations of cognitive development indicators determine the power of a person's cognitive resource (Druzhinin, 2007).

This study aims to assess the specifics of the relationship between cognitive development and the performance in Russian language state exams in various educational systems and language contexts. The analysis is carried out on samples of eleventh-graders with Russian as both native and non-native language from public schools in Kyrgyzstan, Moldova and Russia.

The choice of these countries is due to the similarities in the organization of educational process and differences in the effectiveness of the functioning of the national educational system. According to the international rating of the United Nations Development Program 2020, based on the achievements of the states in three areas of development – health, education, and living conditions – Russia is included in the group of countries with a very high level of human development (52nd place), and Kyrgyzstan with an average level (120th place). It should be emphasized that in Moldova this study was conducted in schools in the city of Tiraspol on the territory of the unrecognized Pridnestrovian Moldavian Republic, which is characterized by a very low socio-economic status and, as a result, the low efficiency of the national education system.

These cross-cultural similarities and differences, as well as the inclusion of students with Russian as their native and non-native languages, made it possible to formulate universal and specific patterns of correlation between cognitive development and the success of learning Russian as a native and non-native language under different educational conditions.

Methods

Sample

The study involved 899 public school graduates from the Kyrgyz Republic, the Republic of Moldova, and the Russian Federation, with Russian as the language of instruction.

During the whole schooling period, the participants were instructed in the Russian language in one Russian school (Moscow region), one Kyrgyz school (Bishkek) and two Moldovan schools (Tiraspol), which were similar in terms of the qualifications of the teaching staff, the compliance of curricula in the Russian language, rating positions in the region, etc. (for more details, see Verbitskaya et al., 2020).

Samples from Kyrgyzstan and Moldova were formed in such a way that they included both students for whom Russian was their native language and, accordingly, coincided with the language of instruction at school, and students for whom Russian was a non-native language (Kyrgyz or Moldovan), but from the first grade, these children were taught in Russian. The sample from Russia was formed only from Russian-speaking eleventh-graders.

Thus, the sample of participants from the Kyrgyz Republic (Bishkek) included 169 Russian-speaking schoolchildren (mean age = 17.6 years; SD = 0.6 years; 66.5 % of girls) and 196 Kyrgyz-speaking

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schoolchildren (mean age = 17.8 years; SD = 0.5 years; 64.3 % of girls).

The sample of participants from Moldova (Tiraspol, unrecognized Pridnestrovian Moldavian Republic) comprised 152 Russian-speaking students (mean age = 17.3 years; SD = 0.6 years; 68 % of girls) and 151 Moldovan-speaking students (mean age = 17.6 years; SD = 0.4 years; 61.3 % of girls).

The sample from Russia comprised 231 Russian-speaking schoolchildren (mean age = 17.6 years; SD = 0.4 years; 58.4 % of girls).

Course of study

The study of cognitive development was conducted at the end of the eleventh grade, and the state exam performance was assessed two months later. The informed consent of parents and representatives of the school administration was obtained for the participation of schoolchildren. Data collection was carried out in the computer science class of an educational institution strictly according to the developed protocol under the supervision of a researcher. Data analysis was carried out using depersonalized data.

Methods

Cognitive development

Indicators of cognitive development – information processing speed and visuospatial working memory – were measured using computerized tasks grouped into a test battery (Tikhomirova & Malykh, 2017). Non-verbal intelligence was assessed using the Standard Progressive Matrices test in printed form (Raven, Kurt, Raven, 2009).

Information processing speed was assessed using the Choice Reaction Timetest with 4 possible answers (Tikhomirova, Kuzmina, & Malykh, 2020). During the test, the numbers 1, 2, 3, 4 appeared on the computer screen 40 times with random intervals ranging from 1 to 3 seconds. The task of the participant was to press the key, which corresponded to the number shown on the screen as quickly and as accurately as possible. The participants had 8 seconds to provide an answer. The accuracy of the answer (correctly or incorrectly pressed key) and the reaction time for each answer were recorded. Correct answers were included into the statistical analysis as scores for reaction time.

Assessment of visuospatial working memory was carried out using the Sequences test, based on the classic Corsi Block-Tapping Test (Tikhomirova, 2017). Sequences of cubes were presented on the computer screen, which 'lighted up' one after the other with an interval of 1 second. The minimum number of elements in the sequence was 4, the maximum was 9. The participant's task was to repeat the order in which cubes 'lighted up' using a computer mouse. The total number of correct answers was included into the statistical analysis.

Non-verbal intelligence was assessed using the Standard Progressive Matrices test in printed form (Raven et al., 2009). The test consisted of 60 tasks grouped into 5 series. Tasks became progressively more difficult within each series, as well as from series to series. The task of the participant was to choose the missing element of the matrix from 6 or 8 proposed options. The number of correct answers for the entire test was included into the statistical analysis.

Performance on the Russian language state examination

The test scores on the state exam were used as indicators of performance – the Unified State Exam for Russian graduates, the National Testing for Kyrgyz graduates and the Unified State Exam

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for school graduates in the territory of the unrecognized Pridnestrovian Moldavian Republic.

The Unified State Examination in Russia (USE) is a set of standardized test tasks, which assess the graduate's level of knowledge of school material, according to the federal state educational standard of Russia. The USE Russian language exam is mandatory for all graduates of Russian schools.

The Unified State Examination in Tiraspol (USE) is analogous to the Russian USE and is designed to assess the level of graduate's mastery of basic educational programs of state's educational standard. The language test in USE is mandatory, but the graduate can choose between Russian, Moldovan or Ukrainian languages. The study analyzed the results of the Unified State Examination in the Russian language, taken by both Russian-speaking and Moldovan-speaking schoolchildren.

The Republic-Wide Test is a series of standardized test tasks aimed at identifying the most capable high school students for further education at universities in Kyrgyzstan. A graduate can choose to take the test in Russian, Kyrgyz or Uzbek languages. The study analyzed the score on the main test in Russian, taken by both Russian-speaking and Kyrgyz-speaking students.

Statistical analysis

In the first phase of the analysis, descriptive statistics were calculated based on the measurements of indicators of cognitive development and the level of performance in the Russian language state exams in the studied groups of school graduates.

During the second phase, a one-way analysis of variance was carried out to understand the differences in indicators of cognitive functioning between all the studied groups of school graduates: 1) Russian speakers from Kyrgyzstan, 2) Kyrgyz speakers from Kyrgyzstan, 3) Russian speakers from Moldova, 4) Moldovan speakers from Moldova and 5) Russian speakers from Russia. The Bonferroni correction was applied during the comparison between different groups. Analysis of variance was also carried out within the groups of Kyrgyz and Moldovan schoolchildren to assess the differences in the performance on the Russian language state exam, depending on whether or not the language of instruction was different from their native language.

During the third phase, a correlation analysis was carried out between the indicators of cognitive development and the score on the Russian language state exam in order to study general and specific patterns in these relationships.

Results

The study analyzed indicators of cognitive development (non-verbal intelligence, information processing speed, and visuospatial working memory) and performance on the Russian language state exam in groups of school graduates from Russia, Kyrgyzstan and Moldova.

Descriptive statistics

Table 1 presents the mean values and standard deviations (in brackets) of indicators of cognitive development and performance on the state exam in groups of Russian-, Moldovan- and Kyrgyz-speaking school graduates who studied for the entire school period in Russia, Moldova or Kyrgyzstan.

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Table 1
Descriptive statistics of indicators of cognitivedevelopment and the Russian language state exam scores

	Moldova		Kyrgyzstan		Russia
	R	M	R	K	R
Non-verbal intelligence	48.55 (5.83)	47.02 (6.79)	48.67 (6.13)	46.82 (7.33)	52.17 (4.91)
Information processing speed	0.74 (0.17)	0.82 (0.17)	0.74 (0.19)	0.80 (0.19)	0.71 (0.24)
Visuospatial working memory	5.30 (1.93)	5.23 (2.16)	4.73 (2.51)	4.74 (2.41)	5.43 (2.05)
State exam score	38.30 (9.99)	37.72 (10.43)	173.31 (26.71)	162.91 (29.86)	72.08 (12.02)

Note: R – Russian-speaking schoolchildren, *M* – Moldovan-speaking schoolchildren, *K* – Kyrgyz-speaking schoolchildren.

Table 1 shows the average score for non-verbal intelligence and visuospatial working memory, which correspond to the number of correctly completed tasks on the Standard Progressive Matrices and the Sequences tests, respectively. Non-verbal intelligence test scores ranged from 0 to 60; working memory test scores ranged from 0 to 12. Information processing speed score was calculated as the average value of the reaction time for correct answers only in the Choice Reaction Time test. Lower reaction time corresponds to higher information processing speed.

According to Table 1, the average values for non-verbal intelligence and information processing speed appear to be somewhat higher in schoolchildren with Russian as their native language, when compared with non-native Russian-speaking students, regardless of the country in which the student studied. No such tendency was observed for working memory scores. However, Russian-speaking students studying in Russia, on average, scored higher than their peers from Moldova and Kyrgyzstan on all tests – Standard Progressive Matrices, Choice Response Time, and Sequences. Significant differences were assessed using the analysis of variance.

Possible state exams scores range from 0 to 100 for USE in Russia, 0 to 231 for the Republic-Wide Test in Kyrgyzstan and 0 to 57 for USE in Moldova.

Results of analysis of variance

One-way ANOVA was used to assess differences in non-verbal intelligence, information processing speed, and visuospatial working memory between the five analyzed groups of school graduates.

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Table 2 presents the results of the analysis of variance, where different groups of schoolchildren were used as a categorical factor: 1) Russian speakers from Kyrgyzstan, 2) Kyrgyz speakers from Kyrgyzstan, 3) Russian speakers from Moldova, 4) Moldovan speakers from Moldova and 5) Russian speakers from Russia. Results of Levene's test showed the absence of differences in the distribution of all analyzed cognitive indicators for the compared groups ($p > 0.05$).

Table 2
Cognitive functioning differences among groups

	Sum of squares (SS)	Fisher's criterion (F)	Significance level (p)	Effect size (η^2)
Non-verbal intelligence	3125.08	19.59	0.000	0.09
Information processing speed	1.28	8.16	0.000	0.04
Visuospatial working memory	79.18	3.96	0.01	0.02

According to Table 2, statistically significant differences among the analyzed groups of school graduates were obtained for all indicators of cognitive development ($p < 0.01$).

The largest effect size of belonging to a group was found for non-verbal intelligence ($\eta^2 = 0.09$; $p = 0.000$). The results of multiple Bonferroni-corrected comparisons showed differences between schoolchildren studying in Russia and their peers studying in Kyrgyzstan and Moldova ($p < 0.001$). At the same time, no differences in intelligence were found between native and non-native Russian-speaking schoolchildren within individual countries. In particular, the average values of non-verbal intelligence of Russian-speaking and Kyrgyz-speaking schoolchildren who study for the entire school period in Kyrgyzstan do not differ ($p > 0.05$). A similar tendency is also observed when comparing the non-verbal intelligence of Russian-speaking and Moldovan-speaking graduates of schools in Moldova ($p > 0.05$).

Information processing speed differs among the analyzed groups of schoolchildren with an effect size of 4 % ($p = 0.000$). The results of multiple comparisons showed statistically significant differences between native and non-native Russian speaking schoolchildren, regardless of the country ($p < 0.05$). For example, the reaction time of Russian-speaking schoolchildren from Moldova (average reaction time of 0.74 seconds) is significantly higher than that of their Moldovan-speaking peers (average value of 0.82). At the same time, no differences were found among Russian-speaking schoolchildren from Russia, Kyrgyzstan and Moldova ($p > 0.05$). The average value of the reaction time of Russian-speaking graduates of Russian, Kyrgyz, and Moldovan schools was 0.71, 0.74, and 0.74 seconds, respectively.

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Visuospatial working memory differs the least in the analyzed groups of schoolchildren (η^2 = 0.02; p < 0.05). Bonferroni-adjusted results of multiple comparisons showed insignificant differences only between schoolchildren from Russia and Kyrgyzstan, regardless of their native language (p < 0.05).

One-way ANOVA was carried out for performance on the Russian language state exam on samples of Kyrgyz and Moldovan schoolchildren, depending on whether or not the language of instruction was different from their native language. The results showed slight, but statistically significant, differences in the exam scores between native and non-native Russian-speaking students from Kyrgyzstan (model characteristics: SS = 9601.23; F = 11.85; p = 0.001; η^2 = 0.02). However, Russian-speaking and Moldovan-speaking schoolchildren studying in Moldova demonstrated no differences in scores on the Russian language exam (p > 0.05), which may be explained by the specifics of the national exam's test tasks.

Results of correlation analysis

Correlation analysis was used for each of the five analyzed groups of schoolchildren to study the relationship between the indicators of cognitive development – information processing speed, visuospatial working memory, and non-verbal intelligence – and Russian language state examination scores.

Table 3 shows the Spearman correlation coefficients between indicators of cognitive development and state examination scores in groups of native and non-native Russian-speaking schoolchildren from Kyrgyzstan, Moldova, and Russia (* p < 0.05; ** p < 0.01).

Table 3
Relationships between indicators of cognitive development and performance on the Russian language state exam

	Native language	Non-verbal intelligence	Information processing speed	Working memory
Kyrgyzstan	Russian	0.33**	0.01	0.08
	Kyrgyz	0.39**	–0.17*	0.07
Moldova	Russian	0.19*	–0.02	0.08
	Moldovan	0.21*	–0.12*	0.06
Russia	Russian	0.26**	–0.08	0.19*

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According to Table 3, there are weak and moderate correlations between the indicators of cognitive development and final Russian language exam scores in all analyzed groups of schoolchildren ($0.39 > | r | > 0.12$; $p < 0.05$).

Of all indicators of cognitive development, non-verbal intelligence is correlated with exam scores the most. This relationship is typical for graduates of schools in Kyrgyzstan, Moldova, and Russia, regardless of their native language. The correlation is even higher in schoolchildren, whose native language does not coincide with the language of instruction at school. In particular, in a sample of Kyrgyz-speaking schoolchildren who study in Russian for the entire school period in Kyrgyzstan, the correlation coefficient of an examination score with non-verbal intelligence reaches a value of 0.39 at $p < 0.01$.

Visuospatial working memory is directly related to the exam scores in only one group of schoolchildren – native Russian-speaking graduates of Russian schools.

Information processing speed has a relationship with examination scores only in groups of non-native Russian-speaking graduates from Kyrgyz and Moldovan schools. In particular, in the group of Kyrgyz-speaking and Moldovan-speaking schoolchildren, the reaction time is inversely proportional to the state exam score – the longer the reaction time, and, accordingly, the slower the student, the lower the state exam score is. However, we should notethat the correlation analysis does not give grounds to assume the direction of the relationship between cognitive development and learning outcomes, which will be taken into account when interpreting the results.

In general, the largest number of relationships with the exam scores was obtained for non-verbal intelligence (all groups of schoolchildren), the smallest – for visuospatial working memory (only in the group of Russian schoolchildren). The relationship between information processing speed and the examination scores turned out to be unique for the groups of Moldovan- and Kyrgyz-speaking schoolchildren, whose native language is different from the language of instruction at school.

Discussion

Of all indicators of cognitive development, non-verbal intelligence varied the most among the groups of school graduates from different countries, regardless of their native language. This result is consistent with data on the directly proportional effect of the quality of national education on individual results on the Standard Progressive Matrices intelligence test (Tikhomirova & Malykh, 2017; von Stumm & Plomin, 2015; Nisbett et al., 2012). An indirect confirmation of this conclusion is the absence of differences in intelligence within country groups – between Russian- and Kyrgyz-speaking schoolchildren from Kyrgyzstan, between Russian- and Moldavian-speaking schoolchildren from Moldova.

Slight differences were observed in the analyzed groups for information processing speed, but of a fundamentally different nature. The differences were observed not among different country groups, but between cross-cultural groups – between schoolchildren with Russian as their native and non-native language. At the same time, native Russian-speaking schoolchildren performed better on the 4-choice reaction time task, regardless of their country of residence. Similar results were obtained in other studies, including those involving Kyrgyz-speaking high school students (Zinchenko et al., 2020; Leonard et al., 2007; Rose, Feldman, & Jankowski, 2011). These findings may indicate specific characteristics of the cognitive sphere of schoolchildren when studying in a non-native language, especially since differences were also observed in state exam

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scores between native and non-native Russian-speaking graduates in favor of Russian-speaking eleventh-graders.

In the structure of the relationship between cognitive development and the state exam scores, both similarities and differences were obtained for groups of native and non-native Russian-speaking schoolchildren who studies in Kyrgyzstan, Moldova, and Russia.

The main similarity for all analyzed cross-cultural groups of schoolchildren, regardless of their native language, turned out to be a directly proportional relationship between non-verbal intelligence and the Russian language state exam score. Indeed, studies have repeatedly emphasized the leading role of intelligence in the formation of individual differences in academic success, based on standardized and expert assessments (Zinchenko et al., 2020; Verbitskaya et al., 2017; Deary et al., 2007; etc.). Thus, in the model of the relationship between the cognitive sphere and general academic success, it is non-verbal intelligence that is the central link between basic cognitive processes and a child's academic performance during all stages of the schooling process (Tikhomirova et al., 2020).

Differences in the relationship between the cognitive sphere and performance on the Russian language state exam were analyzed through the prism of the effects of the national education system and the student's native language and its coincidence with the language of instruction at school.

The effects of the quality of public education were manifested in the relationship between working memory and performance on the Russian language state examination. Thus, in more favorable educational environments, along with the usual role of intelligence, the role of visuospatial memory is emphasized. According to studies, the function of visuospatial working memory in the successful completion of test tasks is related to the reproduction of available information that is relevant to the completion of the task at hand (Wai et al., 2009). As a rule, most of the exam tasks are based on school material and high-quality education leads to better material retention and its availability for extraction at the right time (Verbitskaya et al., 2017).

The relationship between information processing speed and performance on the Russian language exam depended on whether or not the language of instruction was different from students' native language. In particular, this relationship turned out to be typical only for groups of non-native Russian-speaking schoolchildren. Information processing speed is probably the cognitive resource that can be used to optimize the process of learning a second language (for example, Huettig & Janse, 2016).

Conclusion

The study showed universal and specific patterns of correlation between cognitive development and the success of learning Russian as a native and non-native language under different educational conditions.

Of all analyzed indicators of cognitive development, non-verbal intelligence is directly proportional to the score on the state examination in the Russian language among school graduates in various educational and language environments.

The relationship between cognitive development and performance on the final exam in the Russian language can change depending on the educational conditions and whether or not the language of instruction is different from students' native language. In more favorable educational environments, when the native language is not different from the language of instruction, the

importance of working memory for performance on the state exams is emphasized along with the usual importance of intelligence.

The study showed that the structure of the relationships between indicators of cognitive development and performance on state examinations in the Russian language differs between native and non-native Russian-speaking groups of schoolchildren, even after eleven years of schooling in Russian. Information processing speed was observed to have a unique role in the process of learning Russian as a non-native language, regardless of whether students are native speakers of Romance or Turkic languages.

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Author Contribution

Yu. P. Zinchenko supervised the study.

I. V. Gaidamashko contributed to the literature research.

S. B. Malykh contributed to the study conception, coordinated the data collection in the Russian Federation, the Kyrgyz Republic, and the Republic of Moldova, and interpreted the findings of the study.

T. N. Tikhomirova contributed to research methodology, research database, statistical data analysis, and prepared the manuscript for publication.

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Psychosemantic Typology of Student Positional Strategies in Structural and Dynamic Education Environment

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Abstract
Introduction. This paper presents the basis for the structural and dynamic model of positional strategies in the university information and educational environment. Theoretically, it shows possible variations of the psychosemantic description of the typological combinations of complex positional strategies. The novelty lies in the development and approval of a research model for the psychosemantic typology of positional strategies when students perform reflective educational tasks. **Methods**. The study used content analysis of texts of reflective educational tasks completed by students who were forced to study remotely in 2020–2021 (due to the pandemic). The procedure for categorizing psychosemantic levels of cognitive development enabled the determination and identification of 16 positional strategies by combining their dynamic and structural components in a two-dimensional environment. **Results**. The results of content analysis were presented to determine the dominant positional strategies of students in the structure and dynamic environment of a particular educational situation. The highest degree of dominant positional strategies associated with the dynamic level of emotions and the structural level of constructs was recorded. Strategies at the structural symbolic level and strategies at the dynamic imagination level were considered the least expressed. **Discussion**. Some contradictory trends found in the analysis of positional strategies are discussed. On the one hand, there is some personal maturity among the respondents, and on the other hand, there is insufficient participation in the deeper structures of the world, as well as the evident inertia of the 'education baggage' of students. We emphasized the importance of recognizing the diversity of individual education strategies and the need to harmonize psychosemantic organization in the education process.

Keywords
positional strategies, structural dynamic environment, information educational environment, psychosemantic levels, cognitive noetic development, cognitive formations, psychosemantic model, modal vectors, structural attractor, typological combinations

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Highlights

- The structural and dynamic model of positional strategies in the university information and educational environment helps empirically identify typological combinations of psychosemantic cognitive formations according to four organizational and four dynamic strategic vectors.
- The criteria for the classification procedure of psychosemantic levels of cognitive development of students allow a psychosemantic description of the options for the combination of complex positional strategies with horizontal, vertical, and diagonal trends, reflecting the dominance of one or another attractor (organizational or dynamic), integrating various modal vectors.
- Minimization of deficit limitations on the balance of potential of students' positional strategies can be understood as an educational resource for cognitive and noetic development in a modern university.

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Introduction

The use of the term 'strategy' in cognitive research has a fairly clear history, presented in the classical psychological works (Solso, 2006; Tikhomirov, 1984; Kholodnaya, 2019; Vekker, 1976; etc.). We should note that the analytical studies of Dirlik & Aydin-Unal (2014) showed that the definitions of the term 'strategy', which exist in modern cognitive psychology, have their own meaning for certain circumstances of a particular organization (i.e., only in their context). D. A. Rytsev (Rytsev, n.d.), when classifying these definitions into groups ('strategy–method'; 'strategy–goal'; 'strategy–structure'), revealed considerable terminological limitations in all three groups. Relying on the holistic model of personal cognitive-noetic development proposed earlier by V. I. Kabrin, which essence lies in the mutual conjugation of dynamic and structural psychosemantic modalities (Kabrin, 2021), we believe that in today's extremely popular studies on educational strategies for the actions of users of electronic educational platforms, the emphasis should be placed on fully advanced level-related cognitive strategies. At the same time, it is important to take into account the total dominance of the psychosemantic factor over its physical locomotion and sensory component in a strategic action. Unlike an *algorithm*, a strategy can have a large number of degrees of freedom as the possibilities of its 'locomotor' implementation. We have identified a universal semantic core, which directly accentuates the upper levels of psychosemantic cognitive formations – value-semantic and conceptual-target ones. It is expected that they provide two lower levels of constructive solutions and symbolic expressions.

Our structural and dynamic model of positional strategies in the university information and educational environment assumes their identification in a two-dimensional environment – according

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to four organizational and four dynamic strategic vectors. Each positional strategy type is formed by one of the sixteen possible intersections of these vectors.

Since the structural and dynamic variations of strategies are cumulative (each subsequent variation includes the previous one), the positional types of strategies can be arranged in terms of a general index of their development. Table 1 presents this index (see Table 1).

Table 1

General index of positional strategy development in the structural and dynamic matrix

	Motivation	Perception	Imagination	Emotion
Symbols	1	2	3	4
Constructs	5	6	7	8
Concepts	9	10	11	12
Values	13	14	15	16

In the structural and dynamic environment of the matrix, each positional strategy is created by combining one of the four dynamic and four structural-level descriptions (Table 2).

Table 2

Psychosemantic typology of positional strategies in the structural and dynamic model of cognitive-noetic development

	Motivation	Perception	Imagination	Emotion
Symbols	1.1	1.2	1.3	1.4
Constructs	2.1	2.2	2.3	2.4
Concepts	3.1	3.2	3.3	3.4
Values	4.1	4.2	4.3	4.4

The theoretical possibilities for complex strategies are as follows:

1) A *horizontal* trend that shows the dominance of an organizational attractor that integrates dynamic modal vectors.

2) A *vertical* trend that reflects the dominance of a dynamic attractor integrating structural modal vectors.

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3) A *diagonal* trend that shows the achievement of a progressive structural and dynamic synthesis, a balance of intersecting attractors.

In this context, it is possible to give a psychosemantic description of any combination of positioning (nuclear, 'cellular') strategies.

The main question to be answered when translating the psychosemantic model into typology is what kind of experienced and perceived psychological resource the user of the information educational environment relies on (assurance, hope, preference, habitude)? Here we offer criteria descriptions of four dynamic and four constituent positional structural-level strategies that are formed by the essential characteristics of the psychosemantics of the model of personal cognitive-noetic development.

All 16 position strategies are determined by a combination of dynamic and structural components.

The dynamic components of positional strategies are as follows:

1. *Motivational self-determination* is the manifestation and formation of interests as well as the search for information to distinguish them in areas and topics (what I want to do, who I will become).
2. *Study and analysis* of interesting subjects, tools, situations, and related stories.
3. *Forecast, design,* planning of work on the use and creation of interesting situations, tools, and objects; the accompanying and subsequent fantasies of the productive imagination.
4. *Evaluation of the effectiveness* (optimity) of the achieved results, the way to experience successes and failures, taking into account assessments and feedback from important people.

The structural components of positional strategies are as follows:

1. The symbolic level includes all statements and actions that symbolize (demonstrate) involvement and commitment to something greater, which stands behind the symbol as more significant, but diffused and indefinable.
2. The constructive level includes objectified representations and constructs focused on a certain subject-event reality, highlighting its essential concretizing and generalizing features, by which objects, situations, events are classified, qualified and distinguished.
3. The conceptual level includes concepts that detect and master contradictions, problems and determine goals, objectives, and ways to solve them.
4. The value-meaning level includes value-meaning orientations based on an intuitive (noetic) understanding of the temporal (temporal and transtemporal) forms of being. They are formed by emergent changes and transformations. Thus, the description of all 16 positional strategies is formed by a combination of dynamic and structural components. Thus, complete strategies will be four-level strategies with a clear value-semantic dominant, realized by the structures of the third, second, and first levels. Any combination of combined inter-level (vertically oriented) positional strategies should be considered as developing strategies.

The proposed typology of strategies is universal in relation to the content and its educational, professional, and subject specificities. This enables the comparison analysis of strategies presented or revealed by students from different grades in different educational programs.

Methods

The main research methodology was an analysis of content derived from the results of two reflective project tasks, which for students served as learning tasks in one of the basic disciplines

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corresponding to the main educational programs. Such tasks enable students to spontaneously express their psychosemantic intentions, which we consider to be the psychosemantic units of their actual consciousness. This ensured the reliability and authenticity of materials.

We regarded the concept of categorization as metalinguistic for content analysis in a broad sense – from the perceptual categories of J. Bruner to the transcendent philosophical value categories. In the context of the holistic approach, interlevel categorical relations suggest that they are 'charged' with an active structural dynamic factor – the potential for qualitative transitions from 'the successive to the simultaneous', i.e. from the sequential to the simultaneous, from dynamics to structure. In linguistics, such examples may be the phenomenon of substantiation – the transformation of a verb into a noun, as well as the principle of recursion in the generative grammar of N. Chomsky (Chomsky, 1972; Everett, 2018). It therefore also applies to the principles of categorization, which are the basis for content analysis procedures (Tarshis, 2018; Almaev, Bessonova, & Murasheva, 2020).

The procedures for identifying the psychosemantic levels of cognitive development are based on certain theoretical contexts and criteria foundations as follows:

1 Symbolization level (nominal structure):

➢ *criteria aspects* (according to dynamic modalities):

– attention;
– choice;
– archetypal experiences (magical metaphors);
– symbolization – naming (keyword);

➢ *theoretical contexts:*

– background – figure (Gestalt psychology);
– field – quantum (holistic physics and psychology) (M. Talbot) (Talbot, 2014);
– archetype – symbol (archetypal Jungian psychology) (Jung, 2015);
– naming – naming as a basic cognitive process (the Sapir-Whorf hypothesis of linguistic relativity) (Borodai, 2013).

2 Structural level (differential structures):

➢ *criteria aspects* (types of constructs):

– identification (designation);
– distinction;
– assimilation;
– unification;

➢ theoretical contexts:

– general semantics (S. Chase) (Rimskaya & Kirillov, 2000; Chase, 2015; Serkin, 2008);
– the theory of personality constructs by J. Kelly (Kelly, 2000);
– the concept of perceptual categorization by J. Bruner (Bruner, 2008; Filatova, 2011);
– Sapir–Whorf hypothesis of linguistic relativity (Borodai, 2013);
– experimental psychosemantics (Petrenko, 2010; Kabrin, 2021; Tolstova, 2007; Bruner, 2008);
– fractal theory (J. Glick) (Glick, 2021).

3 Conceptual level (problem structures):

➢ *Criteria aspects:*

– sensitivity to contradictions;
– acceptance (recognition of contradictions);

– transformation of problem situations;
– development of contradictions in a new concept (solution of problem situations);
➢ *Theoretical contexts:*
– the concept of strange attractors (J. Glick) (Glick, 2021);
– the concept of integration (tense unity) (S. Beer, cited by Jackson, 2016);
– the concept of stress transformation in the theory of transcommunication (V. I. Kabrin) (Kabrin, 2005);
– N. Chomsky's theory of generative grammar (principle of recursion) (Chomsky, 1972);
– methods of synectics (combining the incompatible) (G. Ya. Bush) (Bush, 1985).

4 Value-sense level (emergent structures):
➢ *criteria aspects:*
– thirst for changes and fear of them;
– rethinking of losses, meaning of life, and meaning of death;
– rethinking of a catastrophic change in lifestyle;
– understanding the transgenerative nature of existence – values of emergence, transformation, and disappearance;
– a radical change in attitudes towards goodness, truth, beauty, and mystery;
➢ *theoretical contexts:*
– philosophy of life;
– the maxims of the classical scholars (Ecclesiastes, M. Montel, P. Maria, etc.);
– ideological texts of transpersonal psychology (library of the series "Texts of transpersonal psychology");
– research into the higher states of consciousness (R. Bucke, O. Huxley, S. Taylor, E. Tolle, K. Wilber, etc.) (Bucke, 2008; Huxley, 2010; Taylor, 2017; Wilber, 2004).

Classical content analysis is also combined with hermeneutical, phenomenological, narrative psychology methods (E. Ya. Tarshis, E. Betti, A. Giorgi, M. L. Crossley) (Tarshis, 2018; Betti, 2011; Bogomaz, Morozhanova, & Turkovsky, 2019; Crossley, 2013).

In the proposed approach, the categorization levels are defined in terms of criteria that are close to the analytical units of the account. They can include all words and expressions in the semantic area of any criterion moment. Table 3 shows the content of the categories for each coding index.

Table 3

Category coding table

Category coding index	Content of categories
A	*Motivational self-determination* is the manifestation and formation of interests as well as the search for information to distinguish them in areas and topics (what I want to do, who I will become)
B	*Study and analysis* of interesting subjects, tools, situations, and related stories
C	*Forecast, design,* planning of work on the use and creation of interesting situations, tools, and objects; the accompanying and subsequent fantasies of the productive imagination

Table 3

Category coding table

Category coding index	Content of categories
D	*Evaluation of the effectiveness* (optimity) of the achieved results, the way to experience successes and failures, taking into account assessments and feedback from important people
E	*Symbolic level* includes all statements and actions that symbolize (demonstrate) involvement and commitment to something greater, which stands behind the symbol as more significant, but diffused and indefinable. Options: allegories and parables, hints and allusions, rituals and memes, brands and trends, phantoms and superstitions, etc.
F	*Constructive level* includes objectified representations and constructs focused on a certain subject-event reality, highlighting its essential concretizing and generalizing features, by which objects, situations, events are classified, qualified and distinguished
G	*Conceptual level* includes concepts that detect and master contradictions, problems and determine goals, objectives, and ways to solve them. Concepts assimilate contradictory, conflicting opposites in a new form. It is important to learn to distinguish between concepts that open up perspectives and concepts that lead to a dead end
H	*Value-meaning level* includes value-meaning orientations based on an intuitive (noetic) understanding of the temporal (temporal and transtemporal) *forms of being*. They are formed by emergent changes and transformations

Results

The proposed research model was tested on a sample of first-year students and undergraduates who were forced (due to the pandemic) to study via distance learning at the Faculty of Psychology of the National Research Tomsk State University in 2020–2021. A total of 88 participants took part in the study. Using the results of the content analysis of the creative works of the respondents (exhibited in the LMS Moodle e-learning environment), the indicators of positional strategies were calculated as the sum of the generalized indices of the 2 corresponding categories in the two-dimensional structural and dynamics environment of the matrix. The mean value (22.00) and standard deviation (4.2) for the groups were calculated. Based on the obtained results, the range of 17.8 to 26.2 was determined as average, i.e. the average severity of a particular positional strategy.

The general results of the content analysis for determining the dominant positional strategy in a student group are shown in Table 4.

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Table 4

Psychosemantic typology of positional strategies in the structural and dynamic model of cognitive-noetic development

	Motivation	Perception	Imagination	Emotion
Symbols	14.78	17.21	12.16	21.01
Constructs	25.46	**27.89**	22.85	**31.70**
Concepts	19.34	21.77	16.72	25.58
Values	22.37	24.80	19.75	**28.60**

The results obtained allow us to conclude that students, who express the motivational components of self-determination, choose value-sense structural and constructive strategies and as their most frequent forms of statements. This may indicate a relatively high level of reflection of first-year students. The first year of university education (including a master's degree) is a period of crisis for students, because adaptation and acceptance of a new life status presupposes reasoning about the value component of life and attempts to concretize new experience, embedding it into the existing system of cognitive constructs for perceiving information and their image of the world.

To evaluate the severity of different strategies within the sample, descriptive statistics were calculated for each positional strategy. The results are presented in Table 5.

Table 5

Strategies for the entire sample of subjects

Positional strategy	Mean value	Std. error of the mean	Median	Std. deviation	Dispersion	Min.	Max.	Percentile		
								25	50	75
AE	0.17	0.01	0.15	0,11	0.01	0	0.56	0.08	0.15	0.24
AF	**0.29**	0.02	0.3	0.15	0.02	0	0.69	0.18	0.3	0.38
AG	0.22	0.01	0.23	0.12	0.01	0	0.59	0.15	0.23	0.29
AH	0.25	0.02	0.24	0.14	0.02	0	0.67	0.16	0.24	0.34
BE	0.20	0.02	0.16	0.14	0.02	0	1	0.11	0.16	0.24
BF	**0.32**	0.02	0.3	0.18	0.03	0	1	0.2	0.3	0.41
BG	0.25	0.01	0.24	0.14	0.02	0	1	0.15	0.24	0.32
BH	0.28	0.02	0.26	0.15	0.02	0	1	0.17	0.26	0.35
CE	0.14	0.01	0.13	0.1	0.01	0	0.39	0.06	0.13	0.23

Table 5

Strategies for the entire sample of subjects

Positional strategy	Mean value	Std. error of the mean	Median	Std. deviation	Dispersion	Min.	Max.	Percentile		
								25	50	75
CF	0.26	0.02	0.24	0.15	0.02	0	0.71	0.15	0.24	0.33
CG	0.19	0.01	0.19	0.1	0.01	0	0.47	0.13	0.19	0.25
CH	0.22	0.01	0.22	0.12	0.01	0	0.59	0.13	0.22	0.3
DE	0.24	0.02	0.25	0.14	0.02	0	0.61	0.13	0.25	0.33
DF	**0.36**	0.02	0.33	0.16	0.03	0	0.74	0.26	0.33	0.46
DG	**0.29**	0.02	0.27	0.14	0.02	0	0.67	0.2	0.27	0.39
DH	**0.33**	0.02	0.31	0.17	0.03	0	0.68	0.21	0.31	0.44

Statistics

Mean value of positional strategies

N	Valid	16
Minimum		0.14
Maximum		0.36
Average value		0.25
Standard deviation		0.06
RMS error		0.02
Percentiles	25	0.21
	50	0.25
	75	0.29

Note: AE is a strategy that combines the categories 'motivation' (A) and 'symbols' (E); *AF* is a strategy that combines the categories of 'motivation' (A) and 'constructs' (F); *AG* is a strategy that combines the categories of 'motivation' (A) and 'concepts' (G); *AH* is a strategy that combines the categories of 'motivation' (A) and 'values' (H); *BE* is a strategy that combines the categories of 'perception' (B) and 'symbols' (E); *BF* is a strategy that combines the categories of 'perception' (B) and 'constructs' (F); *BG* is a strategy that combines the categories of 'perception' (B) and 'concepts' (G); *BH* is a strategy that combines the categories of 'perception' (B) and 'values' (H); *CE* is a strategy that combines the categories of 'imagination' (C) and 'symbols' (E); *CF* is a strategy that combines the categories of 'imagination' (C) and 'constructs' (F); *CG* is a strategy that combines the categories of 'imagination' (C) and 'concepts' (G); *CH* is a strategy that combines the categories of 'imagination' (C) and 'values' (H); *DE* is a strategy that combines the categories of 'emotions' (D) and 'symbols' (E); *DF* is a strategy that combines the categories of 'emotions' (D) and 'constructs' (F); *DG* is a strategy that combines the categories of 'emotions' (D) and 'concepts' (G); *DH* is a strategy that combines the categories of 'emotions' (D) and 'values' (H).

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On the basis of the obtained results, we should note that the dispersion level, which indicates the extent to which the indicators obtained are grouped around the average value, is quite low. The values of all positional strategies are mainly grouped near the mean value. This indicates that the value of the average level can be used to assess the level of expression of certain positional strategies in the majority of respondents. Therefore, we can distinguish a number of positional strategies, which severity exceeds average values: motivation and constructs (AF), perception and constructs (BF), emotion and constructs (DF), emotion and concepts (DG), emotion and values (DH). This enable us to say that in the study sample a constructive level of strategies is expressed, which is characterized by representations and constructs oriented to the subject-event reality. The result obtained may indicate both the formed orientation to follow specific, objectified interests, and the dominance of evaluating the effectiveness of the results achieved. When performing reflective tasks, organizational elements such as, generalization, classification, enumeration of features, etc., inherent in scientific knowledge, turned out to be a priority. The level of the 'emotion and value' (DH) strategy shows the presence in the consciousness of students of certain value-meaning categories associated with life motivation, reasoning about the values and meanings of activities executed in different spheres of life and their rethinking.

Positional strategies that show values below average are as follows: motivation and symbols (AE), perception and symbols (BE), imagination and symbols (CE), imagination and concepts (CG). The low result may be due to a lack of positive self-determination experience at this stage of life. In addition, we also recorded the fact that the motivational component is poorly expressed in the form of symbols, allegories and parables, showing involvement in global and significant phenomena.

The most dominant positional strategies were found in students with a sufficiently high dynamic level of emotions (emotions and values, emotions and concepts, emotions and constructs) and an organizational level of constructs (constructs and motivation, constructs and perception, constructs and emotions). These respondents were able to classify phenomena in multiple ways, assess actions, and phenomena, and could also take into account the assessments of the constructs of subject-event reality that were directed towards them. The rarest positional strategies were related to the organizational symbolic level (symbols and motivation, symbols and perception, symbols and imagination) and the dynamic imaginative level (imagination and symbols, imagination and concepts). We should note that the organizational level of symbols is the most difficult to master and deeply understand. Despite the fact that this level is represented to a certain extent in the results of all first-year students who participated in the study, it is insignificant for all others, both in dynamic and organizational components. This confirms again the previously recorded research fact that first-year students are largely focused on a particular subject-event reality using generalization and concretization features, while it is significant for them to evaluate the effectiveness of the results achieved, taking into account feedback from important others.

Discussion

Therefore, psychosemantic analysis of the considered positional strategies implemented by students in the structural and dynamic environment of a particular educational situation made it possible to identify some contradictory trends. Thus, we can conclude that the respondents

have a certain personal maturity, since indicators for all strategies related to value-meaning and conceptual levels, as well as emotional components, are at an average or high level, i.e. the study participants are able to comprehend and independently resolve problem situations, especially personally significant ones, as well as to form symbolic statements on the evaluation of the effectiveness of the results achieved. However, there was a clear manifestation of insufficient participation of the respondents in the deepest organization of the symbolic layers of the world, which may be due to the lack of formation of relevant experience at their present stage of life.

The positional strategy (PS) of motivational values (AH) is considered to be the most common. It became clear that there was a problem with further analysis of the thesaurus of value-meaning formations. PS based on emotional structures (EF) have a slightly lower occurrence, which corresponds to the ideological orientation of education and gives hope for the future.

The third dominant PS is the PS of promising constructs (BF), which is fully consistent with traditional subject-oriented education. It is symptomatic that the total frequency of the appearance of dynamic components in dominant PS directly confirms the cumulativeness of psychological modalities along the dynamic vector – motivation (A) – 50 %, perception (B) – 30 %, imagination (C) – 10 %, and emotion (D) – 10 %.

A variety of PS combinations were weakly expressed among students. Only 10 respondents (out of 88) identified two dominant PS – perceptual symbols (BE) and perceptual constructs (BF). Only one student had four PS, but they also had a common perceptual basis – however, only at all four organizational levels (BE, BF, BG, and BH). Consequently, the problem of promoting the formation of various educational strategies among students remains relevant. The results of a pilot study of students' positional strategies in the context of the structural and dynamics model of personal cognitive development show that the long-term impact of our country's education process on young people's cognitive development is quite realistic.

The analysis of the general frequency structural and dynamics matrix of the psychosemantics of positional strategies shows the greatest expression of the organizational level of the constructs and the emotional dynamic vector at all levels. If the first trend reveals inertial educational baggage of students, then the second one shows the actual opportunity for university teachers to harmonize the psychosemantic organization of the educational process. This applies in particular to the imaginative-conceptual positional strategy (CG), which is the least represented in the strategic potential of a student and is mostly associated with the development of the creative potential of an individual.

In discussions on the results achieved, it is important to draw the attention of modern information technology developers to the need to attract more diverse diagnostic tools for psychological support in the monitoring of user actions in the electronic educational environment of a modern university.

Analyzing the existing experience in the development of intelligent learning environments shows that the prediction of the models of interaction with an information learning environment needs efficient cognitive interfaces that can adapt to the user of the learning environment (Chen, Zou, Xie, & Wang, 2021; Yin, Alqahtani, Feng, Chakraborty, & McGuire, 2021; Slade & Prinsloo, 2013). In addition, the adaptive selection is based on the pre-diagnosis and subsequent adaptation of the learning system (Zhang & Chang, 2020). Currently, many researchers develop various adaptive learning systems based on biometric, cognitive and

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other characteristics and preferences of students (Elbahi, Omri, Mahjoub, & Garrouch, 2016; Panasiuk, Szymkowski, Dąbrowski, & Saeed, 2016; Laamanen et al., 2021; Curum & Khedo, 2021). Psychological support for the personalization process of the electronic educational environment for specific users should be one of the priority tasks, including the development of new diagnostic tools designed to discover and evaluate psychological new formations as educational results.

In this respect, it seems appropriate for the next phase of the study to conduct an analysis of the content of psychosemantic areas at the level of their thesauruses and possibly at the level of narratives and discourses of each positional strategy. This can reveal the depth of development (manifestation) and the potential for developing students' complex positional strategies when elaborating appropriate educational modules in the modern university information and educational environment.

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Meaning-building Techniques for the Implementation of Students' Value-meaning Choice in the Educational Process

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Abstract

Introduction. The use of psychological techniques and technologies for the implementation of students' value-meaning choice in the educational process creates conditions for creative activity and self-disclosure of personal experience, thereby providing a personal-meaning orientation of the learning process. However, there is also a disadvantage of choice, namely, 'sacrificing' one alternative in favor of another in such situations. Therefore, the classification of meaning-building techniques for the implementation of a value-meaning choice also contains support technologies. This study reports the first development of a classification of meaning-building techniques capable of initiating students' value-meaning choice, as well as their testing in the educational process to increase students' motivation and develop their value-meaning sphere. **Methods**. The study used the following psychological assessment tools: (a) the Meaning-in-Life Orientations test (MLO) by D. A. Leont'ev, (b) the inventory for Diagnosing the Orientation of Educational Motivation by T. D. Dubovitskaya, and (c) the Multidimensional Questionnaire of Personality Self-Realization (MQPSR) by S. I. Kudinov. The study involved students of the South-Russian State Polytechnic University (Novocherkassk) and the Don State Technical University (Rostov-on-Don). A total of 437 respondents participated in the study. **Results**. The results of the formative experiment in the experimental groups showed that according to the MLO test, the overall score of meaningfulness in life increased by 6.5 %; according to the 'life performance' subtest, the overall score of meaningfulness in life increased by 2.06 %. According to the MQPSR, the 'optimism' indicator increased by 3.6 %, and the 'pessimism' indicator, on the contrary, decreased by 2.3 %. Experimental results at the initial and final stages showed the effectiveness of the use of meaning-building techniques in the educational process and speak in favor of the performance and meaningfulness of their life paths. **Discussion**. The proposed classification of meaning-building techniques is focused not only on students' self-expression, creation of conditions for creativity, and actualization of subjective experience, but is also represented by technologies of psychological and pedagogical support, which are of particular importance in the act of choice.

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Keywords
alienation, subjective experience, value-meaning choice, psychotechniques, meaning-building techniques, associative-figurative technologies, self-expression and creativity technologies, problem-oriented technologies, support technologies

Highlights
- Removal of alienation between the subjects of the educational process, increasing educational motivation, finding the meaning of educational activity is possible in the case of creating situations of choice.
- The presence of 'sacrificing' in situations of choice necessitates psychological and pedagogical support for some students.
- The introduction of emotional and sensual mechanisms for the initiation of a value-meaning choice (meaning-building techniques) creates conditions for the manifestation of internal sources of students' self-development and self-expression.

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Introduction
The meaning-building technique is a mechanism of psychological influence. The use of the meaning-building technique as an efficient modern learning technology is discussed in various publications (Abakumova & Zorina, 2017; Abakumova, Mironenkova, & Pen'kov, 2019; Abakumova, Pronenko, & Golubova, 2019; Elagina, Pen'kov, Solov'eva, & Marchenko, 2019; Zorina & Zelenov, 2016; Stakanova, 2018). Thanks to the inclusion of such psychological techniques in the learning process, it is possible to initiate students' personal meanings, reveal their inner world, and develop the emotional-volitional sphere. The importance of the use of meaning-building techniques in the educational process is explained by the ability to initiate students' meanings their direct connection with emotional-sensory sphere of an individual. "Meaning-building techniques may influence the meaning-based choice of an individual" (Abakumova, Mironenkova et al., 2019, p. 68). After all, the lack of creativity and choice can lead to alienation from learning (Osin, 2015; Barnhardt & Ginns, 2014; Jones, 2017; Tomaszek, 2020).

"Under the conditions of alienated activity, the emerging meanings exist to a greater extent at the egocentric level, which leads to irreversible consequences in society up to the loss of the values of relations" (Abakumova, Mironenkova et al., 2019, p. 67). Therefore, modeling situations of students' value-meaning choice is often of paramount importance.

However, until now there has been no empirical data on the change in the value-meaning sphere in the context of the use of meaning-based techniques in the educational process that initiate a meaning-based choice, as well as having the potential of psychological and pedagogical support for selective activity. Indeed, "subjective experience carries traces of an individual's life, but it also regulates further activity through the personal meaning that objects and phenomena of the external world acquire for each individual; therefore, such experience is always an individually

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special form of expression of human manifestations" (Mironenkova, 2015, p. 47). In other words, subjective experience will be a basis for a meaning-based choice. Therefore, *this study aims* to highlight meaning-based techniques for the implementation of students' value-meaning choice in the educational process.

For the first time, I. V. Abakumova presented a classification of psychotechniques according to the principle of meaningfulness, thus distinguishing the following subgroups of meaning-based techniques: meaning-based techniques addressed to subjective experience; meaning-based techniques of dialogue; game techniques; meaning-based techniques of self-expression; meaning-based techniques of support; meaning-based techniques of creativity; and meaning-based techniques of a problematic nature (Abakumova & Zorina, 2017, p. 42).

Based on this classification, E. Stakanova presented a modified classification of meaning-based techniques for the educational environment, focusing on EFL teaching methods. At the same time, in the process of studying English, the author refers the following active methods to meaning-based techniques: projects, debate, role-playing games, creative work, essay, academic disputes, tasks that make you think, and language portfolio (Stakanova, 2018, p. 30). However, in this classification there are no meaning-based techniques aimed at students' subjective experience. After all, when learning a foreign language, the formation of the student's subjective position is impossible without relying on his/her subjective experience and the manifestation of his/her selective activity (Mironenkova & Susimenko, 2021). According to A. Yu. Aleksin, E. A. Pomel'nikova, and L. V. Sukhova, "discipline has the widest possibilities in terms of the professional development of a specialist and, above all, the possibilities of becoming a subject of professional self-development" (Aleksin, Pomel'nikova, & Sukhova, 2014).

That is why, for the development of subjectivity and the formation of the subjective position of the student, a classification of meaning-based techniques was developed to address the experience of the student on the basis of a value-meaning choice: associative-figurative technologies, technologies of self-expression, and creative technologies (Abakumova, Mironenkova et al., 2019). The proposed meaning-based techniques were tested in the educational process to increase motivation and develop the meaning-based sphere of students in mathematics classes. However, we admit that it can be applied in other disciplines, since it is based on the principle of meaningfulness, and *meanings are inherent in everyone*.

According to the alternative choice, it also has a disadvantage: 'sacrificing' one alternative in favor of another. Consequently, reframing as "changing the existing framework in which the situation is enclosed" can become an adequate technology for initiating situations of a meaning-based choice (Odintsova, 2012, p. 78). An individual begins to see the same situation in a positive perspective, the alternative is re-evaluated. A meaning-based choice is made on the basis of the reformulated meaning of the situation. Due to the essence of reframing, disadvantages of choice are minimized, which positively affects the state of mind of students. Reframing as a technology was developed within the theory of neurolinguistic programming (Bandler & Grinder, 1982) as a technique for positive perception and a mechanism for influencing personality behavior (Dilts, 2012; Kumar & Supriya, 2020). We refer this technology to the meaning-building techniques of support in the selection process.

In pedagogical research, the creation of a 'positive environment' seems to be an effective means of creating conditions for revealing creative abilities, increasing involvement in the educational process, and revealing personal potential (Li et al., 2017; Lake, 2013; Palanac, 2019; Brizhak, Kolesina,

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& Mironenkova, 2020). In most cases, the technologies of self-help and psychological support are aimed at creating positive thinking. Positive thinking can be developed if the following three strategies are applied: positive affirmations, positive attitude, and positive perception (Slabinskii, 2014). Positive thinking is positively correlated with psychological well-being, including life satisfaction and happiness, and negatively – with stress, anxiety, depression, and anger (Wong, 2012). A number of researchers note that creativity also makes an individual happier – it has a positive effect on subjective well-being (Tan et al., 2019; Tan, Chuah, Lee, & Tan, 2021). Moreover, people are more open to changes when they are in a good mood (Vulpe & Dafinoiu, 2011). This determines the importance of paying attention to the emotional and sensory sphere of students.

From the whole set of meaning-based techniques, we have identified those aimed at: students' subjective experience, creativity, problematic nature of situations, specifics of the act of choice (sacrificing) (Table 1). These meaning-based techniques may play an important role in the meaning initiation of the value-meaning choice, making a significant contribution to meaning-based didactics.

Table 1
Meaning-based techniques for the implementation of students' value-meaning choice in the educational process

Meaning-based technique (technology)	Example	Methods and techniques in the educational process
Associative-figurative technologies	Association, personal-meaning generalization, work with images and context	Method of free associations, translation of theoretical material into figurative one, structural-logical schemes, symbolic vision, method of collision of images, color images, meaning immersion
Technologies of self-expression	Choice situations, personalization, living situations, self-reflection, gamification	The method of accustoming (empathy), imagination, the method of projects, the method of free choice, game, disidentification
Creative technologies	Creative assignments, essays, art technologies, art didactics technologies, installation, inversion, reframing	Figurative painting method, joint presentation, art therapy methods (music therapy, bibliotherapy, game therapy, park therapy, isotherapy, etc.), photo projects, linguistic constructs

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Problem-based technologies	Tasks for meaning, mindsight, insight, personal-meaning generalization, mind maps	Mindfulness, mental maps, introspection, discussion, tasks for life sensations, Bloom's taxonomy (daisy model)
Support technologies	Meaning reframing, context reframing, linguistic affirmations, emotional stroking, situations of success and recognition, life creation, value orientation	Metaphors, expressions with a universal quantifier, language structures that affect the perception of the individual, positive affirmations, attitudes towards self-affirmation, positive attitude, gratitude, students' essays about themselves

We should note that the same meaning techniques, appearing in different forms, can be used in different ways depending on the learning goal. For example, reframing can be used as a technique for disclosing the creative potential of students or as a technique for psychological and pedagogical support in order to reduce anxiety and fear (Mironenkova & Abakumova, 2021). Thus, O. A. Tamochkina suggests using framing and reframing to develop the creative potential of students. Frames (singling out) enable students to concentrate on the content and start the creative process by limiting students' thinking, thereby forcing them to think deeper (Tamochkina, 2019).

Methods

Students of the South-Russian State Polytechnic University and the Don State Technical University (n = 437) took part in the empirical study. We divided students into control (n = 217) and experimental groups (n = 220). The presented meaning-based techniques served as a basis for the training course (Table 1).

To identify actual meaning-based states and meaning-based orientations at the initial and final stages of the study, we used the Meaning-in-Life Orientations test (MLO) by D. A. Leont'ev (Leont'ev, 2000). To determine the level of internal motivation for the educational activity of students, we conducted a survey using the inventory for Diagnosing the Orientation of Educational Motivation by T. D. Dubovitskaya (Dubovitskaya, 2002). To determine specific characteristics of students' self-realization, we used the Multidimensional Questionnaire of Personality Self-Realization (MQPSR) by S. I. Kudinov (Kudinov, 2012). In our study we also used the methods of comparative and terminological analyses, generalization and systematization, and methods of mathematical and statistical processing of empirical data.

Results

At the formative stage, the MLO results showed that the overall score of life meaningfulness in the experimental groups increased by 6.5 %, while in the control groups it remained virtually at the same level.

At the final stage of the study in the experimental groups, the test data on the subscales of 'goal in life', 'process' and 'life performance' indicate that students perceive their life paths as interesting, emotionally rich, and filled with meaning; they are satisfied with self-realization and are characterized by the presence of purposefulness and focus on the future (Fig. 1).

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At the final stage of the study, the results of our survey conducted using the inventory for Diagnosing the Orientation of Educational Motivation by T. D. Dubovitskaya confirmed the effectiveness of the use of meaning-based techniques for the implementation of choice. Thus, the percentage of students with intrinsic motivation increased by almost 15.7 %. There was an internal motivation for learning activities, which is confirmed by empirical data (Fig. 2).

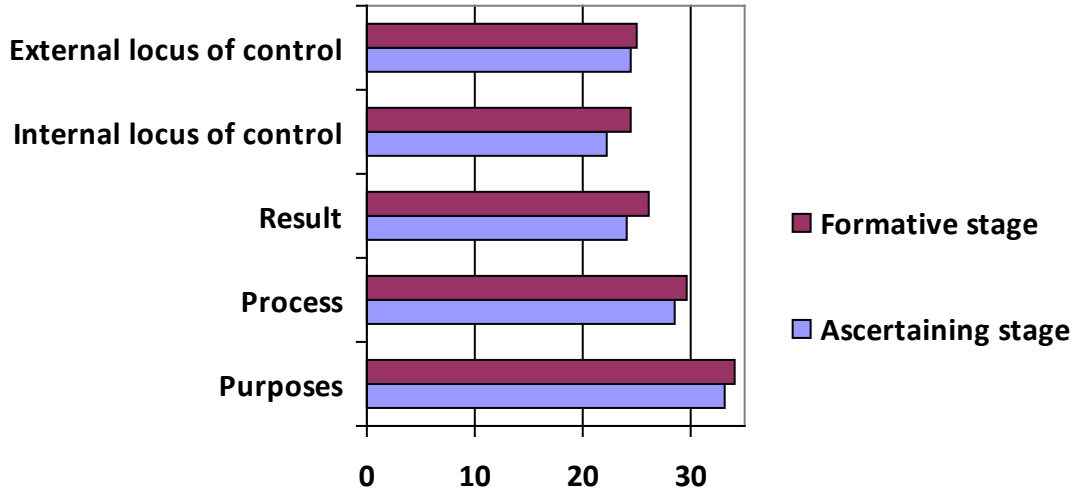

Figure 1. MLO mean scores at the ascertaining and formative stages in the experimental groups

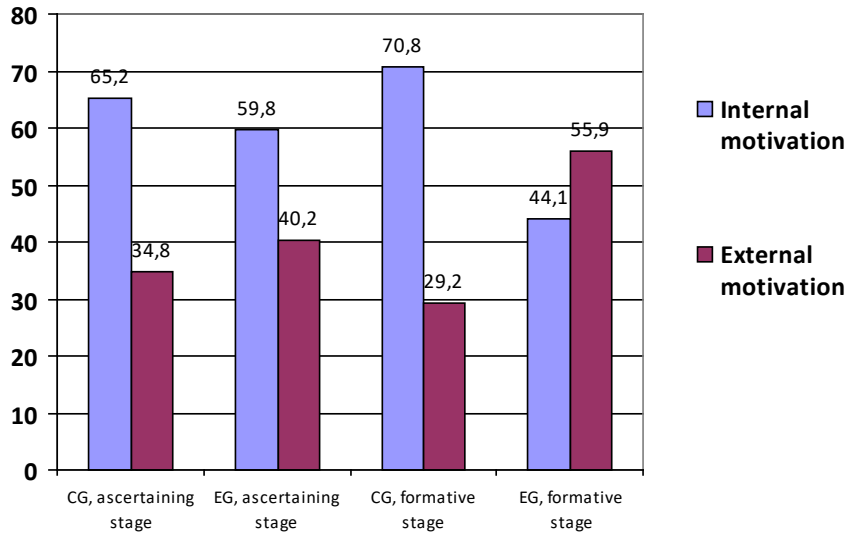

Figure 2. The results of diagnosing the orientation of educational motivation at the ascertaining and formative stages

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To determine specific characteristics of students' self-realization, we used the Multidimensional Questionnaire of Personality Self-Realization (MQPSR) by S. I. Kudinov (Table 2). The questionnaire aims to identify two most important characteristics, especially with regard to situations of a value-meaning choice – self-realization and self-actualization. Self-realization as a manifestation of the student's personal potential is considered a personal basis for the manifestation of self-actualization.

Table 2
Mean scores for variables in the experimental groups at the initial and final stages of the study

Variables	Mean scores and the level of severity for experimental groups	Mean scores and the level of severity for experimental groups
Socio-corporate attitudes	18.7 (medium)	20.3 (high)
Subject-personal attitudes	21.8 (high)	20.4 (high)
Activity	19.8 (medium)	23.4 (high)
Inactivity	16.3 (medium)	12.1 (medium)
Optimism	17.8 (medium)	21.4 (high)
Pessimism	7.8 (low)	5.5 (low)
Internality	20.3 (high)	25.7 (high)
Externality	9.1 (low)	7.2 (low)
Sociometric motivation	17.6 (medium)	19.4 (medium)
Egocentric motivation	9.3 (low)	4.9 (low)
Creativity	22.7 (high)	28.5 (high)
Conservatism	13.5 (medium)	10.5 (medium)
Constructiveness	17.2 (medium)	19.7 (medium)
Destructiveness	9.3 (low)	6.9 (low)
Social Barriers	9.5 (low)	7.9 (low)
Personal barriers	11.7 (medium)	7.8 (low)

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The MQPSR results indicated that there are statistically different characteristics in the experimental groups. The prevalence of the obtained scores in socio-corporate attitudes, sociometric and egocentric motivation confirms the conclusion that the model is related to group-centric or pro-social, ultimate meanings. Thus, in most cases, the motivating force for self-realization is not egocentric personal motives, but the desire to be realized for the good of a common cause or others, which could not be confirmed in the control groups. For example, in the experimental groups, the score of the indicator of egocentric motivation decreased by 4.4 %, and the level of subjective-personal attitudes decreased by 1.5 %. In the control groups, these indicators, on the contrary, increased – the value of the indicator of egocentric motivation increased by 3.1 %, and the level of subjective-personal attitudes increased by 2.4 %.

Average academic performance throughout the formative study showed an increase in the quality of student learning. Qualitative indicators of academic progress increased by 12 % in the experimental groups, and in the control groups increased slightly – by 3 %. A slight increase in the qualitative indicator of academic performance is determined, in our opinion, by the desire of students to receive scholarships. Thus, at the final stage, the processing of the academic data from the experimental groups showed an increase in academic performance in the disciplines that used meaning-based techniques for the implementation of a meaning-based choice, compared to the control groups which continued to study according to the traditional system of education.

Discussion

The comparative results of our study (MLO, inventory by T. D. Dubovitskaya, MQPSR, and academic results) in ascertaining and formative experiments indicate the general dynamics of the value-meaning development of students.

Our classification of meaning-based techniques for the implementation students' value-meaning choice has a number of advantages. It is focused on self-expression and self-actualization of students, creates conditions for actualization of subjective experience, aims at creating conditions for creativity, and contains the technologies of psychological and pedagogical support, which is very important for selective activities.

Among the latter, such technologies as meaning reframing, context reframing, linguistic affirmations, emotional stroking, and situations of success and recognition are of particular importance. This is how this study differs from the previous ones (Abakumova & Zorina, 2017; Abakumova, Mironenkova et al., 2019). In addition, the study refers to positive thinking, which is relevant due to the essence of choice. The creation of a 'positive environment' seems to be an effective means of creating conditions for the disclosure of creative abilities, increasing involvement in the educational process, and unlocking personal potential. In the experimental groups, the 'optimism' indicator increased by 3.6 %, 'pessimism' – decreased by 2.3 % (according to the MQPSR), and the indicator of life performance or satisfaction with self-realization increased by 2.06 % (according to the MLO subtest). This indicates that students are characterized by a positive assessment of their life paths and feel that their lives were productive and meaningful.

Thus, the presented meaning-based techniques are modern psychological and pedagogical technologies that reveal students' inner world and their personal and meaning potential. The ability to regulate the sensory-emotional and motivational-value expressions of students provides them a wide range of applications in the educational process.

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N. N. Mironenkova worked with sources and wrote the overview part of the article, contributed to the experimental design of the study, collected the data, carried out statistical data processing, revised and prepared the manuscript for publication.

V. G. Pakhomova wrote the overview part of the article, developed diagnostic tools, collected the data, carried out statistical data processing, and prepared the draft of the manuscript.

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Associations Between Visions of the Future and Educational Outcomes of Young Adults

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Abstract
Introduction. This study aims to examine the association between young adults' visions of their own future and their Unified State Examination (USE) scores. The present study is the first to detail this vision and define the meaning-based content of young adults' visions of the future and self-assessments of their existing achievements in comparison with the expected ones. **Methods**. The study was conducted in two stages with a 2.5-year interval. In the first stage, the Me in 5 Years inventory was used on a sample of 1538 male and female young adults aged 14–28 years. In the second stage, 150 subjects of those who participated in the first stage of experiment answered questions about their USE results, about their own achievements, which they assumed in descriptions at the first stage, and about the reasons for poor performance. **Results**. To reach high levels of academic performance, modern young adults need to have a vision of their lives, in the context of their knowledge and what they can do on their own. There is a significant correlation between young adults' self-assessments of their own achievements and the USE scores. Young adults with low elective USE scores indicate that they achieved their plans earlier than planned. Young adults' confidence that everything they planned for the near future may really happen but later than expected is associated with average USE scores in compulsory subjects. **Discussion**. The USE represents a kind of systematization of plans for young adults with average USE scores in compulsory subjects. Those who are less successful in passing the USE in elective subjects have no clear life goals and cannot objectively assess their achievability.

Keywords
youth, modern youth, generation Z, academic success, self-determination, Unified State Examination, USE result, life trajectory, life planning, future

Highlights
- In modern young adults' visions of their future, the meaning-based association created by the "I know" and "I will do" constructs enables them to reach high levels of academic performance.
- Young adults with 'excellent' scores in the elective USE assess the achievement of their plans lower than those who passed the elective USE worse.

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▹ Young adults' stubbornness in achieving their plans for the future is associated with average USE scores in core subjects.

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Introduction

The main idea we will discuss in this article is the assumption that academic success in youth directly depends on students' vision of their own future. Adhering to cultural-historical psychology, we take as an axiom the fact that the most important thing in the theory of development is the 'individual – society' relationship (Kravtsov & Kravtsova, 2020). For representatives of modern youth, relations with society are built mainly through educational institutions. Considering that 'youthful age' denotes the phase of transition from dependent childhood to independent and responsible adulthood (Vygotskii, 1983), we consider educational institutions as high school, secondary vocational education organizations, and universities, as well as entry into professional activity itself. The education system has changed little since P. Ya. Galperin, who noted that it is built on the principle of 'spontaneous learning', where students master actions by making unsystematic trial and error, which is a universal and, at the same time, primitive method of cognizing reality (Kravtsov & Kravtsova, 2020). Success in such a system is measured on a scale of 'excellent student – unsuccessful student', which is ineffective in the changed social reality.

In general, the social structure seemed simple and inviolable a few decades ago. However, it is currently transformed under the influence of increased individualization, economic instability, and the rapid transformation of digital technologies (Polivanova, 2012; Arnett, 2016). All this considerably affects modern young adults, called Generation Z (Bogacheva & Sivak, 2019; Radaev, 2020a, 2020b; Yanitskii et al., 2019; Schwartz et al., 2017). For this generation, Internet resources are an important source of socio-cultural development. They were the first ones who did not catch with the world without modern network technologies (Vorontsova & Ermolaev, 2016). Representatives of generation Z are well versed in information technology (Kulakova, 2018). In our opinion, these conclusions are not so unequivocal. Our observations show that representatives of generation Z demonstrate a spacious mind, relying on numerous information streams, which does not allow them to concentrate on a deep study of information. At the same time, the information is contradictory and sometimes unreliable, which can adversely affect the formation of life prospects. In this regard, it can be difficult for them to independently choose the optimal life path that will lead to success.

The subject of modern research is often the relationship between academic success and the use of the Internet. It shows that those young adults who actively use the learning content of the Internet in their educational track have the greatest success in an educational institution. Thus, there is a correlation between a student's ability to win subject Olympiads and the content topics that such students are interested in the Vkontakte information space (Kashpur, Gubanov, Feshchenko, Izofatova, & Kobenko, 2020). Entertainment content has a direct influence on academic performance in schools. Modern studies have shown that this is confirmed in 83 % of cases. An analysis of the communities visited and viewed by young adults on the VKontakte

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predicts not only their gender (97 %) and age (98 %) but also their academic performance with high accuracy (Polivanova & Smirnov, 2017). From this, we can assume that the correct ratio of educating and developing content, as well as the presence of educating content that includes game functions, creates optimal conditions for sociocultural development and student-centred learning, in the absence of which education becomes more and more alienated from real life. But even in this context, the Internet can be considered as an important resource for modern young adults and not a determining factor in educational success.

Researchers studying the factors of success in learning at existing educational institutions distinguish among them the level of intelligence, readiness to choose a profession, the level of basic training (USE score), and personal characteristics, such as organization and conscientiousness, adaptive potential (Shaporov, 2020) with the formation of new approaches to the education of young adults.

Today, the result obtained at the Unified State Examination (USE) is the main indicator of the success of school education in the Russian Federation. In modern psychological research, personal characteristics of high scorers and those who are successful in further professional education are often studied. Thus, the research by Molotkov and Ryabchun (2019) indicates that a high level of the total USE score depends on general intelligence and volitional potential. At the same time, this study does not show the conditions that influence this volitional potential in young adults and to what extent it is a personal characteristic and/or the result of the increased demands of modern society. While preparing for the Unified State Examination, the low level of personal volitional qualities in young adults can subsequently lead to an insufficiently high level of success in higher professional education. Thus, the formed personal qualities have a direct impact on the effectiveness of preparation for USE and subsequent studies at the university. This refutes the arguments of several researchers that an exceptionally high USE score is important as an indicator of the further success of studying at a university (Dudik, 2016). We conclude that building an effective life trajectory based on higher education involves the formation of personal volitional qualities and a high level of training, confirmed by USE scores.

In the existential context, building a life trajectory means that an individual who builds his/her life path has decided on the ultimate meanings of life; in the social context, he/she has a vision of his/her own future social events and roles in various areas of life (family, career, education, and social life) (Zhilinskaya & Bochaver, 2018; Pichayayothin, 2014; Pinto, Faria, & do Céu Taveira, 2014; Habermas T. & Reese E., 2015). Readiness to choose a profession, professional self-determination, choice of life trajectory, and life planning are distinguished by the most important life objectives of young adults (Yaremchuk, Bakina, & Sityaeva, 2021; Klement'eva, 2019; Neyaskina & Pron'kina, 2017; Petrova, 2019). At the same time, imagining oneself in the future, including professional self-determination, includes not only knowledge and skills but also orientation in society, understanding the laws of the functioning of society, and openness to new experiences (Chesnokova, Churbanova, & Molchanov, 2019; Pinto et al., 2014; Egorenko, 2018; Adelman et al., 2017).

In general, visions of the future form a subjective image of human development. Belogai and Bugrova (2018) indicate that the concept of 'psychological future' is aimed at an individual's cognitive sphere and is associated with his/her attitude to the temporal aspect of his/her own life, while the past is the 'beginning' of objective time, and the future is the psychological 'beginning' of individual time. Individuals have no power over objective time, but they can freely structure their personal psychological time. The duration of the 'expected future' has a direct influence on the present of modern young adults. Unlike a child who sees the coming days and a teenager who

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already has a dream without a definite plan of action, young women and men make connections among the actions they need to take to achieve their goals (Lewin, 2000; Kauffman & Husman, 2004). Accordingly, the future is a psychological space in which the needs of the individual undergo cognitive processing into specific behavioural schemes based on personal volitional qualities.

In the process of developing the volitional potential of young adults, a significant role is played by external socially developed means that help them 'symbolically replace' a significant adult and act concerning themselves in his/her role, thereby forming a new 'psychological system' of a higher level, mastering their own behavior (Pavlenko, 2020). Based on this concept, we concluded that when preparing for the Unified State Examination, which is necessary for further higher education, it is important for young adults to form their own visions of the 'structure of personal psychological future' – when and what needs to be done, what steps lead to the goal, what resources are needed. If young adults realize in themselves the formation of 'psychological systems' that allow them to 'replace a significant adult', their inner need to pass the exam with a high score becomes a personal goal. We assumed that the performance of young adults, demonstrated by them in the Unified State Examination, depends on how they imagine their own future. Our theoretical analysis enabled us to identify the following main criteria for this relationship: (a) the conceptual meaning of young adults' visions of their own future demonstrates their educational outcomes; (b) self-assessments of existing achievements of young adults who demonstrate a high level of education performance, compared to the achievements they expected, indicate a 'long-expected future'.

Methods

This study aimed to analyze the relationship between young adults' visions of their own future and their USE scores. Our research was carried out in two stages. At the first stage (in 2018), using the Me in Five Years inventory by I. S. Kon (Kon, 1984), we identified the content-constituting elements of predicting the future of the study participants. We asked the participants to describe themselves as they see themselves in five years. We chose this time range to reveal a medium-term perspective that is not related to the challenges of the present. There were no restrictions on the amount of written text and the time to complete the task. The study sample consisted of 1538 male and female young adults aged 14–28 years. When forming the sample group, we sent an email invitation to participate in the study to educational organizations in Russia and asked to involve as many participants as possible. The study was conducted in any place convenient for respondents. They only needed their personal computers to link to an electronic resource. At the beginning of the study, respondents had to inform us about their consent to participate in the study and in the end – about their consent to the use of their personal data.

The texts of the essays obtained at the first stage and the answers to the questions were studied using an R-based software package. We studied the relationships among the most popular words used in the essays. Our analysis made it possible to extract information about the semantic similarity of particular words used in the essays. The significance of differences was assessed using the chi-square coefficient to test the discrepancy between empirical (observed) and theoretical (expected) frequencies for categorical data.

At the second stage (in 2021), we conducted an additional survey of the same young adults participated in the first stage. Via the e-mails indicated by the participants at the first stage of the study, we sent a link to the page containing a set of questions – personal data, the Unified State

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Examination results, assessment of their own achievements indicated in the letters to themselves at the first stage of the study, and the reasons for poor achievement. Additionally, we sent them the letters that they wrote about their future selves at the first stage of the study. In our study, only 10 % of the respondents of the first stage participated again, which was a good result. Therefore, at the second stage, the sample comprised of 150 individual participants aged 16 to 28 years. The significance of relationships was assessed using Fisher's exact test (significance level at 0.05).

Such study organization made it possible to compare the content of young adults' visions of the predicted future with their educational success.

Results

At the first stage of the study, we gained information about what words young adults most often use in their descriptions of the future, and how these words are related to each other. In total, 1538 essays contained 15988 words. Prepositions, proper names, numerals, and other words without semantic load were excluded from the substantive analysis. Figure 1 shows the repetitive word associations most often used by young adults in descriptions of their future.

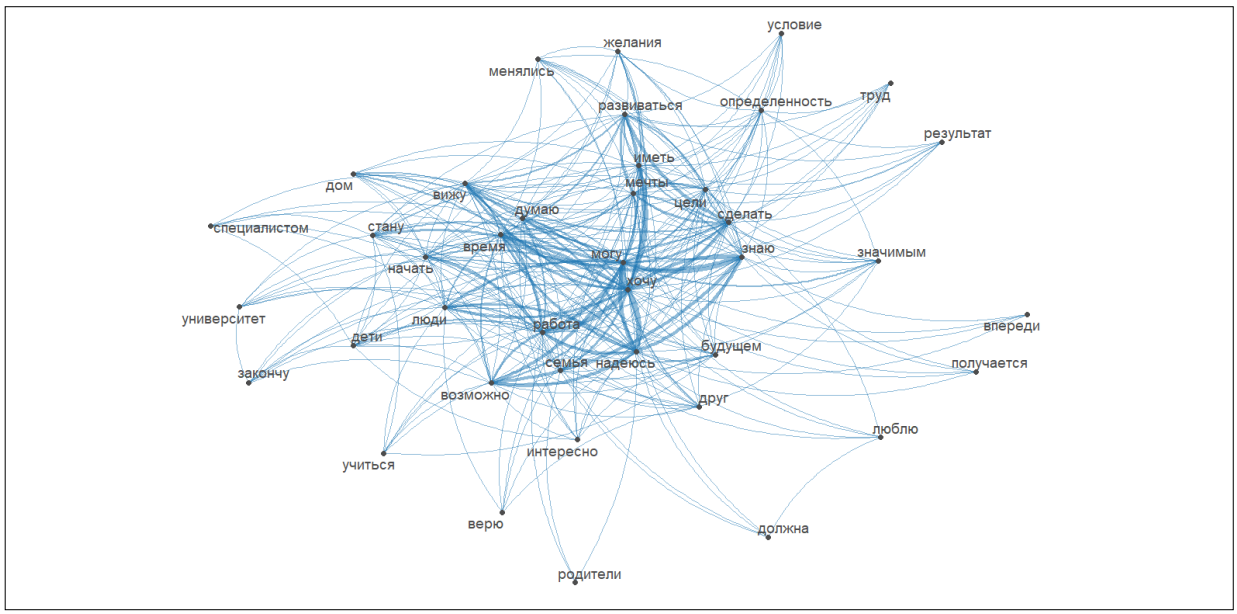

Figure 1. Associations of words used by young adults in descriptions of their future (N = 15988)[1]

1 университет – university; закончу – graduate; учиться – study; верю – believe; родители – parents; специалистом – specialist; дети – children; люди – people; возможно – possible; интересно – interesting; начать – begin; стану - will become; дом – home; вижу – see; время – time; думаю – think; работа – job; семья – family; надеюсь – hope; могу – can; хочу – want; менялись - were changing; желания – desires; развиваться – develop; иметь – have; мечты – dreams; цели – goals; сделать – will do; знаю – know; будущем – future; друг – friend; условие – condition; определенность – certainty; труд – labor; результат – result; значимым – important; впереди – ahead; люблю – love; должна – have to; получается – succeed.

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Language, including written one, is a tool for expressing thoughts. It is very flexible and difficult to formalize. Figure 1shows the results of the analysis of the number of meaning-based associations of different words in the participants' texts. The graph shows that the dependence is complex and non-linear and does not depend on the volume of the text, but rather on the characteristics of the authors. The figure makes it possible to select semantically close words and evaluate the measure of their sense proximity. That is, Figure 1 shows the content of the average representations of young adults about their own future. The following words were fixed in the center of the figure: "see", "can", "hope", "want", "do", "goals", "job", "know", "possible", and "will do". By the number of lines leading to them in the figure, we can conclude that they are most often involved in semantic connections between words that young adults use to describe their vision of the future.

At the second stage of the study, we distinguished the participants with 'excellent' USE scores in at least one subject (score range, 81–100). Thereafter, we compared the frequency of words identified as the focus of young young adults' visions of the future (Fig. 1), in general, by all the young adults who participated in the study, and those of them who were most successful in education (according to the USE scores). Among the essays of the study participants who had excellent USE scores in at least one subject (score range, 81–100), 53 essays contained 2480 words. Figure 2 shows the comparison of the frequency of occurrence of words in essays across the entire sample of young adults and in the essays of the study participants who had excellent USE scores in at least one subject (score range, 81–100).

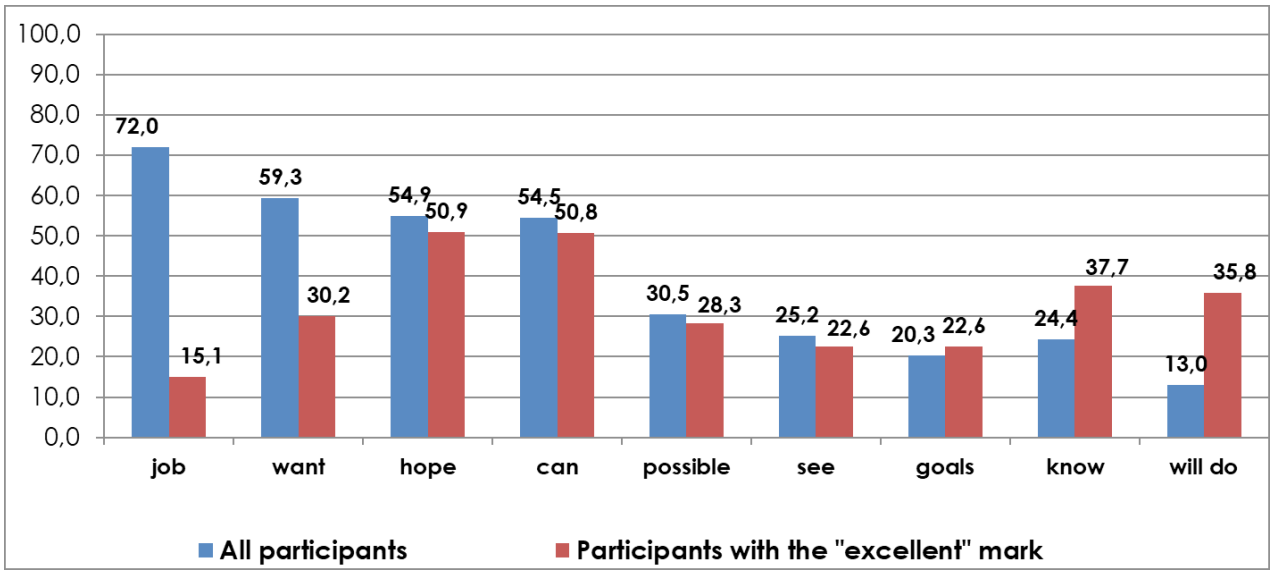

Figure 2. The word frequency, % (N = 1538)

The data presented in Figure 2, demonstrate that the visions of the future of the study participants who had excellent USE scores in at least one subject (score range, 81–100) differ greatly

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in terms of their use of the following four words: "job", "want", "know", and "do". Young adults who passed the exam with 'excellent' scores use the words "job" and "want" less often. At the same time, they use the words "do" and "know" more often. The significance of these differences is confirmed by the analysis carried out using the chi-square coefficient. For the word "want", the chi-square coefficient = 38.9, at a significance level of 0.00 (all cells have an expected count greater than 5, the minimum value is 19); for the word "job", chi-square coefficient = 104.65, at a significance level of 0.00 (all cells have an expected number greater than 5, the minimum value is 14); for the word "know", the chi-square coefficient = 5.63, at a significance level of 0.05 (all cells have an expected number greater than 5, the minimum value is 12); for the word "will do" chi-square coefficient = 28.63, at a significance level of 0.00 (all cells have an expected count greater than 5, the minimum value is 6).

In addition, at the second stage of the research, we found that the vision of the future and the USE scores are interconnected. In the framework of the discussion described in this article, the relationship between the USE scores and the assessment of the realization of individual plans is important.

In young adults' answers to the question of why something has not yet happened or is not happening from what the participants expected, we found significant relationships between respondents' statement that "I will have everything as I expected, but later than in five years" and the average scores obtained in the compulsory subjects USE (not excellent and not unsatisfactory scores).

Thus, young adults who had 'satisfactory' scores in the USE in mathematics (score range, 60–27) reconsider their plans. Among the answers to the question "If something has not happened yet and you put a mark of less than 10 in the previous question please answer why?" they tend to insist on their plans and choose the answer "I will have everything as I expected but later than in five years" (f = 0.0037). Young adults who had 'good' scores in the USE in the Russian language subject (score range, 80–61) reconsider their plans. Among the answers to the same question the tend to insist on their plans and choose the answer "I will have everything as I expected but later than in five years" (f = 0.0387).

Table 1 presents significant associations between the USE scores and the answers to the following question: "In the 2018 research, you described how you see yourself in five years. About half of that time has passed. Please, using a 10-point scale, rate whether everything turned out the way you expected, where 10 points mean that everything worked out, and 0 means nothing happened".

Table 1

Associations between the Unified State Exam scores in elective subjects and respondents' satisfaction with their achievements (N = 150)

USE scores	Assessment of satisfaction with achievements, 10-point scale	Fisher's exact test
Score range, 100–81	4	0,01486

Table 1

Associations between the Unified State Exam scores in elective subjects and respondents' satisfaction with their achievements (N = 150)

USE scores	Assessment of satisfaction with achievements, 10-point scale	Fisher's exact test
Score range, 80–61	6	0,002799
Score range, 60–27	10	0,04762
Score range, 26–0	9	0,04659

Accordingly, young adults who had 'excellent' scores in the elective USE (score range, 100–81) assess the achievement of their plans lower than those who passed the elective USE worse. Young adults who had low scores in the elective USE indicated that they carried out their plans in half the period they planned. One of the typical comments of a female respondent who had an 'excellent' score in the elective USE was the following statement: "I have become smarter and more mature – that is for sure. Believe it or not, I go in for sports every day (well, almost every day). I am going to become a linguist, although it is still not journalism. I lost a couple of years in the other direction, but it is still an experience, and I do not want to worry about it. I realized that money is really important. I still love the "black" style, but I am also keenly interested in punk and, at the same time, something gentle. I try. I think so". Meanwhile, one of the typical comments of a male respondent who had a lowest score (score range, 26–0) in the elective USE was the following statement: "I did not succeed with the planned university..."

Discussion

For young adults, it is important to build a life trajectory, individual future socially determined events, social roles, and individual life (Chesnokova et al., 2019; Klement'eva, 2019; Belogai & Bugrova, 2018; Neyaskina & Pron'kina, 2017; Petrova, 2019; Zhilinskaya & Bochaver, 2018). Therefore, we studied young adults' visions of their future. Our findings indicate that when describing themselves in the future, young adults most often use the following words: "see", "can", "hope", "want", "do", "goals", "job", "know", and "possible". Based on the cultural-historical concept described by L. S. Vygotskii (Vygotskii, 1983), we explored the meanings of the keywords that indicate how young adults build their own lives. The semantic analysis of the questions about the origin of word meanings, their associations with thinking, social and cultural characteristics of a native speaker, has shown the following:

1. Etymologically, the word "see" suggests vision. However, in connection with the words "can", "know" and "want", it means "I see what I want", "I see what I can", and "I see what I know". Such a vision of the future, first of all, helps young adults understand themselves.
2. The words "goals" and "job" are those socially developed means that, according to V. N. Pavlenko, enable young adults form a new 'psychological system' (Pavlenko, 2020) of

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their own psychological future by means of interiorization. That is, an adolescent assimilates the vision of a future life through the adults around him/her, which represents the thesis "the purpose of life is to find a job".

3. The words "hope" and "possible" appear as a direction of actions in the supposed future of young adults. Considering that future is a psychological "beginning" of individual time (Lewin, 2000), these words characterize the uncertainty in actions of young adults.
4. In the existential context, building a life trajectory means that an individual who designs his/her own life has definite fundamental life meanings. In this context, the words "know" and "will do" indicate respondents' confidence in their own future.

In more than 70 % of cases, the word "job" is the central content of the future life stories of young adults participating in the study. At the same time, in the essays of young adults who had 'excellent' scores in the elective USE, the word "job" was found only in 15 % of the essays. There are also significant differences in the use of the word "want". Young adults, who had 'excellent' scores in the elective USE, used it much less frequently. However, young adults, who had 'excellent' scores in the elective USE, used the words "know" and "will do" significantly more often than other study participants. That is, in order to achieve success in USE, modern young adults need to have a visions of their own lives, but not in the mode of the questions of surrounding adults ("What specialty do you plan to work in?"), but in terms of their own knowledge of what they can do on their own. Therefore, the meaning-based association of the words "know" and "will do" allows young adults to achieve significant educational success.

Thus, the USE scores in core subjects are interconnected with perseverance in achieving plans for the future. "Satisfactory" scores in mathematics and "good" scores in the Russian language subject are associated with young adults' belief that "if something planned did not happen, it would definitely happen, but later than expected". Accordingly, passing the compulsory part of the USE with average scores provokes young adults to increase "the distance of their expected future" (Lewin, 2000). Our data allow us to make a preliminary conclusion that for such young adults, the USE acts as a kind of systematization of their plans – leaving a school that is built on the principle of 'spontaneous learning' (Kravtsov & Kravtsova, 2020), they face with a clear USE structure and organization. These results are consistent with the notion that a high overall score in the USE generally makes it possible to predict future high achievements upon graduation (Dudik, 2016). Moreover, they show that average scores in the USE help analyze individual life trajectory and adjust it further.

Elective USE scores are associated with respondents' assessments of the achievement of their future plans. Young adults, who had 'excellent' scores in the elective USE, assessed the achievement of their plans lower than those who had lower scores in the elective USE. Young adults who had low scores in the elective USE indicate that they reached their goals earlier than they indicated in their essays. Such underestimation of their capabilities is explained by the lack of clear criteria for the desired future. This allows them to underestimate the requirements for themselves, as well as for the necessary level of training and knowledge to achieve stated goals.

In the process of vocational education, the longer the period of time for which young adults see themselves in the future determine their higher readiness to get educated at a higher level (Yaroshevskaya & Sysoeva, 2021; Lukina & Solov'eva, 2019). Such conclusions were demonstrated by N. L. Lukina and E. A. Solov'eva in their analysis of the relationship between plans for future

and the level of vocational education. Thus, a distance of "expected future" has a direct impact on the present of modern young adults. Unlike children, young adults build connections between the actions necessary to achieve their own plans (Lewin, 2000). In this context, our data demonstrate that young adults who are less successful in the USE have no clear life plans and cannot objectively assess their achievability. Figuratively, this can be formulated as "having not achieved what they wanted, they pretended that they wanted what they had achieved". Therefore, young adults who objectively see the prospect of their future life can better organize their educational activities when preparing for exams and score higher on the USE.

Conclusion

In the study, we obtained the data that characterize the relationship between educational outcomes and visions of the future of young adults. The meaning-based association created by the words "know" and "will" allows young adults to achieve significant educational results.

Educational outcomes in the compulsory subject areas are interconnected at the intermediate level with the revision of individual life trajectory and perseverance in achieving individual plans for the future. Educational outcomes in elective subject areas are associated with assessments of the achievement of individual plans for the future. Young adults, who had 'excellent' scores in the elective USE, assess the achievement of their plans to a lesser extent. In their visions, the distance of the 'expected future' is considerably longer than in the visions of those who had lower scores in the elective USE. Young adults who had 'unsatisfactory' scores in the elective USE cannot objectively assess the achievability of their life plans.

The findings of this study can become the basis for further research that was not included in the pool of issues discussed in the article. In particular, the use of social media and Internet resources in the formation of visions of the future remained outside the scope of this study.

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Transfer Effect in Selective Reproduction of an Implicit Sequence

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Abstract
Introduction. This article discusses current issues of implicit knowledge usage. A brief literature review presents the data on two types of implicit learning: 1) learning a system of rules (in artificial grammar learning) and 2) understanding the alternation patterns of stimuli (in learning sequences). This review showed that there are no results of partial reproduction of an implicitly memorized sequence. The study used the transfer effect since it allows modeling various conditions for usage of implicit knowledge and reduces explicit control. This study aimed to detect the transfer effect in selective sequence reproduction. **Methods**. The study was carried out in the sequence learning paradigm. At the first stage, a perceptual sequence was presented in the experimental group. At the second stage, the stimuli were arranged in a horizontal row. Several stimuli of this spatial sequence corresponded to the architecture of the perceived sequence of the first stage. Stimuli were presented randomly in the control groups. The sample comprised 45 subjects. **Results and Discussion**. The subjects of the experimental group showed a statistically significant decrease in the reaction time to the stimuli of the spatial sequence that corresponded to the architecture of the perceived sequence. **Conclusion**. The transfer effect was presented in selective reproduction of both an implicitly learned system of rules and patterns of stimuli alternating. The findings from this study support the idea that not only fragments but also general abstract structures of sequences are implicitly memorized.

Keywords
implicit learning, sequence learning, transfer effect, selective reproduction, cognitive unconsciousness, perceived sequence, spatial sequence, artificial grammar, system of rules, pattern

Highlights
- The transfer effect is used to investigate the usage of implicit knowledge in various conditions.
- A comparison study on two types of implicit learning – learning a system of rules (in artificial grammar learning) and understanding the alternation patterns of stimuli (in learning sequences) – showed a lack of data on the transfer of sequences.

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▸ The transfer effect in the selective sequence reproduction manifests itself in an increased reaction to stimuli that were presented as elements of a previously learned implicit sequence.

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Introduction

The results of research in cognitive psychology have shown that implicit learning (IL) underlies the ability to assimilate numerous patterns and systems of rules in cases where they do not need to be fully assimilated. The subject acquires and uses information without knowing about its presence or essence (Agafonov, Burmistrov, Kozlov, & Kryukova, 2018; Ivanchei, 2014; Ivanchei & Moroshkina, 2011; Kryukova, 2016; Moroshkina, Ivanchei, & Karpov, 2017; Ushakov & Valueva, 2006; Cleeremans, Allakhverdov, & Kuvaldina, 2019; Iwasaki, Kuriyama, Kondoh, & Shirayori, 2018).

Most often, learning and the subsequent use of knowledge takes place in different conditions. In the field of IL research, this phenomenon of application of knowledge is called the 'transfer effect'. A. Reber, who was among the pioneers in this field, applied an experimental technique that became the basis for further methods for studying the transfer effect.

In 1967, A. Reber proposed an experimental technique to study the phenomenology of IL. The method was called 'artificial grammar learning'. What is this kind of grammar? This is a system of rules by which the experimenter can generate so-called grammatical lines of symbols. Figure 1 demonstrates the artificial grammar used by A. Reber in the first experiments.

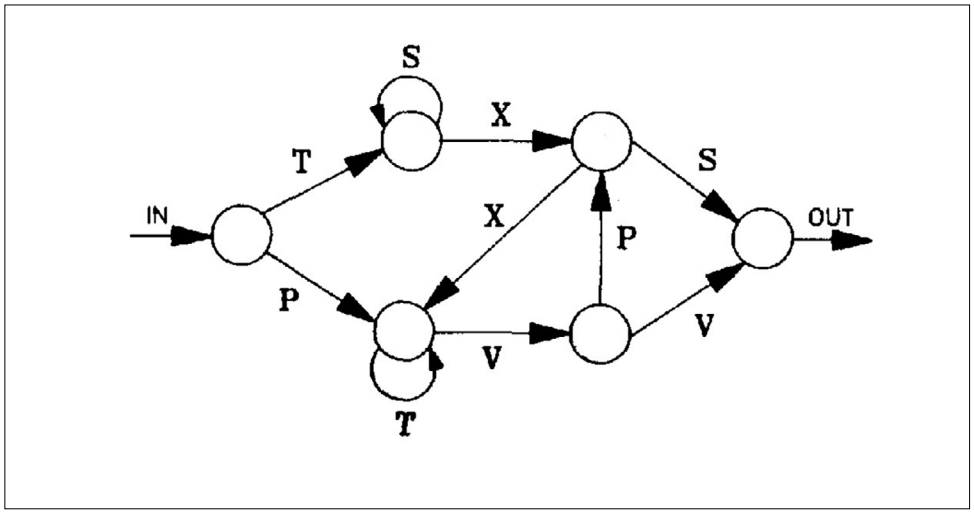

Figure 1. Artificial grammar (A. Reber, 1967)

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An example of a grammar line would be TSXXTVPS. The line VTPPVSSS is agrammatic, which means that it is not constructed by the rule (Reber, 1967).

In a series of experiments, A. Reber showed that without knowing the rule for composing lines, subjects are able to quite effectively distinguish 'correct' rules from 'incorrect' ones. But this is only possible if they were trained before to perceive and memorized only grammatical lines.

A. Reber argued that the transfer effect manifests itself whenever previously learned rules are applied during the processing of new information. The very fact that the effective distinction between grammatical and agrammatical lines at the test stage is already a manifestation of the transfer of the rule implicitly learned at the training stage. But the transfer effect manifested itself in another experiment with the same artificial grammar at the training and test stages, yet different symbols used (at the test stage the alphabet changed but the grammar remained the same). In this case, although the subjects categorized lines somewhat worse, the amount of correct answers remained above the level of random guessing. In other words, under new stimulus conditions the subjects unconsciously discovered the grammar structure that was learned during the first stage (Reber, 1967; Reber, 1989; Reber, 1969).

The research direction found by A. Reber was continued by J. Altmann and colleagues. In their experiment, the subjects perceived visual stimuli (lines of letters) at the training stage. Notes were used as test stimuli instead of letters. Thus, the subjects had to perceive short melodies as stimulus sequences. The task was to differentiate the audial stimuli into those grammatical and agrammatical ones. The results showed that the subjects performed successfully, although they could not explain the rule for organizing rows of stimuli. The authors conclude that the area of transfer is not limited by the modality of perception (Altmann, Dienes, & Goode, 1995).

As further studies have shown, the transfer of implicit knowledge of previously learned patterns does not depend on the type of learning activity. Thus, in our earlier study, the standard procedure for using artificial grammar included one more new part. After training and test stages the subjects went through the control stage, which combined two types of cognitive activity (work with grammar and sensorimotor activity). The purpose of this stage was to test the possibility of transferring the results of one activity to the process of performing another. In the experimental group, the subjects were presented with a green circle after each grammatical line, and a yellow one after an agrammatical line. According to the instructions, the subjects had to respond as quickly as possible by pressing the keys that were relevant to the color of the circle. In the control group, the circles appeared randomly. It was found that the subjects of the experimental group performed sensorimotor tasks significantly faster, but at the same time they did not realize a pattern of stimulus presentation. Presumably, the subjects of this group implicitly established a connection between the line and the color of the circle, which allowed them to expect the appearance of a green circle after a grammatical line and respond faster (Kryukova, Agafonov, Burmistrov, Kozlov, & Shilov, 2018).

According to the abovementioned data, knowledge gained in the process of IL is used in the system of rules in different conditions. Another type of implicit learning is the learning of patterns in alternating of stimuli, actions, and events. This type was explored in a popular experimental paradigm of sequence learning. This method by M. Nissen and P. Bullimer involves the presentation of certain stimuli in a certain order specified by the experimenter, while the subject does not know the rules of line architecture (Burmistrov, Agafonov, Fomicheva, & Shilov, 2021; Cleeremans, Destrebecqz, & Boyer, 1998; Clegg, DiGirolamo, & Keele, 1998; Destrebecqz

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& Cleeremans, 2001; Nissen & Bullemer, 1987). This experimental paradigm is related to artificial grammar. Therefore, it was expected that the transfer effect was repeatedly found in these studies. In one of the experiments, when a stimulus appeared, the subjects were required to press the keys with the index and middle fingers of their right and left hands. At the second stage, it was necessary to react only with the index finger of the right hand. The authors of the work suppose that they have established a transfer between the executive organs, since the reaction time of the subjects at both stages was the same. Meanwhile, the transfer was absent under conditions when it was necessary to indicate the location of the stimulus on the screen verbally, and then press the keys (Cohen, Ivry, & Keele, 1990; Curran & Keele, 1993). It also turned out that the subjects reacted faster if they had previously watched the experimenter perform this task. Probably, for the most effective learning of sequences, it is necessary to combine perceptual and motor learning (Bird, Osman, Saggerson, & Heyes, 2005).

Another type of the considered effect is spatial transfer. It was discovered by K. Tanaka and K. Watanabe. They trained the subjects by demonstrating sequences using a horizontal arrangement of stimuli. At the second stage, the horizontal row was replaced by a vertical or a mirror one. Participants performed the target task more efficiently if the test sequences were composed according to the original rule (Tanaka & Watanabe, 2014). In the same research direction the data demonstrated the transfer between sequences of different types. For example, implicit knowledge of the organization of a perceptual sequence was effectively used in the course of solving problems of determining the spatial localization of a stimulus (Kryukova, 2020).

We should note that in experiments with artificial grammars, subjects are implicitly taught with a system of rules, and each grammatical line at the test stage is a fragment of this grammar. At the same time, the results of experiments performed in the sequence learning paradigm were obtained with a complete reproduction of the sequence at the test stage. However, this is precisely what has been criticized by those, who suppose that during the assimilation of the sequence the subjects explicitly memorize its constituent elements (two or three stimuli following one after another) (Perruchet, 2008; Perruchet & Amorim, 1992; Perruchet & Pacton, 2006; Willingham, 1999). At the same time, a number of researchers support the idea that during the process of implicit learning, it is precisely the organization rule that is assimilated, and that is in the pattern of the stimuli sequence, not in stimuli themselves (Reber, 1989; Destrebecqz & Cleeremans, 2001). The transfer effect can serve as confirmation of this position, since changing conditions make it difficult to apply previously learned and assimilated information that reflects only a set of stimuli without understanding the general principles of their interaction.

In order to solve the problem, we used the technique of selective reproduction in our study, which makes it possible to find the learned earlier patterns in fragments of the test sequence. Thus, the study *aimed* was to establish the transfer effect in selective sequence reproduction. We tested experimentally the following hypothesis: the reaction time will decrease for structural elements that are a part of the previously learned implicit regularity.

Methods

We carried out an experiment with a sample of 45 subjects (14 men, 31 women) aged 18 to 40 years (M = 21 years). All subjects had normal vision. The sample was randomly divided into three groups: experimental group (EG) and two control groups (CG1 and CG2). Each subject was tested individually.

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The basic procedure reflected one that demonstrated the transfer of the perceptive structure to a spatial structure (Kryukova, 2020). We developed a special computer program, using that one can change the time and presentation order of stimulus material, and save the answers of the subjects in the database. The experimental procedure consisted of three stages.

At the first stage, a perceptual sequence was presented to the EG, which structure consisted of 10 elements. Four emojis were used as stimuli (Figure 2). The sequence looked like this: 4-1-3-2-3-1-2-4-1-2, where 1 is an emoji with a heart, 2 is an emoji with a cake, 3 is an emoji with flowers, 4 is an emoji with a bowtie. Emojis appeared one by one in the center of the screen. The subjects performed the task following the instructions: with the index finger of the left hand they had to press the 'space' key as quickly as possible only when an emoji with a heart appeared; when any other emoji appeared, we required to press the '→' key as quickly as possible with the index finger of the right hand. The exposure time of one stimulus was 400 ms. If the subjects did not answer during this time, then the screen remained blank until the button was pressed. The time interval from pressing a key till the demonstration of the next stimulus lasted 250 ms.

Figure 2. Stimulus material, the first stage

The first stage included 12 blocks. In first 8 blocks the sequence was repeated 9 times (there were 90 trials in each block). In block 9, 90 stimuli were presented in random order. This block 9 was composed in order to check whether the sequence was learned, in this case the reaction time would increase. In blocks 9–12 emojis were again presented according to the sequence. Between the blocks there was a 30-s pause to rest. In CG1 and CG2, the conditions were the same as in the EG, but there was no regularity in the presentation of stimuli.

At the second stage, the spatial arrangement of stimuli was used in all groups. In the middle of the screen, there was a horizontal row of ten squares, numbered from left to right (1, 2, 3, 4, 5, 6, 7, 8, 9, and 10). The squares filled green in a sequence. The subjects had to press the key with the letter B as quickly as possible if the square numbered 1, 2, 3, 4 or 5 turned green, in other cases the letter was U. The exposure conditions were the same with the first stage. The sequence repeated 30 times.

In EG and CG1, we introduced the following rules for coloring the squares:

- the rule of the variable localization of the green signal: the first, third, fourth, fifth, seventh, eighth, tenth in turn; any square could be colored, except for the second, sixth, and ninth ones;
- the rule of the deterministic localization of the green signal: only the square numbered "2" was painted second in turn, the square numbered "6" was painted sixth, and the square numbered "9" was painted ninth.

Thus, in this study, the selective reproduction of the sequence architecture is manifested

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in the fact that in the EG, with the same amount (10) of elements of the perceptual sequence and the spatial series, only the order (2nd, 6th, 9th elements) of the appearance of one of the stimuli (emoji with a heart) at the first stage and the order of the deterministic localization of the green signal at the second stage are equal.

The subjects were not told about the existence of any of the rules.

In CG2 there were no patterns, which allowed carrying out a more detailed analysis of the results of the second stage among the three groups.

At the end of the main procedure, a post-experimental interview was conducted to test the ability of the subjects to explicate the sequences. Since the stimulus material was tested in a previous work on the subject of unconsciousness (Kryukova, 2020), it was decided just to interview the subjects without additional tasks.

All stimulus exposure conditions, the number of blocks and tasks, interview questions were selected basing on the experience of previous studies and our pilot experiments.

Results and Discussion

First of all, we analyzed the answers to the interview questions. Some of the subjects said that they noticed some order in the sequence of emojis, but did not understand it. The EG participants noted that their reaction time increased in one of the blocks of the first stage (this was block 9, where the sequence was broken.) However, no one saw any pattern in the second stage. Thus, the analysis of the answers showed that the subjects did not understand the rules, and no one had a solution strategy at the second stage.

Further processing of the results took place in two stages. Incorrect answers were less than 1 %; the time of these answers was not taken into account.

Implicit memorization of a perceptual sequence

First, it was necessary to make sure that the subjects learned the perceptual sequence at the first stage. As shown in previous works, in EG the results of four blocks were the most informative for analysis: block 1 revealed the initial indicators of reaction time; in block 8 the effect of learning can be fully observed; block 9 is a test block; by block 12, the effect of learning was restored. In the control groups we selected the results of the same blocks. The reaction time of the first ten presentations in each block was removed in order to eliminate the period of adaptation to the conditions of the task. Mathematical processing of the results was carried out using the two-way repeated measures ANOVA, 3x4 (3(EG, CG1, CG2) x 4(four blocks)).

Analysis of variance revealed a significant interaction of factors ($F(6; 179) = 5.14$; $p < 0.01$). This suggests that the conditions in the groups had a different effect on the reaction time in each of the blocks.

According to the clarifying data of the Tukey test, in the EG, the subjects in the block 8 spent significantly less time to answer than in the block 1: $p < 0.01$. In the block 9, when the sequence was broken, the reaction time increased significantly compared to the block 8: $p = 0.016$. In the block 12, the reaction time again significantly decreased: $p < 0.01$. These results can be explained by the fact that in block 9 the change in the order of stimuli sequence prevented the subjects from the implicit usage of the previously learned sequence. Since block 10 the stimuli continued to be presented according to the rule; the subjects were able to use it again. In the control groups, in general, there was only a slight decrease in the reaction time, which is associated with

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the effect of working out. Since the difference in conditions in the groups is due to the presence of a rule in the EG, the difference in the dynamics of the results (Table 1, Figure 3) indicates that the subjects in the EG implicitly learned the perceptual sequence.

Table 1
Describing characteristics of the first stage of the experiment

Group	Block	Reaction time (ms)		95 % confidence interval	
		Mean	Standard deviation	From	To
EG	1	395	66	358	432
	8	317	66	280	354
	9	372	48	345	399
	12	259	32	242	277
CG1	1	361	56	330	392
	8	336	46	310	362
	9	321	52	292	350
	12	341	78	298	384
CG2	1	360	51	332	389
	8	337	56	321	368
	9	332	48	318	346
	12	321	53	305	352

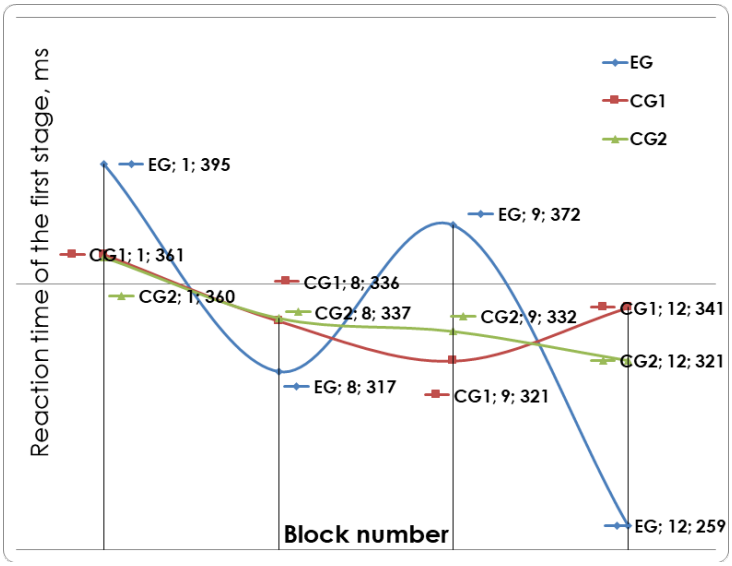

Figure 3. Results of the first stage of the experiment

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Investigation of the transfer effect

The possibility of the transfer effect is determined by the results of the second stage. During the presentation of the spatial sequence, a part of the structure of sequence architecture was reproduced; the 2nd, 6th, and 9th elements were repeated. Therefore, we took into account only the response time to these stimuli. The results of the first five repetitions of the sequence were removed to avoid the influence of the adaptation period to the conditions of the task. To process the results, a one-way analysis of variance was used, which revealed a significant effect of the group ($F(2; 44) = 4.43$; $p = 0.017$). According to Tukey's test, subjects in the EG responded to the green signal significantly faster than in CG1 ($p = 0.047$) and CG2 ($p < 0.01$). The results are presented in Table 2 and Figure 4. The data indicate that it was the presence of the transfer of the previously memorized structure that contributed to the increasing efficiency of the EG. This conclusion is also supported by the fact that the presence of only a spatial sequence (which the subjects could begin to assimilate) in CG1, managed to lead to a slight increase in reaction time, compared to the indicators of CG2, where there were no patterns: $p = 0.5$.

Table 2
Describing characteristics of the second stage of the experiment

Group	Reaction time (ms)		95 % confidence interval	
	Mean	Standard deviation	From	To
EG	393	47	366	419
CG1	427	42	403	450
CG2	437	36	416	457

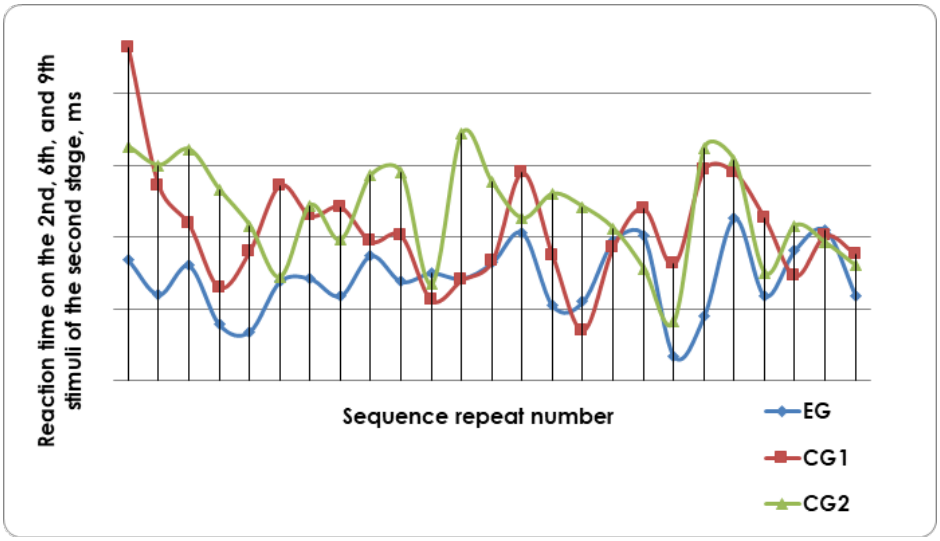

Figure 4. Results of the second stage of the experiment

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Additionally, the results were compared within the EG. The response time to the 2nd, 6th, and 9th stimuli (M = 393 ms) was compared with the response time to the other stimuli (M = 407 ms). It turned out that, although the subjects responded faster to deterministic stimuli, it was not significant: $t = 1$; $p > 0.05$. Presumably, such results are due to the fact that the task of the second stage is quite simple, and it is impossible to obtain significant changes. Difficulties in obtaining fine effects have been reported before (Jiménez, Vaquero, & Lupiáñez, 2006; Sanchez, Yarnik, & Reber, 2015). Therefore, it is necessary to continue searching for optimal conditions for studying this phenomenon.

Conclusion

The study of the effect of sequence transfer was carried out using selective reproduction. It implied the repetition of several structural elements of a previously learned sequence in new conditions. At the same time, the length of the sequence (i.e., the number of elements) was the same while the stimuli were replaced. In addition, in order to make it more difficult for the subjects to use the consciously memorized sequence elements, we used the structural elements that were separated from each other.

As a result, there was an increase in the efficiency of solving the tasks where stimuli of the new sequence corresponded to the elements of the previously learned structure. Thus, the transfer effect can be observed in the selective reproduction of both an implicitly learned system of rules and the patterns of stimuli alternating.

The findings are consistent with a recent study that not only fragments but also general abstract structures of sequences are implicitly memorized (Fu, Sun, Dienes, & Fu, 2018).

The results of the study can be useful in IT companies for developing ergonomic interfaces.

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Author Contribution

A. P. Kryukova contributed to the idea and experimental design of the study, carried out statistical data processing, interpreted findings, and prepared the manuscript for publication.

A. Yu. Agafonov contributed to the idea of the study, prepared the manuscript for publication, supervised the study, interpreted findings, and provided financing.

S. B. Burmistrov conducted the experiment, selected study participants, and interpreted findings.

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Research article

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Features of Teachers' Meaning-based Regulation Under Conditions of Information Uncertainty

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Abstract
Introduction. Meaning-in-life orientations and self-reflection are important indicators of the regulation of personal meanings. In a modern rapidly changing society, individuals do not fully manage their lives due to the influence of various uncertainty factors. The COVID-19 pandemic that began in early 2020 and swept across the world is considered a global factor of uncertainty. The increased uncertainty of life associated with the pandemic is an additional stressor. This paper represents a first effort in obtaining empirical data on gender characteristics of teachers' meaning-based regulation in the context of the coronavirus pandemic. This paper reports the results of an empirical study of differences in meaning-in-life orientations and self-reflection among teachers before and during the pandemic as different conditions of information uncertainty in their lives. **Methods**. The study was conducted among female teachers of secondary schools in the Rostov region in March 2017 (n = 53) and in October 2020 (n = 43), i.e. before and during the pandemic, which can be considered different conditions of information uncertainty in their lives. We used the following psychological assessment tools: (a) the Meaning-in-Life Orientations test by D. A. Leont'ev and (b) the Self-reflection Questionnaire by I. A. Stetsenko. **Results**. We observed an increase in all means of both tests during the pandemic, compared to the pre-pandemic values. Differences in all parameters are statistically significant (according to the Mann–Whitney U test). **Discussion**. Our findings indicate that the pandemic represents a surmountable stressor for the homogeneous acmeological category of female teachers surveyed in this study. Information uncertainty contributes to constructive restructuring of the processes of meaning-based regulation and psychological adaptation, which leads to an increase in the level of meaningfulness of life orientations and self-reflection among the respondents.

Keywords
meaning, meaning-based regulation, meaning-in-life orientation, meaningfulness of life, self-reflection, information uncertainty, stressor, coronavirus infection, pandemic, female teacher

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Highlights

- The leading indicators of the orientation of meaning-based regulation include meaning-in-life orientations and self-reflection.
- The coronavirus pandemic as a form of information uncertainty is associated with a significant increase in indicators of meaning-in-life orientations and self-reflection among female secondary school teachers, compared to the pre-pandemic values.
- In the context of the coronavirus pandemic, female secondary school teachers perceive an increase in information uncertainty as a surmountable stressor that is associated with a transition to a state of greater organization and mobilization of the processes of meaning-based regulation.

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Introduction

The meaning-based regulation represents the highest level of the regulation of personal development. The meaning-based nature of the key mechanisms of managing individuals' interactions is determined by the integral nature of the influence of meaning-based constructs on their behavior (Leont'ev, 1997). At the same time, there is a difference between the category of meaning and the category of sense, which is manifested in the discourse of psychology, linguistics, cultural studies, and philosophy. Meaning is necessary to clarify the sense of a message in verbal communication via a minimal set of words (Wierzbicka, 2019). Meaning is a way of setting and contextual use of sense, forming Frege's semantic triangle, as a logical model of a sign (Frege, 2008). In the humanities, there is no generally accepted definition of the concept of 'meaning' because it contains various characteristics (Leont'ev, 2007). Meaning represents an interdisciplinary construct and is increasingly seen as a philosophical-linguistic-psychological category (Seriy, 2002).

Today, the psychological study of the phenomenon of meaning becomes an important area for theoretical and experimental work. The meaning-based approach helps to expand the scope of problems to be solved in the field of personal value-motivational sphere, education in a rapidly changing world, ways of experiencing difficult situations, and understanding life. These issues are considered in works on modeling meaning-based reality (Leont'ev, 2007), analysis of meaning-based attitudes (Asmolov, 2016), empathy (Vasilyuk, 2016), levels of the meaning-based sphere (Bratus', 2014), foundations of meaning-based didactics (Fomenko & Abakumova, 2014), features of meaning-based communication in learning (Kagermazova, 2014), and the search of the meaning of life (Frankl, 2017).

To fully establish meaning-based connections in the system as its understanding, it is necessary to go beyond its limits into the context of Bakhtin's 'outsideness' (Bakhtin, 2012). This

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explains the fact that the meanings of words are found from sentences, the meanings of sentences are found from texts, the meanings of texts are found from contexts, and the meaning of life is found beyond life. This means that it is impossible to abstractly deal with it, but only based on the target context (Tul'chinskii, 2018). Then the construction of general conceptual models of meaning is influenced by the context of cognition, activity, and communication in its broadest sense, which is an extremely heterogeneous field with unique conditions for personal development.

The current interest in the impact of various effects of uncertainty on personal development is associated with the need to consider internal subjective factors of development, including needs, motives, goals, interests, and personal meanings of the individual. All of them may not coincide with the external objective conditions of activity situations (Kocheulova, 2018). Considering the influence of uncertainty factors makes it possible to consider the external and internal risks in the process of personal development for a better understanding of the experiencing subject's behavior. Uncertainty becomes a new methodological principle and a key element of science, which guides psychological theories of thinking, consciousness, and self-regulation (Kornilova, 2018). The postmodern paradigm and interdisciplinary approach in the study of the phenomena of uncertainty show the changeability of the modern society states as the transitivity of modern civilization (Martsinkovskaya, 2018).

In terms of the effects of uncertainty, the most effective impact has had the global pandemic of the COVID-19 infection that that began in early 2020. The impact of this pandemic should be considered as a global effect of uncertainty on the modern development of civilization. Unlike an epidemic, a pandemic is not a continuously transmitted disease that has a progressive spread in some areas beyond a certain epidemiological threshold. According to WHO, a pandemic is the highest phase in the epidemic development that is steadily spreading worldwide.

The primary source of uncertainty is the increased possibility of contacting coronavirus infection (Advice for the public…, 2020). This source of increased vital risk entails secondary factors that increase the uncertainty of life – the introduction of sanitary standards and distances when people are in contact ('social distancing') and the exclusion or minimization of social contacts ('self-isolation') (Pfattheicher, Nockur, Böhm, Sassenrath, & Petersen, 2020). These initial uncertainties generate 'derivative' uncertainties that affect all areas of public life, ranging from the spatial distance between individuals and their number in certain rooms, changes in consumer behavior, transition to distance learning, business shutdowns, and ending with quarantine restrictions on moving to other regions and countries.

T. V. Kornilova notes that during the coronavirus pandemic, personal regulation of internal choice and decision-making is transferred to the area of interactions with external social requirements, in particular, due to the need to maintain social distancing (Kornilova, 2020). In terms of the psychosomatic state, there was an increase in insomnia, depressive and anxiety reactions, post-traumatic and obsessive-compulsive disorders, as well as the state of social alienation (Talevi et al., 2020). According to L. E. Gorlevskaya, during the pandemic, there was a transformation in consumer preferences and an increase in demand for food, pharmaceuticals, and personal hygiene products; the consumption of luxury goods, tourist services, and cars decreased. At the same time, there was a rapid growth of electronic services and online commerce; the consumption of media content has changed. There was an increase in demand for TV and Internet broadcasts and a decline of interest in outdoor advertising (Gorlevskaya, 2020).

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Since the spring of 2020, various quarantine measures have been applied around the world to prevent the spread of coronavirus infection, including the complete blocking of the movement of people and the shutdown of economy sectors, significant restrictions on social, cultural, and economic activities. Thus, restrictions were imposed on the export of certain types of products based on the Decree of the Government of the Russian Federation no. 223 dated March 2, 2020. In such a force majeure situation, entertainment, sports, social, educational, and other events that attracted large crowds were cancelled or suspended. This resulted in the impossibility of fulfilling contracts for the supply of goods and the provision of services due to the termination of the fulfillment of obligations by Rule 417 of the Civil Code of the Russian Federation (Baranova & Udalov, 2020).

There were effects of distortion of objective facts and the appearance of unconfirmed news – fakes that misled various segments of society in terms of broadcasting information about coronavirus infection. In a socio-psychological context, the total spread of such a combination of adequate and inadequate facts should be considered an infodemic – the information uncertainty of knowledge about coronavirus infection. Transmitting into an individual's cognitive sphere, this provokes an increase in the level of anxiety, stress, and depressive disorders (Zinchenko, Morosanova, Kondratyuk, & Fomina, 2020). This can lead to adverse changes in behavior patterns due to a decrease in the level of critical thinking when analyzing truthful and fake information. This also may result in the violation of anti-epidemiological requirements, and a decrease in trust in government and medical authorities. To successfully overcome information uncertainty during the period of self-isolation, it is necessary to be engaged in tactical and strategic goal-setting and achieve goals, which means a higher level of self-regulation of the individual in the context of infodemic (Zinchenko et al., 2020).

Therefore, the global impact of infectious diseases, in this case the coronavirus pandemic, should be considered as a global factor of uncertainty affecting all individuals in the objective and subjective spheres.

Some researchers note that there are tendencies to overcome the influence of the current coronavirus pandemic as a global factor in the uncertainty of life. It is a temporary situational phenomenon (Mal'kova, 2020), which overcoming, in addition to medical prevention and treatment measures, should be supplemented by various psychological techniques and coordinated psychological assistance to the population (Emel'yanova, 2020).

In the context of studying human behavior under the influence of effects of uncertainty, it is important to examine the features of the processes of meaning-based regulation under various effects of uncertainty - in this case, under the influence of coronavirus infection. We should note that in the first phase, we studied meaning-based regulation in 2016–2017, i.e. before the pandemic, when our respondents were in a more definite state of life. The second phase of the study began in October 2020, when the pandemic lasted for six months, and our study participants had to reorient themselves in the face of increased life uncertainty. Therefore, it is necessary to investigate the direction and quality of changes in meaning-based regulation under different conditions of uncertainty.

The COVID-19 pandemic began in late 2019 and swept across the world. Since the beginning of 2020, it has been considered a pandemic. Under its influence, the life of the world community proceeds in unknown conditions, which uncertainty introduces considerable changes and restrictions in all spheres of life. We classify the impact of the coronavirus pandemic as a global effect of

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uncertainty affecting modern individuals' lives. We compare it with unexpected and severe 'black swan' crises (Taleb, 2018). The presence of unreliable information about coronavirus infection is considered as information uncertainty in the context of obtaining information and rethinking life under its influence. In the context of studying behavior changes under the influence of such effects of uncertainty, it is important to investigate the trends in the meaning-based regulation of an individual who is under the influence or in absence of the effects of such information uncertainty.

Methods

To identify trends in meaning-based regulation under the influence of the coronavirus pandemic as a form of information uncertainty, we carried out a specially organized analysis of the empirical data obtained in the first and second stages of the study. In both phases, we used two psychodiagnostic instruments for studying meaning-based regulation. Their indicators represented the main and additional markers of polar sense-building strategies (Godunov, Elagina, & Belova, 2017). These were (a) the Meaning-in-Life Orientations test by D. A. Leont'ev and (b) the Self-reflection Questionnaire by I. A. Stetsenko. Thus, we examined seven indicators:

1. General Life Meaning (GLM);
2. Purposes in Life;
3. Life Process;
4. Life Productivity;
5. Internal Locus of Control;
6. External Locus of Control;
7. Self-reflection Level (SRL).

Tests with the use of these psychodiagnostic instruments were carried out twice – the first time – before the coronavirus pandemic, the second time – during the coronavirus pandemic. In our study, we used two samples of almost similar size and having similar acmeological features – age, gender, marital status, level of education, professional orientation, and place of residence. In this pair of samples tested before and during the pandemic, the respondents were not the same ones (not a longitudinal study) but different individuals who met the requirements for the characteristics of the sample – married female teachers of secondary schools in the Rostov region. To assess the significance of differences in indicators in each pair of samples, we used the Mann–Whitney U test (Nasledov, 2012).

The Meaning-in-Life Orientations test contains pairs of opposite statements that reflect the idea of the factors that make an individual's life meaningful. When answering each question, a respondent has to choose one from two opposite statements (for example, "Usually I'm: terribly bored / full of life and enthusiasm"). Each answer should be assessed on a 7-point rating scale (Leont'ev, 2000). The General Life Meaning indicator is calculated for each of 20 test items. The Purposes in Life scale characterizes the presence or absence of purposes in a respondent's life in the future, which provide life meaning, direction, and time perspective. The Life process scale indicates whether a respondent perceives the process of his/her life as interesting, emotionally rich, and filled with meaning. The Life Productivity scale reflects a respondent's assessment of the passed segment of the life path, the feeling of its productivity and meaningfulness. The Internal Locus of Control scale shows whether a respondent perceives himself/herself as an architect of his/her life. The External Locus of Control scale shows a respondent's perception of the controllability of his/her life. The first three factors form mining-in-life orientations - purposes

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in life (sight into the future), richness of life (reliance on the present), and satisfaction with self-realization (acceptance of the past). The last two factors characterize a respondent's internal locus of control as a general worldview belief that control is possible and he/she is able to implement it.

The Self-reflection Questionnaire by I. A. Stetsenko establishes an indicator of self-reflection by examining the processes of self-analysis and self-assessment of respondents. This enabled us to get an idea of respondents' attitudes towards themselves (Stetsenko, 2003). While answering 60 questions, respondents chose how fully their judgments about themself correspond to the statements presented in the questions. Then we calculated the general indicator of Self-reflection Level using the total scores of all of the questionnaire items.

Mathematical processing of the empirical data included the determination of the average values of the studied indicators 'before' and 'during' the pandemic. We also assessed the statistical significance of differences.

Results

Both samples coincided in terms of the main acmeological indicators (gender, age, level of education, professional orientation, marital status, and place of residence) and were of almost similar size. In our empirical study of the features of meaning-based regulation under the influence of various conditions of uncertainty, we obtained means for the test values. Table 1 presents the differences found in indicators. To establish the statistical significance of differences, we calculated the Mann–Whitney U_{emp} coefficients.

Table 1

Means of meaning-in-life orientations and self-reflection, and the Mann–Whitney U_{emp} coefficients of the significance of their differences (U_{cr} = 670 at the $p \leq 0.05$ significance level) in female secondary school teachers 'before' and 'during' the coronavirus pandemic

Scale	Before the COVID-19 pandemic	During the COVID-19 pandemic	The empirical U_{emp}-Mann–Whitney coefficient
Period of testing	February 2017	March 2021	–
Sample size	37	46	–
Mean age, years	42.6	41.3	–
General Life Meaning (GLM)	110	122	266
Purposes in Life	35	38	610
Life Process	32	35	316
Life Productivity	27	30	468
Internal Locus of Control	23	25	337
External Locus of Control	32	36	406
Self-reflection Level (SRL)	392	402	428

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According to the data presented in Table 1 and considering all the studied indicators of the Meaning-in-Life Orientations test and the level of self-reflection, the differences in female secondary school teachers 'before' and 'during' the pandemic are statistically significant, as $U_{emp} \leq U_{cr} = 670$ at the $p \leq 0.05$ significance level. Under the influence of such information uncertainty, meaning-based regulation is restructured. Particularly, there is an increase in indicators of the level of self-reflection, general life meaning, perception of the past, present, and future, as well as internal and external locus of control. Such an increase may indicate the transition of the meaning-based sphere to the level of stricter organization and increased mobilization. This may be explained by the mechanisms of the formation of new personal meanings, their initiation, and changes in the meaning-based choice to overcome the increased uncertainty in the world caused by the coronavirus pandemic. This influence of information uncertainty should be considered as an additional stressor. It is substantial but surmountable for the female group of respondents of a 'subject – subject' profession type (according to the classification of E. A. Klimov).

Discussion

This study was conducted to identify indicators of meaning-in-life orientations and self-reflection among teachers. We obtained means for the tests used in our samples and identified differences between them. We conducted testing in the same city on acmeologically identical samples in March 2017 and October 2020. In terms of studying the influence of uncertainty on the meaning-based regulation of the experiencing subject, this study represents a psychological study 'before' and 'during' the coronavirus pandemic.

The differences between all indicators established during the study 'before' and 'during' the pandemic were statistically significant. Means of meaning-in-life orientations and self-reflection, measured before the pandemic, were lower than during the pandemic. Therefore, it can be considered as an additional factor that has never existed before and which enhances the information uncertainty of modern life. That is, after the beginning of the pandemic, the higher indicators of meaning-based regulation indicate the transition of the meaning-based sphere of the respondents to a state of greater organization and increased mobilization. We assume that this is how self-regulating mechanisms for choosing and initiating relevant personal meanings are implemented to overcome the increased resistance of the uncertainty of life in the world brought by the coronavirus pandemic. Therefore, the female secondary school teachers who participated in our study perceive the impact of the pandemic as a surmountable uncertainty factor. Under its influence, there was an increase in the level of self-reflection, meaningfulness of their lives, perception of the past, present and future, as well as internal and external locus of control. Our assumption is confirmed by the fact that other researchers also note a trend towards overcoming the impact of the pandemic (Mal'kova, 2020; Pfattheicher et al, 2020).

Conclusions

In our opinion, the study of the features of meaning-based regulation on the most homogeneous (in acmeological terms) sample using the same battery of psychological tests is of great value. We conducted psychological survey among teachers using the Meaning-in-Life Orientations test by D. A. Leont'ev and the Self-reflection Questionnaire by I. A. Stetsenko. Our empirical study can be considered as a one-factor experiment. The variable factor was the different level of influence of uncertainty on respondents' meaning-in-life orientations and self-reflection. We consider

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the change in uncertainty as the state before the spread of coronavirus infection (March 2017) and during the pandemic (October 2020).

The data obtained in our empirical study can be used to construct and refine various groups of conceptual models for overcoming uncertain and crisis situations.

Clearly, *further research* will be needed to identify the effect of such a global factor of uncertainty as the impact of the pandemic on various gender, age, professional, ethno-confessional, and geographical categories of respondents. It is also relevant to establish the boundaries of a constructive response to the impact of a pandemic in the form of eustress, and to identify areas of distress influence that negatively affects the organization of meaning-based activity in a pandemic. In turn, eustress increases the mobilization resources of meaning-based regulation. This may help develop targeted techniques of psychological assistance to the groups subjected to distressing effects of coronavirus infection. At the same time, a reasonable increase in the battery of psychodiagnostic tests becomes important. Such psychodiagnostic testing makes it possible to expand the studied spheres of meaning-based regulation of the experiencing individual.

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Author Contribution

I. V. Abakumova developed the methodology for the study and edited the text of the manuscript.
M. V. Godunov contributed to study design and writing the report.
E. V. Belova contributed to data collection and data analysis.
N. E. Komerova contributed to data collection and data analysis.

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Impact of the Covid-19 Pandemic on the Metacognition and Emotional Intelligence of Natural Science Students

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Abstract

Introduction. This paper presents the results of an empirical study that compares the parameters of the metacognitive components and emotional intelligence (EI) of young people using cross-sectional surveys before and during the COVID-19 pandemic. This study explores, for the first time, the effects of remote learning during the COVID-19 pandemic using samples of natural science students. **Methods**. The sample was comprised of 551 second-year students at St. Petersburg State University, 260 of whom took part in the study in 2018–2019; 98 respondents took part in the study in May 2020; 114 respondents took part in the study in January 2021; 79 respondents took part in the study in May 2021. The study used the following diagnostic tools: (a) the Emotional Intelligence Questionnaire developed by D. V. Lyusin, (b) a short version of the Metacognitive Awareness Inventory modified by E. I. Perikova and V. M. Byzova, (c) the Differential Test of Reflectivity developed by D. A. Leontiev and E. N. Osin, and (d) the Self-organization of Activity Questionnaire developed by E. Yu. Mandrikova. **Results**. The study showed an increase in the scores of metacognitive awareness and metacognitive regulation, as well as a reduction in interpersonal EI in students during the COVID-19 pandemic, compared to the pre-pandemic group. Students' scores of purposefulness and intrapersonal EI increased significantly during the pandemic. However, the differences were only significant in some pandemic subgroups. The predictors contributing to the level of intrapersonal EI differed in the pre-pandemic and pandemic groups. Systemic reflection and purposefulness were significant predictors of the level of intrapersonal EI for the pre-pandemic group (explained 11 % of the variance). Systemic reflection, metacognitive knowledge, and perseverance were significant predictors of the level of intrapersonal EI for the pandemic group (explained 28 % of the variance). **Discussion**. The emerging transition from the classical form of learning to remote learning, in the context of the Coronavirus pandemic, seems to lead to an improvement in metacognitive regulation and a decline in interpersonal EI in students of natural sciences.

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Keywords
emotional intelligence, metacognition, metacognitive regulation, reflection, self-organization, purposefulness, perseverance, pandemic, higher education, remote learning

Highlights
- Compared to the pre-pandemic sample, students of the pandemic group showed an increase in scores of metacognitive awareness, as well as a decrease in interpersonal emotional intelligence.
- Purposefulness and intrapersonal emotional intelligence increased in some student samples during the pandemic compared to the pre-pandemic sample.
- The predictors that contribute to interpersonal emotional intelligence in young people during the COVID-19 pandemic are systemic reflection, metacognitive knowledge, and persistence.

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Introduction
The COVID-19 pandemic has led to dramatic changes in the organization of the educational process in global higher education systems. In spring 2020, many educational institutions were forced to move to remote learning and maintain remote learning for the next two years to comply with restrictions implemented by governments. Although several Russian universities have used online courses or programs before (Bekova et al., 2020), most of the major educational programs suggested full-time education, which included training practice and internship, as well as non-clinical laboratory studies.

The transition to remote learning brought to life the challenges widely described in the literature, including the problem of social inequality in higher education (Williamson, Eynon, & Potter, 2020; Soria & Horgos, 2020), as well as technical problems of remote learning (Bekova, Terentiev, & Maloshonok, 2021); lack of motivation (Soria, Chirikov, & Jones-White, 2020) and lack of communication with classmates and teachers (Soria, et al., 2020; Bekova, et al., 2021). These obstacles had a profound effect on learning efficiency and caused a significant increase in stress levels in students (Aleshkovskii, Gasparishvili, Krukhmaleva, Narbut, Savina, 2020; Chirikov, Soria, Horgos, & Jones-White, 2020; Soria et al., 2020).

Previous research suggests that students at the first level of higher education – those who obtained a bachelor's degree (Chirikov et al., 2020), especially first-year students (Soria et al., 2020) had the greatest difficulty. Natural science, engineering, and art students (Soria et al., 2020) have faced the greatest challenges, as the content of some of their courses was not appropriate for online learning at all.

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Russia's researchers also reported that young people were among the most affected groups by the pandemic (Baranova, Dubovskaya, & Savina, 2021). Nevertheless, the unique experience acquired by a young person in the current extreme situation can have a positive impact on behaviour and personal qualities in general (Magomed-Eminov, 2008). Thus, the success of remote learning during a pandemic is linked with the willingness to maintain the working capacity necessary for learning. Such behaviour could impact the development of metacognitive abilities and emotional intelligence (EI).

Studies of remote learning formats such as massive open online courses (MOOCs) have shown that their students need specific knowledge and skills for successful completion of MOOCs, including motivation (Milligan, & Littlejohn, 2014); self-regulatory learning and reflection skills (Littlejohn, Hood, Milligan, & Mustain, 2016; Kizilcec, Saltarelli, Reich, & Cohen, 2017); previous experience of taking such courses (Lim & Morris, 2009); and socio-demographic characteristics of students (Bazanova & Sokolova, 2017; Watson, Watson, Yu, Alamri, & Mueller, 2017). Bekova and colleagues (2020) described the results of a series of empirical studies conducted using student samples at Russian universities in 2017–2018. They showed that in order to successfully complete MOOCs students needed the following skills: the ability to organize their workspace and time-management skills, as well as metacognitive control of their own learning process and goal setting. In accordance with the described results, we may hypothesize that the increased number of remote learning courses could influence students' metacognitive processes, which are necessary to achieve successful learning outcomes. Jia (2021) showed the implications of remote learning for students' self-regulated learning (SRL) in higher education during the COVID-19 pandemic. In-depth interviews with graduates revealed that remote learning influences SRL framework in a specific way at different phases – goal setting and self-efficacy (in forethought phase), task strategies and metacognitive monitoring (in the performance phase), and self-evaluation and self-satisfaction (in self-reflection phase).

Emotion regulation ability and resilience have been identified as characteristics associated with maintaining mental health and reducing anxiety during the pandemic (Barzilay et al., 2020; Li, Yang, Dou, & Cheung, 2020; Taylor, Thomas-Gregory, Hofmeyer, 2020). The ability to recognize, understand and regulate individual and others' emotions is related to reduced burnout and the use of positive coping strategies in response to stressful situations (Moreno-Fernandez et al., 2020). In a study by Vargas et al. (Vargas Valencia, Vega-Hernández, Aguila Sánchez, Vázquez Espinoza, & Hilerio López, 2022), second-year medical students showed low levels of EI and fourth-year students showed normal levels of EI just one year after the start of the pandemic. The authors explained these results with the fact that second-year medical students had only remote learning experience, while fourth-year students spent many hours in hospitals due to the emergency situations in public health and medical care system. In another study researchers compared the level of EI in two groups of students of a leadership skills development program – from the class of 2021 and the class of 2017–2019. During the COVID-19 pandemic, students of the program experienced greater increases in EI than did the pre-pandemic cohorts (Goodlet et al., 2022). Therefore, the results of research on changes in EI level during the pandemic are contradictory and can be explained by a number of factors with multi-directional effects.

Many researchers have noted a significant relationship between EI and metacognitive components (Perikova & Bysova, 2021; Sergienko, 2014; Karpov & Petrovskaya, 2008). Metacognitive skills are a basis for reflection aimed at understanding individual and others' emotions, as well

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as implementing the relationship between emotion and cognition. According to Melnichuk & Belogash (2021), EI manifests itself in metacognitive abilities and predicts academic success and the level of expertise. It also contributes to the development of effective communication strategies in educational and professional environments. We have previously shown the high explanatory potential of systemic reflection and metacognitive knowledge in relation to intrapersonal EI (Bysova & Perikova, 2020). Emotional and cognitive systems influence each other, both in usual circumstances and in the situation of a pandemic (Allodola, Buccolo, & Mongili, 2020; Lahiri, Dubey, & Ardila, 2020).

Several questions remain at present. 1. Did the pandemic itself affect the metacognition and EI of students? 2. How lasting are the identified changes of psychological parameters? The *aim* of our study was to compare the metacognitive components and EI scores in second-year students of natural sciences at Saint Petersburg State University (SPbU) before and during the COVID-19 pandemic. We hypothesised a persistent increase in metacognitive components and EI happened during the pandemic. And we expected that the predictors of EI in both groups would be metacognitive components, but their contribution to the explanatory potential would be different.

Methods

Participants and procedure

We collected data over four years (2018–2021). Our sample included 551 students of natural sciences (psychology and biology departments) at SPbU in the second year of their undergraduate program. The 'pre-pandemic group' for control consisted of 260 students aged 18 to 24 years (45 males; mean age (M ± SD) – 19.54 ± 1.15 years), who took part in the study during 2018 and 2019. The 'pandemic group' included 291 students aged 18 to 24 years (67 males, 19.33 ± 1.1 years), who participated in the study after May 2020. The groups did not differ statistically in neither gender ($\chi2(1) = 2.8$, $p = 0.096$), nor age ($\chi2(6) = 12.2$, $p = 0.058$).

Data of the 'pandemic group' were collected in three stages – May 2020 (98 respondents, 29 males), January 2021 (114 respondents, 14 males), and May 2021 (79 respondents, 29 males). According to the decrees of the Ministry of Education and Science of the Russian Federation students transitioned from ordinary full-time to remote learning in spring 2020; The so-called 'mixed' learning format (in classroom and remote learning) was used in September – October 2020. Learning was mostly remote in November – December 2020, as well as in spring 2021. Thus, the 'pandemic group' of this study included students studying remotely for one, two and/or three semesters. All students had experience of a transition from normal full-time learning to remote learning.

Instruments

In order to examine EI and metacognitive components of the participants we asked them to fill out several questionnaires.

EI was assessed with Emotional Intelligence Questionnaire (EmIn-Q) by Lyusin (Lyusin, 2009). EmIn-Q consists of 47-items, which are estimated with a 4-point response scale. In our study we used three subscales – Interpersonal EI (Cronbach's alphas indicated here and further are for the whole sample (n = 551) = 0.85), Intrapersonal EI (Cronbach's alpha = 0.81), and General EI (Cronbach's alpha = 0.70).

The Self-organisation of Activity Questionnaire was developed by Mandrikova (Mandrikova, 2010) to evaluate the maturity of tactical planning and strategic goal-setting skills. The Self-organization

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of Activity Questionnaire consists of 25 items. The items are evaluated with a 7-point Likert-like scale ranging from "completely disagree" to "completely agree". The instrument consists of the following seven subscales: Purposefulness (Cronbach's alpha = 0.83), Perseverance (Cronbach's alpha = 0.73), Planning (Cronbach's alpha = 0.87), Fixation (Cronbach's alpha = 0.49), Orientation to the Present (Cronbach's alpha = 0.30), Self-organization (Cronbach's alpha = 0.33), and General Index of Self-organisation of Activity (Cronbach's alpha = 0.82). The scales Fixation, Orientation to the Present, and Self-organization were excluded from the analysis due to low internal consistency coefficients.

The Differential Test of Reflexivity (DTR) by Leontiev and Osin (2014) is a 30-item questionnaire using a 4-point response scale, which operationalises Leontiev's 3-component model of reflexive processes. The DTR estimates three subscales – Systemic Reflection (Cronbach's alpha = 0.85), Introspection (Cronbach's alpha = 0.87), and Quasi-reflection (Cronbach's alpha = 0.86).

The short version of the Metacognitive Awareness Inventory modified by Perikova and Byzova (Perikova & Byzova, in press) consists of three subscales – Metacognitive Knowledge (Cronbach's alpha = 0.79), Metacognitive Regulation (Cronbach's alpha = 0.83), and Metacognitive Awareness (Cronbach's alpha = 0.88). In this inventory, 32 items are scored on a 5-point Likert scale.

The data collected were analysed using SPSS Statistics version 26.0. The first stage of analysis included the calculation of descriptive statistics (M ± SD), assessment of the normality of the data distribution using the Kolmogorov-Smirnov test and computation of r-Pearson's correlation coefficient. The assumption of normality was largely fulfilled. Therefore, in the second stage of analysis Student's t-test for independent samples was used to find any significant differences in EI and metacognitive components between the two groups of youth. A Kruskal–Wallis H test was conducted to define the specific differences in the scores between different groups of students – those who took part in the study before 2020 ('pre-pandemic group'), May 2020 students, January 2021 students, May 2021 students ('pandemic sub-groups'). The non-parametric test was used because the assumption of normality was violated in three small samples of students of 2020-2021. Dunn's post hoc test was used to determine differences between the 'pre-pandemic' group and each 'pandemic' sub-group. Cohen's d was used to estimate effect sizes between groups after Student's t-test and Kruskal–Wallis H test.

Finally, we tested the hypothesis about the predictive ability of the metacognitive components for EI using multiple linear regression analysis (the enter method). A regression analysis was carried out for Interpersonal EI and eight independent variables, including Systemic Reflection, Introspection, Quasi-reflection, Metacognitive Knowledge, Metacognitive Regulation, Planning, Purposefulness, and Perseverance. Regression analysis was carried out separately for each sample ('pre-pandemic' and 'pandemic' groups).

Results

Table 1 shows the means, standard deviations, and coefficients of correlation between EI and the metacognitive components for the total sample (n = 551). The EI indicators Interpersonal EI, Intrapersonal EI, General EI were found to have significant correlations with Systemic Reflection, Metacognitive Awareness, Metacognitive Knowledge, Metacognitive Regulation, Planning, Purposefulness, Perseverance, and General Index of Self-organisation of Activity (all $p \leq 0.01$).

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Table 1

Descriptive statistics (M ± SD) and coefficients of correlation between EI and the metacognitive components (for the whole sample)

Parameters	M±SD (n = 551)	2	3	4	5	6	7	8	9	10	11	12	13
1. Interpersonal EI	43.5 ± 9.5	0.40**	0.83**	0.29**	–0.15	–0.04	0.20**	0.24**	0.15**	0.16**	0.27**	0.18**	0.24**
2. Intrapersonal EI	40.6 ± 9.8	1	0.84**	0.22**	–0.43	–00.2	0.26**	0.28**	0.22**	0.12*	0.33**	0.32**	0.23**
3. General EI	84.1 ± 16		1	0.31**	–0.35	–0.14	0.28**	0.31**	0.22**	0.17**	0.36**	0.23**	0.28**
4. Systemic reflection	39.7 ± 5.8			1	0.11*	0.19*	0.20**	0.16**	0.21**	0.18**	0.13*	0.1	0.13*
5. Introspection	24.2 ± 6				1	0.45**	–0.13	–0.17	–0.09	–0.06	–0.28	–0.31	–0.19
6. Quasi-reflection	25.9 ± 6					1	–0.07	–0.09	–0.05	–0.14	–0.14	–0.25	–0.21
7. Metacognitive awareness	118 ± 18.4						1	0.9**	0.96**	0.20**	0.24**	0.14*	0.24**
8. Metacognitive knowledge	44.1 ± 7.6							1	0.73**	0.13*	0.21*	0.18*	0.20**
9. Metacognitive regulation	73.7 ± 12								1	0.23**	0.24**	0.1	0.23**
10. Planning	17.7 ± 6.1									1	0.39**	0.31**	0.7**
11. Purposefulness	31.5 ± 7.3										1	0.28**	0.65**
12. Perseverance	18.9 ± 6.5											1	0.59**
13. GISOA	105 ± 18.9												1

Note: GISOA – General index of self-organisation of activity; ** – p ≤ 0.01; ** – p ≤ 0.001*.

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A number of parameters revealed significant differences between 'pre-pandemic' and 'pandemic' student samples (Table 2). In the 'pre-pandemic' group, students had higher scores of Metacognitive Regulation ($t = 10.09$; $p \leq 0.001$), Metacognitive Awareness ($t = 6.624$; $p \leq 0.001$), at the level of medium effect sizes, Intrapersonal EI ($t = 3.410$; $p \leq 0.001$), and Purposefulness ($t = 2.793$; $p \leq 0.01$), at the level of small effect sizes. Interpersonal EI of the 'pandemic' group was found to be significantly lower than in the 'pre-pandemic group', at the level of small effect sizes ($t = -3.690$; $p \leq 0.001$).

A detailed comparative analysis was conducted for scores that showed significant differences between the pre-pandemic (2018–2019) and pandemic samples (2020–2021). We used a Kruskal-Wallis H test to compare the scores in students who took part in our study in May 2020, January 2021, and May 2021 with those of students surveyed before 2020. The following results were obtained: Interpersonal EI ($H = 9.84$; $p \leq 0.05$; $d = 0.23$), Intrapersonal EI ($H = 12.50$; $p \leq 0.006$; $d = 0.27$), Metacognitive Awareness ($H = 40.42$, $p \leq 0.001$, $d = 0.54$), Metacognitive Regulation ($H = 81.63$; $p \leq 0.001$, $d = 0.82$), and Purposefulness ($H = 17.209$, $p \leq 0.001$, $d = 0.327$). Post hoc test showed that in the 'pre-pandemic' group Interpersonal EI, Metacognitive Awareness, and Metacognitive Regulation significantly differed from those in all 'pandemic' sub-groups (all $p \leq 0.05$).

Table 2

Descriptive statistics (M ± SD) of EI and the metacognitive components in young people in the 'pre-pandemic' and 'pandemic' groups

	'Pre-pandemic' group (n = 260)		'Pandemic' group (n = 291)		t	p	d
	M	SD	M	SD			
Interpersonal EI	45.03	9.99	42.11	8.86	–3.690	0.0002	0.32
Intrapersonal EI	39.14	9.23	41.91	10.09	3.410	0.0006	0.29
General EI	84.17	15.87	84.02	16.41	–0.105	0.916	0.01
Systemic reflection	39.57	5.95	39.77	5.73	0.353	0.723	0.06
Introspection	24.60	6.20	23.80	5.82	–1.556	0.120	0.13

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Descriptive statistics (M ± SD) of EI and the metacognitive components in young people in the 'pre-pandemic' and 'pandemic' groups

	'Pre-pandemic' group (n = 260)		'Pandemic' group (n = 291)		t	p	d
	M	SD	M	SD			
Quasi-reflection	26.05	6.15	25.89	6.00	–0.262	0.792	0.02
Metacognitive awareness	112.5	20.29	122.6	15.10	6.624	< 0.0001	0.57
Metacognitive knowledge	43.87	8.73	44.36	6.51	0.743	0.457	0.04
Metacognitive regulation	68.60	12.20	78.28	10.01	10.09	< 0.0001	0.86
Planning	17.70	5.39	17.70	6.71	–0.063	0.949	0.01
Purposefulness	30.59	6.92	32.33	7.46	2.793	0.005	0.24
Perseverance	18.82	6.39	18.92	6.62	0.117	0.906	0.01
GISOA	104.4	17.70	106.3	20.04	1.068	0.281	0.09

Note: GISOA – General index of self-organisation of activity.

We examined the results of the comparison of the "pre-pandemic" and "pandemic" groups and decided to conduct a regression analysis of a single dependent variable – Interpersonal EI. We used parameters showing significant correlations with Interpersonal EI as a dependent variable (Table 3).

For young people who took part in our study before 2020, linear regression analysis revealed that the participants' Systemic Reflection and Purposefulness made significant contributions as predictors of Intrapersonal EI (R^2 = 0.13; adjusted R^2 = 0.11; F (6, 251) = 6.41; p ≤ 0.0001). For young people who took part in our study after 2020 three variables (Systemic Reflection, Metacognitive Knowledge, and Perseverance) were found to be significant predictors of intrapersonal EI (R^2 = 0.30; corrected R^2 = 0.28; F (6, 283) = 20.12; p ≤ 0.0001).

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Table 3

Estimates of regression parameters (with Interpersonal EI as a dependent variable)

Predictors	Unstandardized coefficients		Standardized coefficients	p
	b	SE	β (Beta)	
	'Pre-pandemic' group (n = 260)			
Systemic reflection	0.322	0.099	0.192	0.001
Metacognitive knowledge	–0.024	0.143	–0.021	0.866
Metacognitive regulation	0.105	0.102	0.127	0.305
Planning	0.047	0.119	0.025	0.695
Purposefulness	0.373	0.093	0.258	0.000
Perseverance	0.082	0.094	0.053	0.381
Constant	12.385	5.822		0.034
	'Pandemic' group (n = 291)			
Systemic reflection	0.403	0.086	0.261	0.0001
Metacognitive knowledge	0.350	0.096	0.257	0.0001
Metacognitive regulation	0.074	0.068	0.083	0.277
Planning	–0.096	0.083	–0.072	0.249
Purposefulness	0.113	0.073	0.095	0.122
Perseverance	0.167	0.081	0.124	0.041
Constant	–0.358	4.089		0.930

Discussion

The aim of this study was to compare the metacognitive components and EI scores in natural science students at SPbU using cross-sectional surveys conducted before and during the COVID-19 pandemic. We found significant differences in Interpersonal EI, Intrapersonal EI, Metacognitive

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Awareness, Metacognitive Regulation, and Purposefulness between two samples. A detailed analysis showed that only Interpersonal EI, Metacognitive Awareness and Metacognitive Regulation parameters were found to have a lasting effect. We found an increase in Metacognitive Regulation and a decrease in Interpersonal EI in students studying during the COVID-19 pandemic.

The described results partially confirm our assumptions and are consistent with the data on metacognitive components and EI scores obtained earlier. Existing data show that metacognitive regulation is crucial for success in many types of online learning (Serdyukov & Hill, 2013; Zheng, Liang, Li, & Tsai, 2018). Remote learning 'requires' students to regulate and control their own learning processes more actively, than in classic format of learning (Harris, Dargusch, Ames, & Bloomfield, 2020; Zimmerman, 2008). Students who use a variety of self-regulatory modalities in difficult situations often reported learning success and overall well-being (Carter, Rice, Yang, & Jackson, 2020; Pelikan, Lüftenegger, Holzer, Korlat, Spiel, & Schober, 2021). Our results show that metacognitive scores are higher in students studying via remote learning compared to those learning in classrooms. These differences are associated with an increase in the metacognitive regulation score, but not in the metacognitive knowledge score. The well-being of students in both groups did not differ significantly (The Satisfaction with Life Scale (SWLS), developed by Diener, Emmons, Larsen and Griffin, $t = -1.87$; $p = 0.061$, 'pre-pandemic' group ($n = 93$) and 'pandemic' group ($n = 291$)).

The decrease of Interpersonal EI scores could be associated with the format of remote learning. Social awareness and relationship skills are developed in the process of observing other people and communicating with them. The pandemic has reduced opportunities for such interaction. Carbon (2020) showed in her study that people have difficulty in reading emotions of others wearing face masks. Khalimova, Bogomaz (2021) also found a decline in Interpersonal EI scores during the pandemic, but their results suggest that the decline started much earlier and the effects we observed may not be directly related to the pandemic.

In contrast, our study showed an increase in Intrapersonal EI in the 'pandemic' group compared to the 'pre-pandemic' group. This fact is consistent with our assumptions. However, the post hoc test showed that the increase in these scores was observed only in students who participated in the study in 2021 and was not typical for the 2020 youth sample. Our results are partially consistent with Goodlet et al. research (2022). The data reflect the impermanent change of the Intrapersonal EI parameter over the past years. Khalimova & Bogomaz (2021) found no significant changes in this indicator in cross-sectional data in students who were examined between 2012 and 2020. Thus, our data may indicate a new trend among young people that has emerged only in 2021.

Regression analysis revealed that the predictors contributing to Intrapersonal EI differed in pre-pandemic and pandemic samples. Systemic reflection and Purposefulness variables only accounted for only 11 % of the variance of Intrapersonal EI in the sample of students, which took part in our study before 2020. In the sample surveyed in 2020–2021 Systemic Reflection, Metacognitive Knowledge, and Perseverance collectively explained 28 % of the variance. Thus, in all time periods, the most significant predictor of Intrapersonal EI is the ability to self-distance and look at oneself from the outside. At the same time, Purposefulness was a significant predictor of Interpersonal EI before the pandemic, but it was not significant after 2020. This may be due to the high level of uncertainty in communication during the COVID-19 pandemic: from technical difficulties in interacting with other people online to frequent changes in social circle in case of illness. The revealed significance of metacognitive knowledge and perseverance for

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Intrapersonal EI is partially consistent with the results of a study by Rivers, Nakamura, & Vallance (2021). The authors revealed a significant relationship between online self-regulated learning and achievement when perseverance score was included in the model. Thus, during a pandemic, with a general decrease in Intrapersonal EI, the development of this skill is possible through working on individual Metacognitive skills, as well as developing the ability for self-reflection, acquiring knowledge of individual cognitive processes and the ability to exercise volitional efforts.

Conclusion

An empirical study revealed a persistent increase in metacognitive skills and a decrease in interpersonal EI during the COVID-19 pandemic in students of natural science at SPbU. The predictors contributing to interpersonal EI are systematic reflection, metacognitive knowledge, and perseverance of young people studied during the pandemic.

The study has several limitations that may affect the interpretation of the results. First, the sample of the study is limited to the second-year students of natural science at SPbU. Even though our data are consistent with the results obtained through surveying students from different departments and universities of Siberia (Khalimova & Bogomaz, 2021), this limitation should be considered while interpreting the results. Secondly, respondents who participated in the study before and after 2020 differed in the form of feedback from the study's main researcher. In both cases, the questionnaires were completed online. The first group received feedback via personal meetings with the study's main researcher. The second group received feedback through an e-mail report, with the possibility to discuss the results through correspondence. The online feedback format was chosen as the safest during the pandemic. Third, although the design of the study was improved by including a control group, the increase in metacognitive components and the decrease in EI in the 'pandemic' group may not be related to the pandemic.

Despite these limitations, the study enables us to describe a student's personal portrait during the COVID-19 pandemic. The consequences of the pandemic can impair understanding of emotions of other people. According to a report from the 2016 International Economic Forum in Davos, EI is a 'soft skill' that every employee needs. It is especially important that students of the psychological department were a part of the sample as EI is a key skill for the future professional activity of a psychologist.

Therefore, future research should include collecting more data on the parameters described and analyzing their changes, which will enable researchers to recommend adjustments for existing teaching programs. The main conclusion from our research is that extra classes aimed at developing EI of natural science students and deepening their metacognitive knowledge on themselves and others should be added to the curricula.

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Author Contribution

E. I. Perikova carried out statistical analysis, interpreted the results, prepared and edited the text of the manuscript.

V. M. Byzova developed the research concept and collected data.

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The specifics of the structural organization of the metacognitive components of reflexivity

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Abstaract
Introduction. Currently, the study of cognitive and metacognitive processes in professional activity is becoming particularly relevant. In terms of solving this strategic task, it is objectively necessary to converge research in two important areas, the psychology of reflection and metacognitivism. The novelty of the study lies in the fact that it identifies and interprets the basic features and laws, as well as operational means of the structural organization of reflection and explicating its irreducibility to the additive totality of the main metacognitive processes included in it. **Methods.** The sample (n = 220) consisted of representatives of the main classes of activity – subject-object, subject-subject, and subject-information, as well as students of universities in Yaroslavl and Moscow. Psychodiagnostics was performed using the author's methods of diagnostics of reflexivity (A.V. Karpov, V. V. Ponomareva) and metathinking (A. A. Karpov), as well as a set of methods developed in metacognitivism, the methods of R. Dickson – D. Haltcha (Metamemory in Adult – MIA), the methods of D. Everson for the diagnosis of meta-planning, methods for the diagnosis of motivational metacognitive strategies (MSLQ), etc. **Results.** It is established that the individual measure of reflexivity is not identical to the value of the metacognitive potential formed by an additive set of basic metacognitive processes and qualities. Consequently, in it, as an integral individual quality, there is an action of specifically systemic patterns and mechanisms of the integrative type proper, generating synergetic effects and leading to the generation of new, specific content for it. **Discussion.** The results are interpreted from the positions of the main provisions of metacognitivism as well as the basic provisions of the theory of systems and psychology of reflection. In **conclusion**, it is concluded that the content of reflexivity is incompatible with the additive set of its constituent partial components - metacognitive processes and qualities - which determines the specificity of its psychological status and its uniqueness as an integral mental property.

Keywords
reflexivity, metacognitive processes, metacognitive qualities, structural patterns, integrative mechanisms, synergetic effects, superadditivity, reflection, arbitrary regulation, cognitive processes

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Highlights

- The main metacognitive processes and qualities are partial components of reflexivity; one of the main and most specific patterns of the organization of reflexivity is the nonidentity of the measure of its individual expression and the total value of the metacognitive potential.
- In reflection as a macro–process and, accordingly, in reflexivity as its effective manifestation – an integral individual quality – there is an action of specifically systemic patterns and mechanisms of a type similar to their nature, integrative proper; they generate synergetic effects leading to the generation of a new content specific to it and also explicate it as a formation of a systemic type.

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Introduction

The main and most general trend in the evolution of types and forms of professional activity, as well as changes in their content, is, as is known, its significant complication. It has acquired particularly distinct and multifaceted manifestations due to the widespread use of computer technologies, with their introduction into almost all major areas of professional activity. In turn, the dominant vector of such a complication is the giving of an emphatically informational character to many types of activity and, as a consequence, the increasing role of the cognitive component proper in them. Because of this, the need for more and more complete and in-depth study of similar degrees of complexity of the organization of professional activity, taken in their most complex and complex forms, cognitive, is steadily coming to the fore. The most important of them are the processes of arbitrary, actually reflexive, organization of activity, as well as the underlying patterns and mechanisms of its conscious regulation.

In terms of solving this essentially strategic task, it is objectively necessary to rely not only on those studies that have been carried out in line with the traditional "reflexive problematics", but also on the results that have been obtained so far in one of the main directions of modern cognitive psychology – metacognitivism. The fact is that it is in it that the main subject of research is those processes and qualities that are the main partial components of reflection itself and, accordingly, the main operational means of conscious, arbitrary regulation of activity – metacognitive. Moreover, metacognitivism itself as a whole is, in fact, in many ways the modern manifestation of reflexive problematics as such and, more broadly, the psychology of consciousness, represented in new and recent achievements of cognitive psychology. However, in their light, one of the acute and important, but still unresolved problems is being explained, even a kind of paradox consisting of the following. On the one hand, in the psychology of reflection, it is proved that the property of reflexivity is continuous and has an individual measure of severity, which can be diagnosed by appropriate measuring procedures (A.V. Karpov, 2004). Currently, there are several such procedures,

in particular, the methods of D. A. Leont'ev and E. N. Osin (Leont'ev, Osin, 2014), the method of "reflexivity of activity" (Shadrikov, Kurginyan, 2015), the method of M. Grant (Yzerbyt, Lories, & Dardenne, 1998), as well as the method of diagnostics of the integral level of reflexivity, developed by us with V. V. Ponomareva (A.V. Karpov, 2004). On the other hand, metacognitivism also shows that the main metacognitive processes (in particular, meta-thinking and meta-memory) and their corresponding productive effects, metacognitive qualities, also have a different individual measure of severity. In this regard, studies have been conducted aimed not only at a meaningful analysis of these processes, but also at studying individual variations to the extent of their severity (Abdelrahman, 2020; Allon, Gutkin, & Bruning, 1994; Schwartz & Metcalfe, 2017; Karpov, 2015). Studies are also presented in which an attempt is made to develop special psychodiagnostic techniques aimed at determining this individual measure (Craig, Halle, Grainger, & Stewart, 2020; Dixon & Hultsch, 1983; Schraw & Dennison, 1994; Lim & Ng, 2011; Song, Loyal, & Lond, 2021).

These studies are conducted mainly within a broader theoretical context, in line with, perhaps, the main and defining direction of all metacognitivism, whose main task is to explicate the content and specifics of its subject, as well as to define its boundaries. The most significant concepts that reveal the content and organization of the subject area of metacognitivism are formulated in its course. Among them, it should be noted, first of all, the hierarchical model of metacognitive processes by M. Ferrari (Ferrari & McBride, 2011), the theory of "cognitive metaoperators" by D. Dörner (1978), the concept of "cognitive monitoring" by L. Nelson and L. Narens (Nelson, 1996), the concept of "meta-regulatory functions" by M. Lefebvre-Pinard (Lefebvre-Pinard, 1983), the concept of "synthetic meta-processes" by R. Jarman (Jarman, Vavrik, & Walton, 1995), the concept of structure Metacognitive experience of M. A. Kholodnaya (Kholodnaya, 2012), the theory of "metaarchitectonics of consciousness" by E. Blackie and S. Spence (Yzerbyt et al., 1998). There are also more specific concepts devoted to the study of a particular metacognitive process (A. Brown, J. Borkowski, J. Flavell, R. Kluve, J. Metcalf, R. Paris, E. Madigan, E. Tulving, etc.) (Brown, 1987; Borkowski & Muthukrishna, 1992; Anderson, 2002; Flavell, & Miller, 1993; Kluwe, 1982; Metcalfe, Eich, 2019; Tulving, 1985; Splichal, Oshima, & Oshima, 2018).

These studies show that not only each of the metacognitive formations individually, but their entire totality is also characterized by an individual measure of severity, varying in a very wide range. It should also be emphasized that there is no generally accepted term for its designation yet, although the need for it is being felt more and more acutely. In this regard, concepts such as the metacognitive potential of the subject, metacognitive personality, metacognitive sphere of personality, metacognitive resource, metacognitive giftedness, etc. are used, for example. They are quite constructive conceptual means synthesizing several fundamentally similar functional terms factors of the metacognitive plan but doing so concerning different research tasks. Therefore, the concept of a metacognitive resource is directly related to the resource approach developed by M. A. Kholodnaya and her collaborators in the psychology of abilities (Kholodnaya, 2012). The concept of the metacognitive sphere of personality is more focused on the generalized explication of not only the factors of the metacognitive plan proper, but also on their determination from the side of others, the actual personal qualities (Karpov, 2018). The concept of metacognitive giftedness, also having a close connection with the problem of abilities, is still more relevant to another – the "didactic direction" of metacognitivism, the main subject of which is the metacognitive factors of the learning process and its optimization (Dori, Mevarech, & Baker, 2018; Schraw & Dennison, 1994; Veenman, Van Hout-Wolters, & Afflerbach, 2006; Davidson, Deuser,

& Sternberg, 1994; Mariano, Figliano & Dozier, 2017). The concept of metacognitiveness is more correlated with research in the field of personality psychology since it uses this construct as a conceptual means of differentiation and subsequent study of invariant and relatively orthogonal personal quality (Karpov, Karpov 2015).

It is also important to keep in mind that, despite the obvious and quite natural differences in the concepts presented and their interpretations, they all have one common and very characteristic feature. It consists in the fact that the general degree, a measure of expression, a quantitative explication of the essence that they denote, whether it is "potential", "giftedness", "metacognitiveness", "resourcefulness", etc., is interpreted as a direct derivative of the additive totality of their components, parts, "components", i.e. from their aggregative union. In other words, it is axiomatically assumed that this potential is not only derived from the "sum of parts" of the components forming it, but also reduces to it. However, it is almost completely ignored that it can be determined not only by the sum of metacognitive factors, but also by their organizational structures and associated synergetic mechanisms, and organizational phenomena. Consequently, it can be seen that the current way of interpreting it is not only very close to the analytical approach as such but also has its direct manifestation. And this alone indicates that such an approach is not the most promising and constructive one, since it not only can, but also should be transformed into a different, more heuristically powerful approach, a systemic one. It is from his position that fundamental opportunities open up for the disclosure of patterns of the structural, organizational type proper. However, they remain practically not taken into account and are not explained in the existing approaches to the explication of the metacognitive sphere of personality and the potential that characterizes it.

All this determines the situation that has developed at present and consists of the following. If we base ourselves on the dominant analytical approach today, on the additive interpretation of metacognitive potential, and also take into account one of the main provisions, about metacognitive processes and qualities as the main components of reflection, then we should conclude that the individual degree of reflexivity and the magnitude of metacognitive potential should not just be similar but also practically identical. However, this is exactly what the studies show is not systematically confirmed. In other words, the general level of reflexivity – an individual measure of its severity and the value of metacognitive potential, represented as a superposition of basic metacognitive processes and qualities, as well as other operational means of this type, are different, and in some cases very significantly. This is exactly what seems not only not quite clear, but also partly paradoxical, requiring clarification of its reasons. The attempt to do this is precisely the main purpose of this work.

Methods

Research and measurement procedure

The realization of this goal implies the need to obtain two main sets of empirical data. First, these are data on the individual measure of the severity of general reflexivity of the subjects. Secondly, it is data on the individual measure of the severity of the main metacognitive processes and their qualities. The following diagnostic techniques were used for this purpose.

To determine the individual measure of reflexivity, we used the method developed by V. V. Ponomareva and myself to determine the integral level of reflexivity (A.V. Karpov, 2004). Concerning it, it should be particularly noted that it allows you to diagnose general reflexivity, its integral

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manifestation, and not any, although important, but still a particular aspect of it, one or another of its partial components (which other methods of this type are aimed at, in particular, the M. Grant method, which diagnoses socio- and autoreflexion as its partial manifestations). The integrative nature of this technique is ensured by the fact that it provides special scales for the diagnosis of the basic "components" of reflexivity: actual, retrospective, and prospective; autoreflexion (i.e. self-reflection) and socioreflexion; behavioural and communicative reflexivity, reflexivity in the professional and household sphere, etc. We also emphasize that this technique has been used in research practice – not only by our own but also by other authors, for more than twenty years, systematically confirming its validity and diagnostic capabilities.

Furthermore, the following main metacognitive processes and qualities were diagnosed using appropriate techniques that have also demonstrated their validity and are currently considered the most reliable:

– an individual measure of the development of meta-thinking (MM) as a basic and process (according to the methodology developed by us) (A. A. Karpov, 2018);

– an individual measure of the development of metamemory (MPam.) as another basic meta-cognitive process (according to the methodology of R. Dickson - D. Haltcha "Metamemory in Adult" – MIA (according to (A. V. Karpov, 2015));

– methodology of D. Everson for the diagnosis of the level of development of metaplaning – MPlan. (by (A. A. Karpov, 2018); Tobias & Everson, 2002);

– formation of motivational metacognitive strategies (MMS) by the MSLQ method (Yzerbyt et al., 1998);

– the degree of formation of metaemotional control (IEC) according to the scale of the methodology "Complex questionnaire of the metacognitive potential of personality" (A. A. Karpov, 2018);

– self–assessment of the degree of formation of metacognitive behaviour (MP.) according to the methodology of D. LaCoste (by (A.V. Karpov, 2015));

- measure and nature of metacognitive monitoring of knowledge (MOH) according to the method "Questionnaire of metacognitive awareness" (MAI) (Schraw & Dennison, 1994), defined as the sum of points on two scales: on the scale of "metacognitive knowledge" and the scale of "metacognitive regulation";

– the processes of metacognitive inhibition (MCI) according to the methodology developed by us (A. A. Karpov, 2018), the essence of which is as follows. Recent studies show that metacognitive processes can be directed not only at facilitating conscious control over activity but also at its inhibition–minimization and even almost complete reduction, which is recorded, in particular, in the phenomena of reduction of reflexivity, metacognitive blockade, and metacognitive moratorium. They are very important operational tools that are part of the overall metacognitive potential of the individual and, therefore, must be taken into account when determining it.

We emphasize that in this aggregate there are factors not only of the cognitive plan (meta-thinking, meta-memory) but also factors of a regulatory orientation (the scale of metacognitive behaviour, metaplanning processes). There are not only traditional modes of meta-processes, cognitive and regulatory, but also their other types, in the field of motivational support (MMS) and emotional control (IEC). Not only the factors of operational–procedural orientation but also their final – the so-called "knowledge" manifestations (in the form of procedural knowledge, i.e., "knowledge monitoring" (MOH)). Thus, this set is substantially homomorphic to the main classes of mental processes (cognitive, emotional, motivational, and regulatory). Consequently, it is quite

representative in terms of displaying in it their overall totality as a whole, i. e. the metacognitive potential of the individual.

Research sample

The sample (n = 220; 115 men, 105 women) consisted, first, of representatives of the main classes of activity - subject - object (36 people), subject-subject (59 people) and subject information (65 people) living in four cities of Russia (Yaroslavl, Moscow, Rybinsk, Kursk) aged 26 to 58: < 31 years – 82 people (51.25%), 31-45 years – 56 people (35.0%), > 45 years – 22 people (13.75%).

The type of subject information in the sample was represented by the professions of a programmer, technical editor, web designer, data entry operator, system administrator, IT engineer, software tester, database administrator, and video game developer. *The subject-object type* in the sample was represented by such professions as master builder, electrical welder, electronics engineer, and process engineer. *The subject-subject type* was composed of secondary school subject teachers, university teachers, middle and senior management managers, and front office operators of telecommunications organizations. Secondly, the sample included students from several universities in the years Yaroslavl and Moscow, which ensured the representation of persons engaged in not only professional but also educational activities on another type of basis (60 people, 30 representatives of humanitarian and technical specialities each). Due to considering the differences noted above in the formation of the sample – by type and type of activity, gender, age, educational profile, etc. – the degree of its heterogeneity, which is necessary from the point of view of the general idea of this study, was achieved, which, in turn, is an important condition for its representativeness in terms of solving the main tasks of this work.

Data analisis

During the study, the methodology of *structural and psychological analysis* was implemented, assuming, as is known, a certain sequence of several specific research procedures. Thus, it includes the well-known method of "polar groups", which involves the differentiation of the sample into contrasting groups with subsequent differentiated processing and comparative analysis of the data in them according to a certain criterion. In our case, it was an individual measure of reflexivity. Furthermore, it involves the implementation of a multidimensional correlation analysis procedure. It includes a method for determining intercorrelation matrices of the parameters studied (in our case, the main factors of the metacognitive plan), a method for constructing structurograms of significantly correlating parameters, a method for calculating structural organization indices, a method χ^2 for determining the homogeneity/heterogeneity of intercorrelation matrices. Recall that the essence of the method of determining the indices of structural organization (in our study, the main metacognitive parameters) is as follows. These include, as is known, the structure coherence index (SCI), the structure divergence (differentiation) index (SDI), and the structure organization index (SOI). The coherence index of the structure of parameters is defined as a function of the number of positive significant connections in the structure and the degree of their significance; the structure divergence index (SDI) – as a function of the number and significance of negative connections in the structure; the structure organization index (SOI) – as a function of the ratio of the total number of positive and negative connections, as well as their significance (A.V. Karpov, 2015). At the same time, a "weight" coefficient of 3 points is attributed to the connections at $p < 0.01$, and a "weight" coefficient of 2 points is attributed to $p < 0.05$. The "weights" obtained

throughout the structure are summed up, which gives the values of these indices. Such a method allows, as is known, to identify and characterize the determination of a phenomenon not only in terms of its analytical, "single" connections with an individual's qualities, but also in terms of its complex structural conditionality by their integral subsystems.

Results

Table 1 presents data on the individual measure of the severity of the diagnosed parameters of metacognitive potential, as well as its overall value, in the "polar" groups of subjects, with relatively the lowest and highest reflexivity.

Table 1
Means and standard deviations

Variable	Sample as a whole (N = 220)	Comparison of groups by groups with different levels of reflexivity		
		Low reflexivity (n = 54)	High reflexivity (n = 56)	p
MT	22.06(6,00)	16.95 (5.40)	26.16 (6.95)	**.000**
MM	20.01 (5.66)	18.26 (4.62)	22.82 (5.68)	.328
MMS	64.25 (4.99)	34.41 (4.64)	34.08 (4.22)	.461
MEC	134.18 (9.88)	43.36 (9.57)	45.02 (7.74)	.560
MP	12.29 (2.40)	12.14 (2.63)	12.47 (2.14)	.924
KM	36.59 (3.35)	31.39 (3.11)	37.07 (4.11)	.337
MCB	39.43 (5.14)	35.77 (5.69)	44.09 (8.03)	**.000**
MCI	88.67 (5.18)	87.92 (4.58)	90.43 (5.72)	.331
MCP	61.10 (6.62)	57.68 (3.34)	66.37 (3.55)	**.000**

Note: MT – meta-thinking, MM – meta-memory, MMS – meta-motivational strategies, MEC – meta-emotional control, MP – meta-planning, KM – knowledge monitoring, MCB – meta-cognitive behavior, MCI – meta-cognitive inhibition, MCP – meta-cognitive potential (unlike all other parameters, it is expressed not in points of the corresponding melodics, but as a superposition of wall scores for all 8 parameters, since when determining it, it is not correct to directly summarize the qualitatively different units in which the results are expressed for each of the methods); p is the asymptotic two-sided significance of differences according to the Mann-Whitney test; p<0.10 values are in bold.

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Further verification was carried out using a one-way analysis of variance (one-way ANOVA), for which subgroups were identified according to the reflexivity factor, corresponding to low, medium, and high levels of its severity and representing approximately 25%, 50%, and 25%, respectively, on the size of the group under consideration. Multiple comparisons were made according to the Games-Howell test, which does not require the equality of subgroup sizes or homogeneity of variances.

Analysis of the results presented allows us to fix the following facts. First, in general, the individual measure of the severity of individual parameters of the metacognitive plan is somewhat higher in the group with a high level of reflexivity, which, however, is quite natural. However (and this is second) these differences are very moderate - only MT and MCB are significant at a level greater than $p < 0.10$. Third, the most significant fact is that the differences between the groups in terms of the overall value of metacognitive potential, although they also sag, are significant only at the level of a *trend*, that is, with $p < 0.20$. Then, in relation to the obtained data, the procedure of multivariate correlation analysis was implemented, and for each group, the intercorrelation matrices of the studied meta-cognitive parameters were determined, on the basis of which their structurograms were built. They are shown in Figure 1.

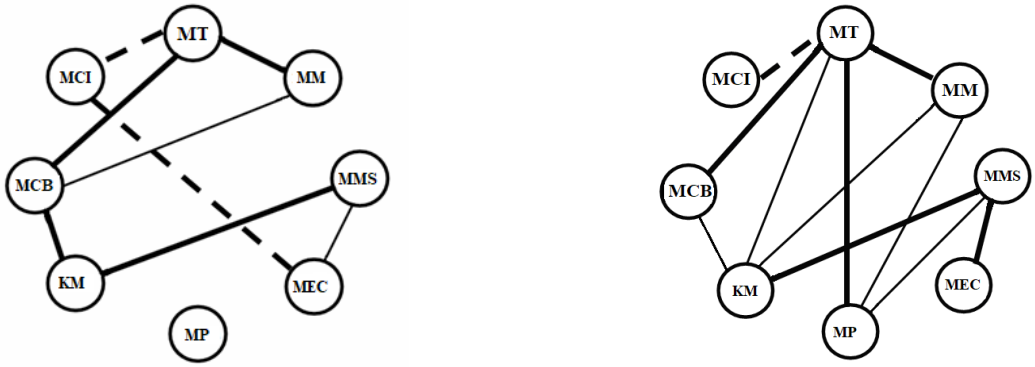

Figure 1. Structural diagram of the main meta-cognitive parameters in the subgroup of low-reflexive (a) and high-reflexive (b) subjects *Legend: the abbreviations in the structurogram correspond to the designations of the parameters given in the description of the methods used; bold line – connections at p < 0.01; thin line – connections significant at p < 0.05; dotted lines are negative links.*

Table 2 presents data on the values of structural indices calculated for each of the subgroups of subjects.

Table 2
Values of structural indices of meta-cognitive parameters

	Low reflexivity group	High reflexivity group
Structure Coherence Index (SCI)	16	25
Structure Divergence Index (SDI)	6	3
Structure Organization Index (SOI)	10	22

Discussion

The totality of the results presented above allows us to establish the following main features and patterns. *First,* with a sufficiently high degree of clarity, the circumstance that was stated above as the initial one and was predicted a priori is revealed. It consists of the fact that there is no identity between the individual measure of the severity of the integral indicator of reflexivity and the value of the metacognitive potential. This fact is manifested in the fact that the value of the metacognitive potential is in the group with high reflexivity, although it exceeds the same value in the group with low reflexivity, but the difference is significant only at the level of a *trend*, that is, with $p < 0.20$, which, known not to be a statistically significant difference. That is, the data obtained once again confirm this fact, which, in our opinion, is very indicative and require its explanation with even greater insistence.

Second, this circumstance finds additional manifestation and confirmation in the fact that significant differences between individual meta-cognitive parameters in the two groups occur only in 2 cases out of 8 (that is, only in a quarter of cases - in 25 %), and then only at levels $p < 0.05$ and $p < 0.10$.

Third, the opposite picture is revealed in the transition from the analytical method of processing the results to the structural one, which involves finding the matrices of intercorrelations of metacognitive parameters, as well as constructing their structurograms and subsequent comparison by the totality of the main structural indices. It can be seen that the degree of coherence of metacognitive parameters in the group of persons with high reflexivity is 25 points, and in the group with low reflexivity it is 16 points, that is, in the first group it is more than 1.5 times higher. Even more pronounced are the differences between the groups in terms of the degree of general organization of the revealed structures: in the first group, it is equal to 22 points, and in the second, it is only 10 points, i.e. in the first group it is already more than 2 times higher. We emphasize that these differences are not only statistically significant, but also very significant in quantitative terms, since they are expressed not only in percentage values (although in them too), but in times - a multiple, that is, not only quantitatively, but also *qualitatively*.

Fourth, synthesising all these results, one should explicate the circumstance of the most fundamental plan. It consists in the fact that the main differences between groups with different levels of individual measure of the severity of reflexivity exist and can be detected not at the analytical level - not in terms of individual metacognitive parameters and their additive totality (i.e., summative association), and at the structural level - in terms of the features of their *integration* and coorganization. At this level, the group of individuals with high reflexivity significantly outperforms the group of individuals with low reflexivity. Consequently, there are all grounds for the conclusion that the very difference in the individual degree of reflexivity expression, reflexivity as such, is determined to a much greater extent not by individual metacognitive parameters and not even by their additive set (although such a determination is also preserved), but by the degree their *integration*, the measure of their coorganization. In other words, this means that reflexivity as a generalized property and a measure of its individual expression as a whole is determined not only by how developed its individual partial components, i.e., the main metacognitive processes and qualities, but also by how integrated they are into integrity, organized and *structured* among themselves. It is *the structural effects* - the effects of an integrative type - that play an important, determining role in relation to this property and to the determination of the degree of its

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severity. They, along with the additive analytical determination, determine its general level, an individual measure of severity. These integrative effects determine the irreducibility of reflexivity to its determination only on the part of metacognitive parameters separately and their summative aggregative, additive association. The significant and very significant determination is generated by their integration and the structural effects that it generates. It is this that should explain the important fact that the level of reflexivity and the measure of metacognitive potential in the general case are not identical. The same or close values of this potential can be accompanied by significantly different values of the total reflexivity, since they depend not only on the sum of the values of the partial components included in it, but on how coorganized and integrated they are. Integration gives rise to that "increase" that distinguishes general reflexivity from the magnitude of the metacognitive potential and the irreducibility of the first to the second.

Fifthly, the presented results not only agree with a whole range of data obtained by us earlier (and thus perform a verifying function in relation to them), but also allow us to deepen and concretize them. We are talking about a group of fundamentally similar regularities of the structural type, identified on the material of various subjects of study, but having a conceptual commonality. In particular, this is the relationship we have established with the degree of *adaptation* of the individual, not only, and in some cases - and not so much with the degree of severity of individual individual qualities (adaptation-important qualities - AIQ) and their additive totality, but with the degree of their *structuring* - integration and co-organization into holistic patterns. They are the subsystems of AIQ, and not their aggregative set, and determine the adaptability of the individual to both professional (Karpov, Orel, Ternopol, 2003) and educational activities (Chimbelenge, 1996). A fundamentally similar regularity of the structural type is established in relation to the efficiency of managerial activity. It is also to a very significant extent determined by regularly organized structures of professionally important qualities, and not by their additive totality (A. A. Karpov, 2018).

Sixth, with all these very significant effects of the structural type, manifested in quite significant differences in the found structure programs, they still cannot be absolutized and succumb to a kind of temptation to hyperbolize the established - indeed, significant effect of the structural type. The fact is that these differences themselves exist and manifest themselves against the background of even more general and, in essence, fundamental laws of the combination of two types (and levels) of determination, analytical and structural. And in this respect, another fact obtained as a result of processing the results is an important confirmation of such generality. It consists of the fact that the comparison of the intercorrelation matrices of metacognitive parameters for their homogeneity/heterogeneity in two groups according to the $\chi 2$ criterion showed their statistically significant *homogeneity*. This means that they differ mainly not qualitatively, not 'in principle', but in terms of structuring and integration, that is, quantitatively.

Both circumstances recorded above deserve special attention, and that is why it is necessary to dwell on them in somewhat more detail. Indeed, at first glance, it seems that the opposite option would be much more “interesting”, in which the matrices would turn out to be heterogeneous, qualitatively heterogeneous. Then it would be possible to make a "catchy" conclusion about the deep fundamental and qualitative transformations occurring in the structure of the metacognitive sphere of the personality under the influence of changes in the individual measure of the severity of reflexivity. However, in reality, this is not observed, and the restructuring is not of a qualitative, but of a quantitative nature. They are traced not in *principle*, but only in *degree*. A detailed

analysis of this result reveals, however, that, despite its, so to speak, 'less and less interesting', it nevertheless corresponds to a much greater extent to the real organization of the psyche, to those basic laws that it obeys. Indeed, if metacognitive processes and qualities, and even more so their general organization (structure), were subjected to deep, fundamental restructuring under the influence of any one, albeit important, factor and, therefore, would be just as fundamentally variable , then we would not have to talk about them as basic and fundamental - as connected with the very basis of the mental with its procedural content - at all. On the contrary, they should be fundamentally *invariant* in their basic features and regularities, including structural ones, which is explained in this study. However, it is against the background of this invariance that, in principle, not only can, but should be presented variations in the degree of action of their basic regularities, which is also revealed above.

This conclusion allows us to explicate another significant pattern, since it allows us to offer a consistent interpretation of those features that are characteristic of reflexivity and its individual expression in terms of two levels (and types) of its determinants - analytical and structural. They, as follows from the presented materials, can be disclosed from the standpoint of attracting the most general and important regularities of the system type proper, established in systems theory. In particular, this is a pattern according to which the overall functional potential of the system and its resource are determined not only by the level of development of its individual components, but also by the level of their structural organization as a whole and, accordingly, by the severity of the effects of the synergetic plan itself. It is this, in essence, direct connection of the individual measure of reflexivity with the degree of structural organization, and consequently with the measure of the representation of effects of a synergistic type, that should be implemented as an interpretive tool to explain its features. At the same time, this also convincingly demonstrates the subordination of the organization of reflection to specific systemic laws, explicating it as the formation of just such a systemic type in which mechanisms and other operational means of an integrative plan play a decisive role.

Seventh, in the most general, actually theoretical terms, the presented results also contribute to the solution of, perhaps, the most important and fundamental question about the psychological *status* of reflexivity as an integral quality and reflection as a process that ensures it. It is known to be especially significant due to the fact that it is reflection that is the most important, the main means of procedural support for consciousness as such, and, accordingly, the main operational means of the highest level of regulation of behavior and activity - conscious, voluntary. This question is usually formulated in the following, although somewhat schematized, but generally correct form: can the procedural content of reflection be reduced to the totality of the contents of those more local processes (in particular, cognitive, metacognitive, and others) that are they really included in it and, moreover, who ensure its implementation? Or, in it and, accordingly, in reflexivity itself as its productive manifestation, such a specific content is formed that cannot be reduced to an additive totality of the content of its individual components - metacognitive processes and qualities? The urgency of this question is also related to the fact that only in the case of a positive answer to it, reflexivity itself can be explained as a formation that really has its own procedural status, which is not fundamentally reducible to all other currently known formations. The results presented above and their interpretation testify in favor of this variant of the answer to this - we repeat, the most fundamental theoretical question. *Reflexivity* as a generalized individual *quality* is revealed as an integrative type formation, which is formed on the basis of

synthesizing the entire set of metacognitive processes and qualities. However, the same is true with respect to reflection as an equally generalized *process* formation: since metacognitive processes are interpreted in theory as processes of the "second order" - fundamentally "secondary", then reflection, which is the product of their integration, acts as a process even more a high level of generalization - as a process of the "third order" of the complexity of the organization. This, apparently, is the true specificity of its level status, as well as its place in the overall organization of the system of mental processes.

In summary of the above analysis, we can formulate the following main *conclusions*. *First,* the development of research in two very significant areas, in the psychology of reflection and in metacognitivism, is characterized by a fundamental and ever deeper convergence, which has now reached such a degree that it already requires their synthesis. The key conceptual tool for such a synthesis can be the interpretation of the main metacognitive processes and qualities, as well as other operational means of the metacognitive plan as partial components of reflexivity, as its basic and most specific "components".

Secondly, the validity of such a conceptualization is associated not only with arguments of a theoretical nature but also with the fact that on its basis new opportunities open up for empirical and experimental research of both reflexivity itself and metacognitive processes and qualities, i.e. with its constructiveness in the actual research plan, with its operationality. This, in turn, creates sufficient conditions for deepening research in both these areas and at their intersection.

Third, one of the main regularities of the organization of reflexivity, explicated by empirical procedures and, therefore, fundamentally objectified, is the nonidentity of the measure of its individual expression and the total value of the metacognitive potential formed by an additive set of basic metacognitive processes and qualities, as well as other operating means of this type.

Fourth, in reflexivity as an integral individual quality and, accordingly, in reflection as a macroprocess that ensures it, there is an action of specifically systemic laws and mechanisms similar to its nature, a proper integrative type, generating synergistic effects and, as a result, leading to generating new content specific to them. It is irreducible to the additive totality of the content of the partial components (meta-cognitive processes and formations) included in reflexivity, thereby explicating its own content and determining the independence and specificity of its status.

Fifth, the revealed connection between the individual measure of reflexivity and the degree of structural organization and, consequently, with the measure of the representation of synergetic-type effects should be considered as an interpretive tool for explaining the fundamental features of its organization. At the same time, this also reveals the subordination of the organization of reflexivity to specifically systemic patterns, explicating it as the formation of just such a systemic plan, in which mechanisms and other operational means of an integrative type play a decisive role.

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Author contribution statement

Anatolii Viktorovich Karpov – ideological scientific guidance based on the application of metacognitive methodology to the development of reflexive problems; theoretical generalization of the results.

Aleksandr Anatol'evich Karpov – disclosure of the idea of the article using the methodology of structural analysis, data processing and interpretation of the results.

Anna Vadimovna Chemyakina – planning an empirical study, applying the method of diagnosing reflexivity, organizing data collection, interpreting the results.

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The authors have no conflicts of interest to declare.

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Regulatory Resources for Work Engagement and Overcoming Professional Deformations in the Context of Human Well-being in the Work Environment

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Abstract
Introduction. This paper focuses on the search for regulatory resources for a person's professional well-being. The authors theoretically demonstrate that professional well-being can be characterized by work engagement and serious professional deformations. They consider conscious self-regulation as a meta-level of an integral system of psychic self-regulation, including cognitive regulatory and personal regulatory resources for achieving goals. These resources contribute to solving various types of problems in human activity. **Methods**. Sample: 119 marine flotilla employees aged 19 to 54 years. Assessment tools: (a) Self-regulation Profile Questionnaire, SRPQM 2020, (b) Russian-language modification of the Utrecht Work Engagement Scale, UWES, and (c) the Personality and Behavior Deformations scale of the Integral Diagnostics and Correction of Professional Stress, IDCPS. **Results**. The results of structural modeling demonstrated that with the increase in conscious self-regulation for achieving goals, the work engagement of employees increases and the probability of professional deformations decreases. The study revealed that the personal regulatory characteristics of self-regulation (reliability and flexibility) not only predict work engagement and overcoming professional deformations, but also mediate the influence of cognitive regulatory processes on them. Thus, the development of conscious self-regulation for achieving goals can serve as a regulatory resource for work engagement, overcoming professional deformations, and achieving professional well-being in the work environment. **Discussion**. The data obtained reveal the prospects of a resource approach to the study of conscious self-regulation in solving the problem of human well-being in various environments. The results of the study can be used to develop programs to support mental health and human well-being in the professional environment.

Keywords
conscious self-regulation, resources, resource approach, cognitive regulatory resources, personal regulatory resources, professional well-being, work engagement, professional deformations

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Highlights

- Professional well-being is characterized by work engagement and the severity of professional deformations.
- Conscious self-regulation is a meta-level of an integral system of mental self-regulation, including cognitive regulatory and personal regulatory resources.
- With the increase in conscious self-regulation for achieving goals, the work engagement of a person increases and the probability of professional deformations decreases.
- Personal regulatory resources (reliability and flexibility) are not only predictors of work engagement and overcoming professional deformations, but also act as mediators of the influence of cognitive regulatory resources on them.

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Introduction

Self-regulation, which is seen as the most important psychological resource for the effectiveness and self-development of individuals in all areas of their lives, has become an actual trend of psychological research at the turn of the 20th and 21st centuries.

V. I. Morosanova proposed a resource approach to the study of conscious self-regulation for achieving goals, which has shown its effectiveness in contemporary psychological research in the fields of education, professional, and sporting activities, in various situations of human interaction with the world (Morosanova, 2014, 2021). In the context of this approach, conscious self-regulation is considered as a meta-level of an integral system of psychic self-regulation, providing cognitive regulatory and personal regulatory resources for achieving goals. Depending on the scale of the tasks and goals of activity, it is proposed to distinguish between special and universal regulatory resources that ensure success in achieving goals and solving life problems (Morosanova, 2014, 2021). The most important indicator of individual regulatory resources is the general level of self-regulation, characterizing the development of a general ability for conscious self-regulation, which contributes to solving various types of problems in human activity (Morosanova, 2021).

The general ability for conscious self-regulation is manifested in the readiness and ability of a person not only to use the regulatory resources already accumulated in experience, but also to create the new ones, either in the presence of significant changes in the normal conditions of existence, the emergence of new activity requirements, or in the discipline of unknown/unlikely types of activity (Konopkin, 2011; Morosanova & Bondarenko, 2016). In other words, when we talk about the general ability for self-regulation, we mean the "general activity potential of a person" (Konopkin, 2006) and a universal regulatory resource that provides productive aspects of voluntary activity (Morosanova, 2014). In general, as demonstrated in the numerous studies within the framework of the resource approach, the higher level of conscious self-regulation development determines higher success in achieving objectives in different types of professional activity, as well as greater educational opportunities (Morosanova, 2021).

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From our point of view, the regulatory approach opens up the possibilities to address the issues of maintaining individuals' mental health, including maintaining their well-being, either in the educational environment (Morosanova & Fomina, 2019; Morosanova, Bondarenko, & Fomina, 2019; Fomina, Burmistrova-Savenkova, & Morosanova, 2020; Stefansson, Gestsdottir, Birgisdottir, & Lerner, 2018), at work (Rasskazova & Ivanova, 2019; Bakker & Oerlemans, 2019; Simon & Durand-Bush, 2015), or in relation to life itself and the diversity of its aspects (Wrosch & Scheier, 2020; Reinecke, Gilbert, & Eden, 2021).

With regard to well-being at work or professional well-being, it is worth noting the following. First, researchers traditionally distinguish two phenomena associated with it – work engagement and 'burnout' syndrome (Polunina, 2009; Maricuțoiu, Sulea, & Iancu, 2017; Schaufeli & Bakker, 2010; Leiter & Maslach, 2017). Engagement is one of the positive states associated with work that reflects individuals' well-being in the work environment. Meanwhile, burnout syndrome is, on the contrary, considered to be a disfunctional state.

Secondly, in recent years, there has been an increase in research on the relationship between self-regulation and positive/negative indicators of professional well-being. At the same time, self-regulation is considered a significant predictor that largely determines individuals' passion for work (Rasskazova & Ivanova, 2019; Bakker & Oerlemans, 2019; Bouckenooghe, Raja, & Abbas, 2014). The role of self-regulation in the recovery of occupational stress syndromes is also being studied, ranging from acute and chronic stress reactions to the negative consequences of stress at the level of persistent personality and behavior deterioration (Fomina, 2016; Evans & Kim, 2013; Morosanova, Kondratyuk, Gaidamashko, & Voytikova, 2019).

Thirdly, with regard to professional deformations, it is well noted that in the field of labour psychology and related fields special attention is paid to 'classical' deformations, such as burnout syndrome and type A behavior. Other deformations become the subject of study much less often (Barabanshchikova, 2019).

This *study aims* to reveal the resource role of conscious self-regulation in ensuring professional well-being, including such aspects as work engagement and professional deformations. In addition to professional burnout syndrome, our empirical study focuses on the following forms of delayed stress consequences: type A behavior, behavioral risk factors, and neurotic reactions.

Methods

Sample

The study involved 119 marine flotilla employees (29 % women) aged 19 to 54 years (M = 30.97, SD = 9.79). The professionals who participated in the study worked in the same organization but differed in their job responsibilities. We consider this professional group just as a model sample to solve certain general psychological problems.

Assessment tools

The level of development of the general ability for conscious self-regulation and its individual characteristics, which are consistently manifested in various types of voluntary activity and life situations, were measured by the Morosanova Self-regulation Profile Questionnaire, SRPQM-2020 (Morosanova & Kondratyuk, 2020). The questionnaire includes 28 statements grouped into the following 7 scales: 'Goal planning', 'Modeling important conditions', 'Programming actions', 'Results evaluation', 'Flexibility', 'Reliability', and 'Insistency', which, by summing up, give an integrative

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scale indicator – 'General level of self-regulation'. The agreement with the statements was assessed using a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree).

Two methods were used to measure professional well-being. First, the Utrecht Work Engagement Scale, UWES (Schaufeli & Bakker, 2004), in its Russian-language version modified by D. A. Kutuzova (Kutuzova, 2006). The questionnaire consists of 17 statements that make up 3 scales: vigor, dedication, and absorption. All statements were rated using a 7-point scale from 0 (never) to 6 (always). The overall indicator of the three scales is considered as an integrative parameter of work engagement reflecting an individuals' well-being in professional life. Secondly, the Personality and Behavior Deformations scale of the Integral Diagnostics and Correction of Professional Stress, IDCPS (Leonova, 2006). The scale includes 22 statements and describes the phenomenology of professional deformations, that is, delayed consequences of stress manifested in the type A behavior, burnout syndrome, neurotic reactions, and behavioral risk factors. Each statement was rated using a 4-point scale from 1 (strongly agree) to 4 (strongly disagree), which helped us measure the correspondence of each item with the subjective experience of the survey participants.

Procedure of statistical data analysis

Data analysis was processed using the IBM SPSS Statistics-26 program (George & Mallery, 2019) and the R programming language environment ('psych' and 'lavaan' packages). Before the main statistical procedures, we calculated descriptive statistics and checked the normality of the empirical data distribution (based on skewness and kurtosis), which revealed moderate and high skewness for most indicators. The presence of statistically significant correlations between the components of conscious self-regulation, work engagement, and professional deformation was tested using the analysis of the R-Spearman rank correlation coefficient. Structural modeling methods were used to study the contribution of conscious self-regulation to professional well-being.

Results

Before analyzing the correlation and causal relationship among indicators of conscious self-regulation, work engagement, and professional deformations, we calculated their descriptive statistics (minimum/maximum, mean, standard deviation, skewness, kurtosis) and decided to use nonparametric methods (Table 1).

Table 1
Descriptive statistics of indicators of conscious self-regulation, work engagement, and professional deformations

Scales	Min	Max	Mean	Standard Deviation	Asymmetry	Kurtosis
Self-regulation Profile, SRPQM 2020						
Goal planning	4	20	16.1	4.44	–1.05	0.35
Modelling important conditions	8	20	15.02	2.71	–0.91	1.16
Programming actions	4	20	17.26	3.61	–1.57	2.6

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Table 1
Descriptive statistics of indicators of conscious self-regulation, work engagement, and professional deformations

Scales	Min	Max	Mean	Standard Deviation	Asymmetry	Kurtosis
Results evaluation	4	20	15.34	5.04	–0.83	–0.33
Flexibility	8	20	17.14	3.96	–1.28	0.5
Reliability	4	20	15.15	5.19	–0.76	–0.62
Insistency	4	20	14.21	3.25	–0.32	0.13
Utrecht Work Engagement Scale, UWES						
Vigor	10	42	27.43	5.62	–0.04	1.26
Dedication	9	35	24.62	4.73	–0.35	1.14
Absorption	12	35	22.33	3.94	0.21	0.91
Personality and Behavior Deformations Scale, IDCPS						
Type A behavior	6	17	9.8	2.01	0.51	0.65
Burnout syndrome	5	16	6.34	1.76	2.33	8.1
Neurotic reactions	5	15	6.21	1.69	2.44	8.09
Behavioral risk factors	5	15	7.28	1.77	1.42	3.19

The analysis of rank correlation coefficients by R-Spearman (Table 2) showed a stable positive relationship between conscious self-regulation and work engagement and, on the contrary, negative correlations between conscious self-regulation and professional deformations. This applies to both system-forming cognitive regulatory processes (goal planning, modeling important conditions, programming actions, and results evaluation) and personal regulatory characteristics of flexibility and reliability, except for the insistence, where no significant correlations were found.

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Table 2
Correlation coefficients among indicators of conscious self-regulation, work engagement, and professional deformations

Scales	Self-Regulation Profile (SRPQM-2020)							
	Pl	Pr	M	RE	F	R	I	GL
Utrecht Work Engagement Scale, UWES								
Vigor	0.05	0.32**	0.23*	0.3**	0.29**	0.33**	0.04	0.42**
Dedication	0.05	0.23*	0.17	0.31*	0.24*	0.32**	–0.04	0.37**
Absorption	–0.04	0.16	0.12	0.22*	0.16	0.23*	0.01	0.24*
Personality and Behavior Deformations Scale, IDCPS								
Type A behavior	0.13	–0.04	0.17	–0.09	0.01	–0.2*	0.04	–0.02
Burnout syndrome	–0.21*	–0.23*	–0.12	–0.2*	–0.23*	–0.38**	–0.18	–0.39**
Neurotic reactions	0.01	–0.29**	–0.2*	–0.17	–0.29**	–0.48**	–0.05	–0.39**
Behavioral risk factors	–0.09	–0.27**	0.05	–0.13	–0.09	–0.39**	0.03	–0.28**

Note: Pl – goal planning, *Pr* – programming actions, *M* – modeling important conditions, *RE* – results evaluation, *F* – flexibility, *R* – reliability of self-regulation, *I* – insistency, *GL* – general level of conscious self-regulation; * $p < 0.05$; ** $p < 0.01$.

Table 3 shows the correlations among the indicators of work engagement and various professional deformations. All statistically significant correlations found were negative. In the scientific literature, work engagement and, for example, burnout syndrome (one of the most studied indicators of professional deformations) are often considered to be opposites. However, there is a debate about the contradictory nature of the relationship between these two phenomena, which are closely related to work-related psychological well-being. (Maricuțoiu et al., 2017). The analysis of the relationship between work engagement and professional deformations was not directly included in the objectives of this article. It only had its task to explore the contribution of conscious self-regulation to occupational well-being. However, these data can guide future research to investigate the reciprocity among self-regulation, work engagement, and professional deformations.

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Table 3
Correlation coefficients among the indicators of work engagement and professional deformations

Personality and Behavior Deformations Scale, IDCPS	Utrecht Work Engagement Scale, UWES		
	Vigor	Dedication	Absorption
Type A behavior	–0.1	–0.2*	–0.12
Burnout syndrome	–0.18	–0.28**	–0.15
Neurotic reactions	–0.35**	–0.33**	–0.22*
Behavioral risk factors	–0.16	–0.24*	–0.16

*Note: * p < 0.05; ** p < 0.01.*

To answer the main empirical question about the predictability of conscious self-regulation in relation to phenomena related to human well-being in the professional environment, we compared several alternative models using structural modeling methods. To calculate the model parameters, we implemented the MLR (maximum likelihood robust) estimator; this method is used when it is assumed that the normality of distribution can be moderate or significantly disturbed (Li, 2016). The degree of conformity of the model with empirical data was assessed using the following indicators: the ratio of degrees of χ2 to the number of freedom degrees (χ^2/df) ≤ 2, the level of p for χ^2 (p) ≥ 0.05, Comparative Fit Indices, CFI ≥ 0.95, Root Mean Square Error of Approximation, RMSEA ≤ 0.05, and Standardized Root Mean Square Residual, SRMR ≤ 0.05. Taking into account our theoretical assumptions, the structure of the analyzed constructions, and the objectives of the research, we compared models with three ('self-regulation', 'work engagement', 'deformations') and four ('cognitive regulatory resources', 'personal regulatory resources', 'work engagement', 'deformations') latent factors, differing in the presence/absence of correlations. Indicators of the subscales of the questionnaires were used as indicator variables. For the model with four latent factors, the best-fit indices were obtained. The resulting structural model is presented in Fig. 1.

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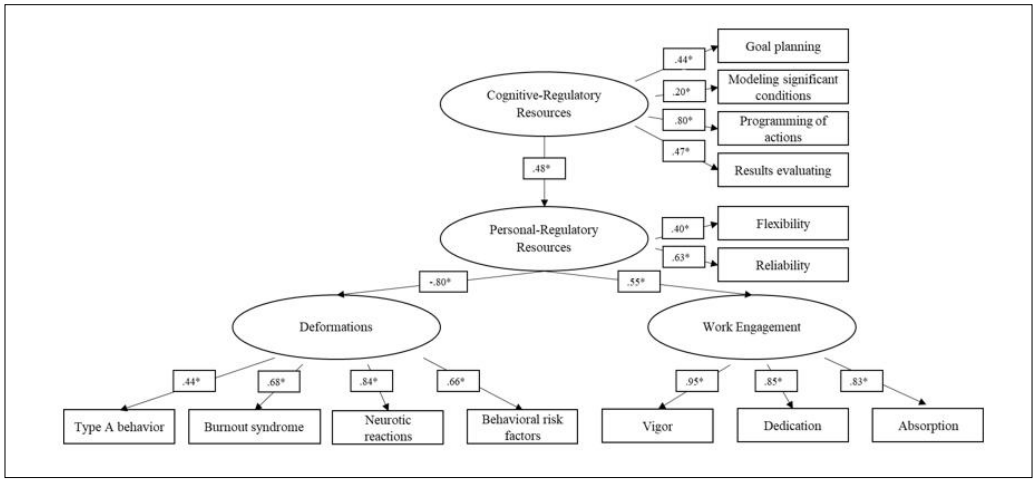

Figure 1. Structural model of the contribution of conscious self-regulation to professional well-being

In the resulting structural model, conscious self-regulation forms two latent factors. The first factor is 'cognitive regulatory resources', including goal planning, programming actions, modeling conditions important for achieving goals, and results evaluation. The second factor is 'personal regulatory resources', including flexibility and reliability. The regulatory characteristic of 'insistency' was not included in the model, because the introduction of this indicator variable results in a deterioration of the compliance index and the loading factor of this parameter is interpreted as insignificant. According to the results of the correlation analysis, 'insistency' also has no statistically significant correlation with any of the engagement and deformation parameters analyzed. The third factor includes indicators of 'work engagement', and the fourth one – indicators of 'deformations'.

The consistency indices showed an acceptable fit between the model and the empirical data: chi-square (df = 58) = 67.667; CFI = 0.96; RMSEA = 0.044; SRMR = 0.066 (90 % range from 0.000 to 0.072). All factor loadings and regression coefficients turned out to be significant, and their signs corresponded to theoretical assumptions. The model indicates that the variable of 'cognitive regulatory resources' determines the variables of 'work engagement' and 'professional deformations' through 'personal regulatory resources'. In other words, this study demonstrated the specificity of the determination of phenomena associated with professional well-being (work engagement and professional deformations) through conscious self-regulation. This effect is achieved due to the high development of all cognitive regulation processes and their stability and flexibility.

Discussion

The results of the study demonstrated that conscious self-regulation makes a significant contribution to work engagement of an individual. The obtained data are supported by the coherence of the content contained in the work engagement structure proposed by V. Schaufeli and A. Bakker, and theoretical ideas about the general ability for conscious self-regulation.

Thus, the 'vigor' scale is characterized by a high level of energy, concentration, readiness to work hard, perseverance in a situation of interference; the 'dedication' scale diagnoses involvement in work, a sense of the importance of individual activity, and readiness to accept challenges

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and overcome difficulties. As far as the 'absorption' scale is concerned, we are talking here about the experience of happiness, the perception of time peculiarities in the work process, and the lack of desire to distract from work and/or stop working. This emphasizes the understanding of work engagement as a characteristic of professional well-being (Kutuzova, 2006; Schaufeli & Bakker, 2010).

Considering the concept of the general ability to self-regulate consciously, it should be noted that "it is directly manifested in the initiative-creative mode, in the ease and success of mastering new types of purposeful activity, in the ability to independently solve non-standard tasks, to carry out activities under changed conditions" (Konopkin, 2011, p. 274) and includes an obligatory emotional component as a specific sense of 'subjectivity', which is realized in a feeling of confidence in the ability to achieve success (Konopkin, 2011; Morosanova & Bondarenko, 2016). It is easy to notice and draw parallels when correlating the components of 'vigor' and 'dedication' with the initiative-creative mode of the general ability for self-regulation.

We should recognize that the validity of correlation between conscious self-regulation and work engagement (as a positive state) also follows from the already classical works related to the study of emotion as an obligatory and significant factor in self-regulation of various types and forms of voluntary human activity (Konopokin, 2006; Prokhorov & Chernov, 2019; Kryukova, 2010). Associations of self-regulation with positive indicators of professional well-being (including work engagement and positive emotions) were recorded in the samples of specialists involved in a wide variety of activities (Rasskazova & Ivanova, 2019; Fomina, 2016). The results of the study carried out in a sample of teachers in schools of general education demonstrated that conscious self-regulation is not only a predictor of work engagement but can also act as a feedback mediator between work engagement and professional burnout, that is, reduces the likelihood of professional burnout manifestations in teachers with a high level of engagement in educating activities (Fomina, 2016).

However, in our opinion, the greatest interest in explaining the predictive value of self-regulation in relation to engagement is connected with research on the resources of work engagement. The idea of exploring resources for work engagement has been of interest to scientists for decades and is considered from the standpoint of different approaches (Halbesleben, 2010). All of these theories have one thing in common: There are some resources that can increase work engagement (Halbesleben, 2010). Our results confirm and develop these assumptions.

Work engagement has been shown to be positively associated with important performance outcomes, including job performance (Halbesleben & Wheeler, 2008) and financial results (Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009, etc.). Considering the problem of engagement resources described above, we should note that it is fundamental to raise the question of finding not only resources contributing to the increase in work engagement and, as a result, the activity outcomes. It is not less important to find resources that contribute to the effectiveness of activities, even with a low level of work engagement. The prospects of an approach based on resources to conscious self-regulation of the achievement of goals are fairly obvious in answer to both questions.

Regarding the role of conscious self-regulation as a factor that prevents the development of professional deformations, this result is consistent with the data available in the literature on a significant relationship between conscious self-regulation and emotional states of a person (Vets' & Bondarenko, 2021; Konopkin, 2006; Kryukova, 2010; Prokhorov & Chernov, 2019; Baumeister,

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Vohs, DeWall, & Zhang, 2007; Dawson & Golijani-Moghaddam, 2020), as well as its central role in coping with various forms of stress (Morosanova et al., 2019).

An important result of this study is not only the conclusions on the significant contribution of conscious self-regulation to professional engagement and the prevention of deformation. The results obtained clearly demonstrate the hierarchical and multilevel nature of the structure of conscious self-regulation, which includes the basic level of regulatory processes and the level of regulatory properties.

In this respect, we can concentrate on two points relating to such personal regulatory resources as reliability and flexibility.

First, it was previously shown on the model samples of professionals, students, and athletes that regulatory reliability, understood as the stability of self-regulation of psychic activity and practice, serves as a special predictor of stress relief in emergency situations of professional activity (Morosanova, Kondratyuk, & Gaidamashko, 2020), under tense conditions of competitive sporting activity (Morosanova, 2001), and while passing exams (Morosanova & Filippova, 2019). In studies related to self-regulation of human behavior in situations of uncertainty (using the example of the COVID-19 pandemic in the world), it is possible to demonstrate the importance of flexibility in ensuring the stability of human life and preserving individuals' mental health (Morosanova, Bondarenko, & Kondratyuk, 2021; Zinchenko, Morosanova, Kondratyuk, & Fomina, 2020; Dawson & Golijani-Moghaddam, 2020; Kroska, Roche, Adamowicz, & Stegall, 2020). Thus, for example, psychological flexibility, the ability to stay in the present moment and participate in value-oriented activities even in the presence of negative emotions, in a pandemic situation, turned out to be a positive factor (Kroska et al., 2020). Regulatory flexibility, being one of the indicators characterizing the adaptive capabilities of self-regulation in specific conditions of activity, is responsible for the possibility of making corrections to the functioning of various regulatory blocks when the conditions of activity require it. As many authors understand that professional deformations are the result of adaptation to certain characteristics of the profession (for a review, see Bakker & Leiter, 2010), the plasticity of individual adaptation can contribute to the appropriateness of the reaction to the situation from the point of view of the restructuring of the conscious self-regulation system of a person.

Secondly, regulatory reliability and flexibility are not only direct predictors of work engagement and overcoming professional deformations, but also act as mediators of the influence of cognitive regulatory resources on them, thereby confirming the strict hierarchy and sequence of implementation of the conscious self-regulation process.

Finally, although the study is limited by the specificity of the sample, which consists of marine flotilla employees who work in the same organization and have different professional responsibilities, there is all reason (theoretical and empirical) to believe that the results obtained are of general psychological significance and can be applied to a wide range of professions regardless of the specifics of the activity.

Conclusion

This article presents the results of the study on the role of conscious self-regulation in ensuring professional well-being. It is proven that it can be characterized by work engagement and the severity of professional deformations.

Using structural modeling methods, the study demonstrated that conscious self-regulation

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development makes a significant contribution to work engagement and prevents the appearance of professional deformations. At the same time, regulatory flexibility and reliability are also of great importance. These personal regulatory resources not only directly impact professional well-being, but also mediate the influence of cognitive regulatory resources, such as goal planning, modeling important conditions, programming actions, and results evaluation.

The data obtained confirm the broad prospects of a resource approach to the consideration of conscious self-regulation in exploring the problems of human well-being in various environments, including the inevitably increasing anthropogenic burden on the environment, that requires the development of human subjectivity and consciousness to maintain activity and to realize the need for communication and self-realization in life in general.

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Author Contributions

N. G. Kondratyuk wrote the Introduction section, collected empirical data, analyzed, interpreted, and discussed the results, formulated the main conclusions.

V. I. Morosanova, author and curator of the study, made an important contribution to the planning and preparation of the manuscript, to the interpretation of the results and their discussion, made a critical revision of the content of the manuscript, discussed the results and conclusions of the study.

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Stress-related Characteristics of the Actualization of Subjective Experience in the Process of Information Concealment

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Abstract
Introduction. Many theoretical models explain differences in changes in physiological indicators during the implementation of lying and truth-declaring behaviors in polygraph tests. From our point of view, lies can be regarded as a special goal-oriented behavior provided by the implementation of corresponding functional systems – elements of subjective experience. At the same time, polygraph examinations are stressful due to the motivation for the test. We were interested in the characteristics of the actualization of subjective experience when the result of information concealment behavior is achieved under the above-mentioned conditions. **Methods**. The experiment used the modified version of the Block Test by V. V. Korovin in the form of the concealed information test. Heart rate registrations were carried out. Both entropy (as an indicator of rhythm complexity that reflects systemic subordination of behavior) and spectral indicators of rhythm (as a stress severity assessment) were calculated. The examinees were instructed to conceal information obtained at various stages of ontogenesis. **Results**. The study was carried out with the participation of 40 subjects who underwent polygraph examinations during their employment. We analyzed their heart rate entropy in the process of producing honest and false answers under stressful conditions. When information concealment behaviors are realized, entropy changes in different directions. However, this dependence has not been revealed for the new experience, apparently due to the process of temporary system dedifferentiation, i.e. the deactualization of comparatively new systems. **Discussion**. A polygraph test model based on the system-evolutionary approach was proposed. In the process of passing the test, there appears to be a formation of non-universal functional systems of 'lies', but rather those depending on the component of the experience to which this information belongs. Moreover, it is difficult to considerably improve information concealment behaviors of the examinees, due to the impossibility of rapid correction of behavior based on feedback.

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Keywords
polygraph, lie detection, information concealment, stress, system-evolutionary approach, heart rate, sample entropy, adaptation, stress regression, systemic dedifferentiation

Highlights
- From the system-evolutionary approach, the concealment of information is considered as a special goal-oriented behavior provided by the implementation of corresponding functional systems (FS) – elements of subjective experience.
- In stressful situations, when a false answer is given to a question related to the actualization of FS of greater differentiation, heart rate entropy decreases (compared to truth-producing behavior).
- When examinees conceal information associated with a less differentiated FS, entropy increases.
- Behavior changes during polygraph tests are difficult, which manifests itself in the absence of entropy differences among subjects with different number of polygraph tests and the absence of its dynamics during testing.

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Introduction
Despite the widespread use of polygraph testing, there is no generally accepted theoretical model that explains the differences in the recorded physiological indicators for true and false answers. Currently, there are more than 15 of such theories (for a cumulative analysis of theories, see: Obukhov & Obukhova, 2011; Isaichev & Isaichev, 2016; Mailis & Kholodnyi, 2021; Walczyk, Igou, Dixon, & Tcholakian, 2013; and many others) that explain specific phenomena but not regularities of the organization of information concealment behavior. There is a tendency in them to highlight the predominant role of a certain parallel (to the concealment behavior) proceeding psychic process or state (memory, attention, etc.) in the concealment behavior ensuring, which determines their low explanatory power. We believe that it is possible to construct a theoretical model for polygraph testing based on the system-evolutionary approach (P. K. Anokhin, V. B. Shvyrkov) and aimed at analyzing the integral behavior of an individual (Uchaev & Alexandrov, 2020).

From the point of view of systemic psychophysiology (Shvyrkov, 2006; Alexandrov, 2009, 2020; Alexandrov et al., 2018), the ontogenesis process can be understood as a sequence of systemogeneses, i.e. the formation of new functional systems (FS). In this case, the latter are understood as a complex of mutual cooperation of body elements to achieve a useful adaptive result (Anokhin, 1973). Each behavioral act is the organization of the relationship of the entire organism with the environment, but not of individual organs or brain structures with their own specific functions. The implementation of behavior is provided by FS actualization, which in turn form part of the

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individual experience. At the same time, the 'psychic' and 'physiological' aspects are considered different aspects of the unified systemic processes of the organization and implementation of FS (Shvyrkov, 2006; Alexandrov, 2009).

It is important that the formation of new FSs does not lead to the displacement of the old ones that have already been formed. They are accumulated and integrated into the already formed individual experience structure, including its partial reorganization. The set of all FSs available to an individual for implementation in behavior constitutes his/her individual experience. Thus, at the same time, the individual experience structure is the history of its formation from a lesser to a greater differentiation of the organism-environment relationship. Any implementation of behavioral acts is a simultaneous actualization of FS of different ontogenetic ages (Shvyrkov, 2006; Alexandrov, 2009; Alexandrov, 2018).

The advantages of using the systemic approach include the ability to consider the integral organization of human behavior in a polygraph testing situation, as well as the ability to use the language of system processes to describe particular phenomena. In this case, as previously noted in the literature, there is no need to highlight and focus on the leading psychic process or state that determines the information concealment behavior (Isaichev & Isaichev, 2016). Any FS fundamental architectonics (Anokhin, 1973) includes processes which characteristics can be compared to those that the authors of different theoretical models identify as the dominant ones. Furthermore, there is an opportunity for comparing the deliberate concealment behavior during the discussion of issues in the pre-test interview and during polygraph testing. It is possible to compare the similar behavior of humans and other social animals, whose behavior is considered by different authors as deception (Kuczaj, Tranel, Trone, & Hill, 2001; Osvath & Karvonen, 2012). In this case, we do not compare specific "functions" separately, but the dynamics of the course of the "isomorphic" system processes of the organization of the integral behavior in animals and humans (see, for example, Shvyrkov, 2006; Alexandrov, 2003).

Traditionally, polygraph testing is interpreted in terms of the stimulus-response paradigm. Thus, a polygraph examiner's question is considered as a stimulus, associated with it; changes in physiological parameters are considered as a response (see, for example, Ogloblin & Molchanov, 2004). From the standpoint of the systemic approach, an individual's behavior is the implementation of active interactions with the environment. In this case, the environment and the organism form the unity (Shvyrkov, 2004). From our point of view, the polygraph examiner's question should be understood not as a stimulus, but as the environmental component with which there is an active interaction. In a testing situation, an individual has certain goals, and considers the questions through the prism of achieving these goals. The distinct changes in the autonomic nervous system indices recorded by the polygraph are a reflection of the various organ activities that are included in the FS of the whole organism (see Bakhchina, Demidovskii, & Alexandrov, 2018), and formed to implement the question answering behavior. For example, there is a phenomenon in polygraph examination – 'reaction of expectation' (Ivanov, 2019, p. 29). It is a distinct change in the physiological parameters associated with the next expectation of subjectively significant questions. These changes are not passive 'reactions'; they represent the 'prestart integration' of FS components (Anokhin, 1973) for subsequent question answering.

At the same time, the intersystem interrelationship problem is still open. Information concealed during polygraph testing is the examinee's subjective experience component that reflects certain body-environment relationships, i.e. FS. From the perspective of the first person, its description is

possible in the Russian language related to either behavior (see Kolbeneva & Alexandrov, 2016). United by the achieved results, commonality FSs are understood as experience domains (Alexandrov, 2018). They can be associated with approaching/withdrawal, sensory organs, etc.; each of the domains has its own degree of differentiation (Kolbeneva & Alexandrov, 2016). On the other hand, concealment behavior can be considered independently in the form of independent FSs that produce lies for one or another purpose.

Another special issue is the possibility of adapting to the polygraph testing procedure. The testing methodology does not imply direct observation by the examinee of changes in the dynamics of their physiological parameters. Separate test results can be reported with a delay, for instance, cumulatively, on the basis of several test results. Consequently, there is no opportunity to modify individual behavior to achieve the goal. In this case, the difficulty of directed adaptation (learning) to the polygraph testing procedure should be expected. It will be expressed in the absence of the opportunity to improve the corresponding subjective experience associated with the goal achievement formulated by the examinee on the basis of feedback.

From the standpoint of systemic psychophysiology, heart rate variability (HRV) can be considered as a reflection of heart involvement in FS and related to the dynamics of the FS actualization. HRV reflects the coordination process of the activities of various components of the organism and depends on the characteristics of the system organization of the implemented behavioral act, including the degree of differentiation of the actualized set of systems (Bakhchina & Alexandrov, 2017; Bakhchina et al., 2018; Bakhchina, Arutyunova, Sozinov, Demidovsky, & Alexandrov, 2018).

One of the most common methods for assessing HRV in connection with the FSs actualization dynamics is the entropy analysis. It reflects the irregularity measure of the cardiac signal (sequence of RR intervals). In this work, we used the sample entropy indicator, which has a number of advantages, including the ability to apply to short sequences and noise resistance (Yentes et al., 2013; Bakhchina et al., 2018). On the other hand, HRV analysis can be used as a person's stress level indicator through the RR-interval sequence spectral analysis (Kovaleva, Panova, & Gorbacheva, 2013; Kim, Cheon, Bai, Lee, & Koo, 2018).

Polygraph testing is a stressful event (Ermakov, Vorob'eva, & Yatsyk, 2016, p. 158), which accordingly determines the manifestation of several phenomena. From a theoretical and empirical point of view, the relationship between the contribution to the behavior of comparatively younger and older FS changes in favor of the latter during stress. When the activity of highly differentiated (newer) systems is suppressed, the relative contribution of less differentiated (older) systems increases, which can be recorded by the relative changes in the entropy (complexity) of heart rate (Bakhchina & Alexandrov, 2017; Bakhchina et al., 2018). This condition is called regression or the temporary dedifferentiation of the system and is characterized by its reversibility (Alexandrov, 2016; Alexandrov et al., 2017).

Studies using the HRV analysis to detect concealment have been described in the literature (e.g., Sung & Pentland, 2005; Swee et al., 2020). However, in the available studies, only spectral indicators are used to differentiate the lie and truth states. These studies usually describe the information concealment behavior which is realized in a free conversation. In addition, a small number of studies have examined the impact of awareness of details of committed events on the effectiveness of testing. Bradley, Malik, & Cullen (2011) found that more information about the crime, which presumably corresponds to a higher degree of experience differentiation, facilitates lie detection by the polygraph examiner.

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The objective of our study was to analyze the dynamics of heart rate (HR) during the implementation of concealment behavior in information of varying degrees of differentiation by individuals undergoing a polygraph testing procedure under stress. As *hypotheses,* the following assumptions were stated: (1) behavior modification in the polygraph examination process is difficult due to the inability to adjust individual behavior using feedback; (2) when passing polygraph testing, HRV in the information concealment behavior mainly depends not on the differentiation of the systems that provide the newly formed concealment behavior, but on the differentiation of systems belonging to the concealed component of the experience.

Methods

The experiment used the common modification of the method in the polygraph test – concealment information technique (CIT). It involves presenting a number of homogeneous questions containing a particular feature of the event being investigated by the examinee (e.g., the amount of stolen money, the murder weapon, etc.) (Ogloblin & Molchanov, 2004). In the classical technique, the interval between questions usually does not exceed 20–30 seconds (Zhirnov, Pritulyak, & Alekseev, 2016), which is not very informative during HRV registration. The solution to this problem was found in the form of a block test (Korovin, n.d.). Thus, questions are asked without being mixed, which makes it possible to combine them into a single time period of analysis (Fig. 1).

Heart rate (HR) was recorded using the Zephyr sensor (HxM BT) and the special program for the registration of telemetric measurements (Polevaya et al., 2012) during the experiment.

The study involved 40 participants aged 20 to 46 years (M = 25.03, Med = 23, SD = 3.84), 15 of whom were women. All participants had no complaints of physical distress or psychological discomfort. Before testing, each of them signed a written informed agreement to participate in the experiment.

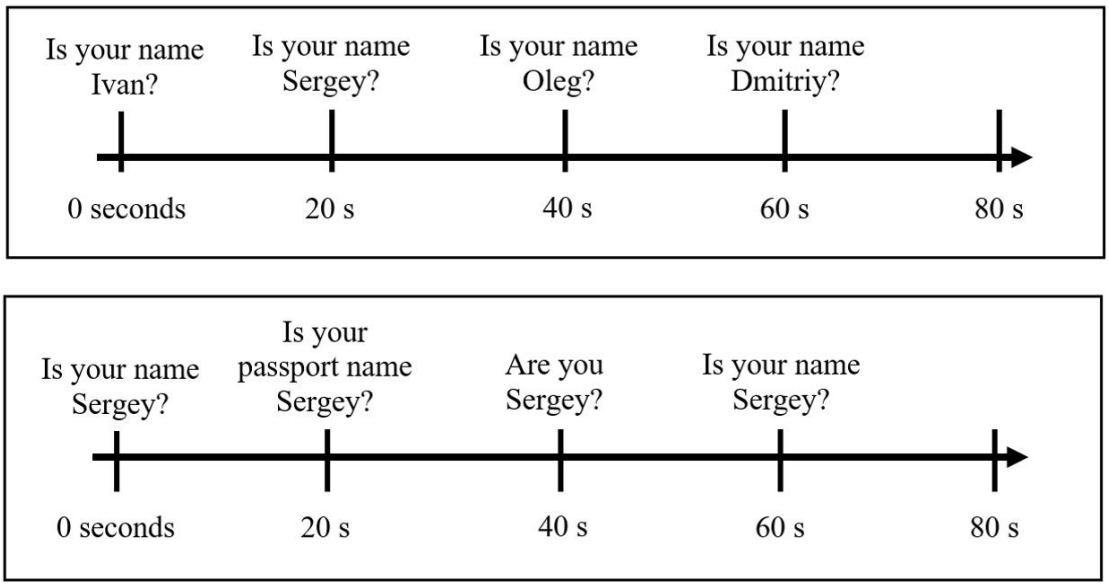

Figure 1. Classical (top) and block (bottom) versions for presenting questions to the examinee

This experiment was timed to coincide with a real polygraph test, which ensured ecological validity, as well as a certain level of stress, due to the motivation to pass the test. In the first stage of the study, the subject was familiarized with the polygraph examination procedure, information on the current state of health was collected, and the necessary documents were signed. The heart rate sensor was then installed; the examinee was interviewed about the events that were checked on the polygraph. Then, the testing was carried out according to the method described above.

During the experimental series, according to the instructions, the participant had to conceal the autobiographical information acquired at different stages of individual development. The choice of concealed information was due to its prevalence in real polygraph testing, for example, in 'stimulation' tests (Ogloblin & Molchanov, 2004). Furthermore, during the investigation process, the events of biography that took place in different periods of time are concealed. During the study, the examinee was instructed to lie when asked about his/her own name, year of birth, the type of school in which he/she studied, the mark in the school certificate, the name of the company for which he/she applied, and his/her age. In each case, a homogeneous series of questions was presented with one of them related to the examinee (Table 1). Before the test started, the examiner was told to lie only on the question related to him/her and to answer the others honestly. Information from a similar experience (e.g., name) was presented together. Each individual test consisted of three series of questions (one with lies and two without lies). For positional equalization, the questions in the tests were mixed and the order of presenting the test itself was changed for each subject.

Table 1
Questions presented to the examinees during the experiment

Concealed experience	False answer	Honest answer	Honest answer
Year of birth	Were you born in 1990?	Were you born in 1985?	Were you born in 1980?
Name	Your name is Ivan, isn't it?	Your name is Sergey, isn't it?	Your name is Oleg, isn't it?
School mark	Do you have an 'excellent' chemistry mark on your school certificate?	Do you have a 'good' chemistry mark on your school certificate?	Do you have an 'average' chemistry mark on your school certificate?
School type	Did you study at the lyceum?	Did you study at the cadet corps?	Did you study at high school?
Place of employment	Are you applying for the 'Alliance' company?	Are you applying for the 'ProTek' company?	Are you applying for the 'Invest' company?
Age	Are you 30 now?	Are you 35 now?	Are you 40 now?

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The sequences of RR-intervals were used to analyze the HRV – calculated intervals between two adjacent R-waves of cardiocomplexes. The following sequences were obtained for each subject: the conversation about the biography and one topic tested on a polygraph, false answers to 6, and true to 12 questions (2 questions in 6 series). Those that contained artifacts were excluded from the resulting records. The analysis of the questions with honest answers was carried out cumulatively by calculating the arithmetic mean, which is a standard procedure for processing polygrams (Popovichev, 2011).

Data processing and statistical analysis were performed in the MATLAB R2020a and IBM SPSS Statistics 23.0 programs. The Lomb–Scargle method was used to calculate the spectral indices and the sample entropy was used as the entropy index (Richman & Moorman, 2000) with the following input parameters: dimension = 2; filtering factor = 0.5*σ. For normality checking, the Kolmogorov–Smirnov and Shapiro–Wilk tests were used. The Spearman correlation coefficient was used to analyze the relationship between parameters. To assess the differences between the samples, Student's t test and the Mann–Whitney U test were used. The results were considered significant at $p < 0.05$.

Results

According to the results of the analysis, we found that all subjects were under stress. For this, the sequence of RR intervals was divided into windows (width: 100 s, shift: 10 s), for each of which the spectral indices were calculated. The criterion for the presence of stress was a simultaneous increase in the ration of low- and high-frequency activity (LF/HF) with a decrease in the total spectrum power in at least three consecutive windows (Shishalov et al., 2013).

For each testing stage, the sample entropy and LF/HF were calculated. There was a significant inverse correlation between them (some of the data are presented in Table 2). In other words, when stress increases, the entropy of the heart rate decreases.

The study involved participants who underwent polygraph testing for the first time (n = 27) and two or more times (n = 13). Comparison of entropy between the indicated groups for each of the testing stages did not reveal their significant differences (Table 2). Thus, the HR complexity was the same for subjects who had different quantitative experience in passing a polygraph test.

Furthermore, we analyzed the sample entropy dynamics throughout the testing. The cardiointerval sequence for each subject was divided into windows (width: 100 s, shift: 10 s); the entropy indices were calculated for them. An approximate straight line was then constructed, which was described by the coefficient function $y = kx + b$, where the coefficient k reflects the angle of its slope. The average value of k was found to be $–4{,}357*10^{–5}$, i.e., almost zero. The comparison of indicators for the first and last questions regardless of their type ($t = –0.055$; $p = 0.956$), as well as for those where there was an instruction to lie ($t = –1.333$; $p = 0.193$) and without it ($t = 1.249$; $p = 0.219$) did not reveal significant differences between them. Thus, the HRV of the subjects did not change considerably during the tests.

Pairwise comparison of questions revealed differences in entropy indices for questions with instructions for true and false answers related to early experience ($t = 2.371$, $p = 0.024$ and $t = –2.338$, $p = 0.025$, respectively), as well as for true answers related to a relatively early experience (relative to the verification date) ($t = 2.135$, $p = 0.045$), but not for false ones ($t = –0.538$, $p = 0.597$). Similarly, no dependence was found for the late experience ($t = 0.776$, $p = 0.447$; $t = –0.169$, $p = 0.868$). This means that the HR complexity is significantly higher with true answers

to the year of birth compared to the name or the school mark compared to the school type. However, lies about the year of birth are characterized by less complexity than lies about the name. For other pairs of questions, including late experience, no differences were found.

Table 2

Spearman correlation coefficients for entropy and LF/HF; Mann–Whitney U test for groups of examinees with different number of polygraph tests

	Biography discussion	Topic discussion	Truth about the name	Lie about the name	Truth about the year of birth	Lie about the year of birth
r	–0.493**	–0.720**	–0.689**	–0.452**	–0.707**	–0.608**
U	137	114	164	148	122	86

*Note: "**" indicates the significance at the p < 0.01 level.*

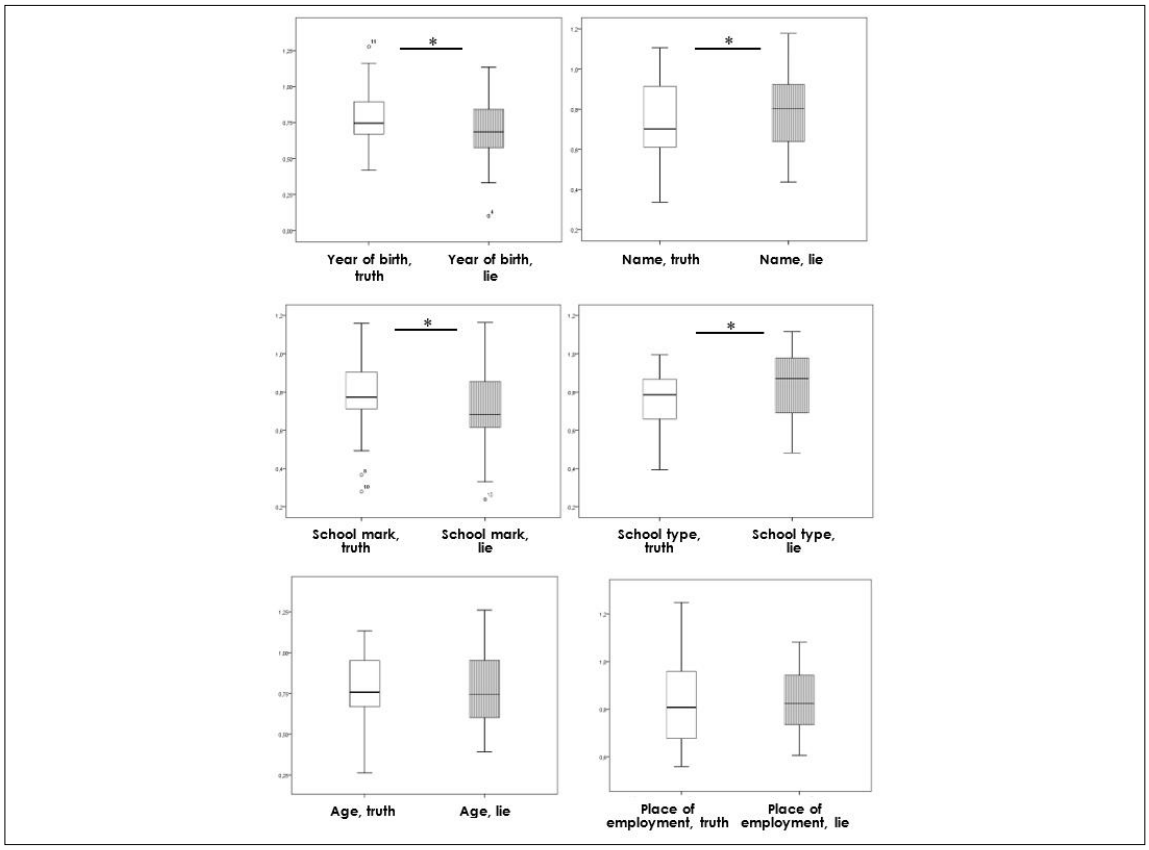

Figure 2. Entropy indices for true (no shading) and false (shaded) answers in tests for experiences acquired at early, relatively early, and late ontogenesis stages (upper, middle, and lower rows, respectively) and belonging to different experiences (numbers on the left, text on the right)

Statistically significant differences are marked with "".*

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Further, we compared the sample entropy indicators for true and false responses with a similar differentiation degree. In the process of lying with instructions to conceal the year of birth ($t = -1.935$; $p = 0.049$) and the school mark ($t = -3.236$; $p = 0.003$) the entropy decreases. On the other hand, the complexity of HR increases during the lies about the name ($t = 2.649$; $p = 0.012$) and school type ($t = 2.340$; $p = 0.030$). In tests with concealed age ($t = -0.207$; $p = 0.837$) and place of employment ($t = 0.164$; $p = 0.872$), that is, for the relatively recently acquired experience, there were no differences in the realization of lie- and truth-related behavior (Fig. 2).

Discussion

We analyzed HR entropy in examinees who underwent polygraph tests in stress. The negative inverse correlation was found between the entropy and the LF/HF indices for each stage. According to the HRV spectral indicators, when the stress level increases, the entropy decreases significantly, which is the temporary systemic dedifferentiation that characterizes stress (Alexandrov et al., 2017; Bakhchina & Alexandrov, 2017).

According to the results of the experiment, there were no differences in entropy for each of the testing stages in those who had different experience of passing polygraph testing. Furthermore, the dynamics of the actualization of subjective experience of examinees almost did not change throughout the study. It is known that any FS fundamental architecture includes a feedback loop designed to reorganize the behavior to obtain the most favorable programmed result (Anokhin, 1973). Participants who undergo polygraph tests are not often aware of the individual test results and changes in physiological parameters are not available for direct observation. In this case, there is no opportunity to correct (improve) individual behavior due to the reduced feedback on the behavior result achieved.

When analyzing data related to a relatively early experience (year of birth and name), differences were revealed in the entropy indices for true and false answers (separately). A similar dynamic was found for true answers related to relatively early experiences. Questions related to the years of birth and the school mark, as well as the name and the type of school, can be grouped according to the fact that they reflect behavior associated with school experience. In turn, qualitative and quantitative characteristics are associated with FS of different subdomains of experience. The implementation of true answers to information expressed in quantitative values (numbers) clearly involves a greater number of heterogeneous FS. At the same time, in the case of lying about autobiographical information acquired early, the opposite trend is observed. The behavior associated with the concealment of the year of birth includes fewer FSs and is simpler (related to fewer behaviors) compared to the concealment of names.

This can be seen in more detail in the material of HR entropy comparing the implementation of lying and truth-declaring behaviors related to the information associated with FS of the same degree of differentiation. HR becomes more complex in the situation of concealing autobiographical information expressed by the text. On the contrary, when concealing numerical information, its complexity decreases. Thus, in a lie situation during polygraph tests HR entropy does not change in one direction. The relativity of changes depends on the initial differentiation of the experience that will be concealed (Fig. 2). Obviously, the concealment behavior associated with numerical information is simpler because it involves the realization of all available components of the indicated experience. It was also shown earlier that lying about school marks is one of the first concealing behaviors that develop in a child (Khazova, Mosina, & Us, 2016). Moreover,

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this dynamic is observed only with the actualization of early and comparatively early behavior systems. This was not revealed for new behaviors (Fig. 2). In a number of experiments conducted within the system-evolutionary framework, it was discovered that, in a stressful situation, the new experience is partially deactivated. In this case, the mechanisms providing behavior shift towards relatively less differentiated and older systems (Alexandrov, 2016; Alexandrov et al., 2017).

In general psychological practice, 'lie' and 'truth' usually represent a dichotomy and are opposed to each other (see Znakov, 2019). However, the study shows that the 'lie' in the polygraph testing process apparently does not represent a single 'universal' FS domain, which is realized in any deception situation. Statistically significant differences were recorded depending on the type of concealed information.

The problem of the existence and interaction of the 'system of lie' and the 'system of truth' was previously raised in the literature (Isaichev & Isaichev, 2016). The authors postulate that in the information concealment process during polygraph testing, there is a conflict between two 'systems' – the automated behavior strategy or the need to modify behavior (if the situation is assessed as threatening). Therefore, two (usually opposed) activities should be mentioned as groups of behaviors aimed at achieving many different results in two different ways – concealment and truth-declaring. The achievement of behavior results of both groups is provided by a variety of FSs. Differences in these groups are found not only between lying and truth-declaring behaviors, but also for the behavior within each of these groups. Truth-declaring is a set of different behaviors recorded in memory. From the point of view of the subject, most of them may not be specifically classified as 'truthful'. Lying have many results which achievement is guaranteed by various methods of deception. As a rule, these behaviors are classified as distortion or information concealment by the subjects. Further research can be directed towards the experimental development of these descriptions, for example, by comparing the brain activity in situations of 'similar' lies that involve various goal achievements.

At the same time, information concealment behavior (which is associated with the formation of special systems to achieve specific new results) is not completely new, but is based on individual experience, as any behavior is the implementation of many systems of different ages (Shvyrkov, 2004; Alexandrov et al., 2017). Although being formed in the process of testing on a polygraph (and possibly in a number of situations before it), at the first encounter with a polygraph testing situation, the individual is very likely to have lying experience in a situation of social interaction (conversation).

In the process of passing polygraph tests, the formation of the FS does not seem to occur for the implementation of concealment behavior as such. It depends on the characteristics of that experience subdomain to which the behavior belongs (for which achievement the lie is used). This may also explain the presence of distinct changes in physiological parameters in testing in a situation of question significance due to any other reason besides concealing: for example, in the case of interviewing an innocent person not willing to reveal real criminals. Polygraph testing has its own motivational characteristics in contrast to indicator registration under other conditions. However, these findings are related to concealment behavior that occurs in different stress situations. For a more detailed consideration of the subject of the study, the data obtained under control (non-stress) conditions are required.

In addition to the general functional definition of testing using a polygraph as a procedure for registering a number of physiological parameters under controlled conditions (Ogloblin &

Molchanov, 2004), there are others, depending on the theoretical model on which its authors base on. In this case, testing is defined as a procedure for testing memory, attention, motives, etc. (Obukhov & Obukhova, 2011; Isaichev & Isaichev, 2016; Mailis & Kholodnyi, 2021). Therefore, it is possible to consider a polygraph examination as a procedure for testing individual experience, aimed at comparing the dynamics of this experience in two situations – truth or lie to achieve results. Moreover, during passing the test, both the urgent formation and implementation of the tested (specific for a given situation) relationship between the organism and the environment take place, as well as the diagnosis of such relationship experience in the past. And as indicated above, it is probably difficult to change the current relationship generated by the tests.

The data obtained in the experiment enabled confirmation of the hypotheses of the present study and the outline of the methods for subsequent studies. First, it is possible to record heart rate when performing similar behavior actions in a test situation, but without stress, for a more complete data analysis. It is also possible to analyze behavior when information related to other areas of experience is concealed, e.g., approach/withdrawal (see Kolbeneva & Alexandrov, 2016). Furthermore, similar experiments were carried out in the form of 'blind' experiments to increase the environmental validity of the method. In this case, the polygraph examiner does not know the concealed information in advance (Ogloblin & Molchanov, 2004), including the ability of the examiner to select the information to be concealed independently (see Kireev, 2017).

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A. V. Uchaev contributed to the design development, conducted the experiment, carried out statistical data processing, interpreted the findings, and prepared the draft of the manuscript. **Yu. I. Alexandrov** suggested the idea of the study, contributed to the design development, conducted the experiment, interpreted the findings, and prepared the manuscript for publication.

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Perceived Age and Attitudes Towards Individual External Appearance in Adults with Various Severity of the Big Five and Dark Triad Components

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Abstract

Introduction. This study represents the first attempt to examine the severity of the Big Five and Dark Triad components of a perceived person as factors of his/her perceived age and attitude towards his/her appearance. **Methods**. These were (a) the Procedure of Photo-video Presentation of Outward Appearance by T. A. Vorontsova (Shkurko, 2018); (b) the questionnaire for Individuals' Evaluative and Meaningful Interpretation of Their Own External Appearance and Its Compliance with Gender and Age Constructs by V. A. Labunskaya; (c) the Five-factor Personality Questionnaire by H. Tsuji modified by A. B. Khromov; and (d) the Short Dark Triad inventory modified by M. Egorova, M. Sitnikova, and O. Parshikova. The study sample comprised 103 participants (65 women, 38 men) aged 18 to 77 years (M = 34.14) as objects of perception; 36 participants (29 women, 7 men) aged 21 to 65 years (M = 39.11) were subjects of perception ('evaluators'). **Results**. Attitudes towards individual external appearance and 'years saved' (chronological age minus perceived age) have certain associations with the severity of the Big Five and Dark Triad components of the objects of perception, which are mediated by their belonging to the 'young' / 'mature' age subgroups. Age dynamics of attitudes towards individual external appearance was also discovered. The findings from this study suggest that there is a significant contribution of the severity of the Dark Triad components (narcissism, psychopathy) on a positive attitude towards external appearance at the age of maturity. **Discussion**. The research expands existing scientific ideas of psychological factors of perceived age and of complex relationships between attitudes towards individual external appearance and the severity of the Big Five and Dark Triad components in adults.

Keywords

age, age perception, perceived age, social perception, external appearance, attitude towards external appearance, years saved, aging, Big Five, Dark Triad

Highlights

▸ The parameters of individuals' attitudes towards their own external appearance are associated with the severity of the Big Five and Dark Triad components of the object of perception. These associations are mediated by their belonging to different age groups.

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▸ The value of the 'years saved' index is associated with the Big Five components, including trustfulness, artistry, and control (in the 'mature' subgroup); activity, emotionality, and playfulness (in the 'young' subgroup). This value is not related to negative personality traits.
▸ The findings suggest the presence of age-related dynamics to individuals' attitudes towards their own external appearance.
▸ Adults who scored highly on the scales of 'narcissism', 'psychopathy', 'control', and 'playfulness' demonstrated a positive attitude towards their own external appearance.

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Introduction

Currently, there is an increasing interest in the study of perceived age (PA) in medicine, genetics, gerontology, psychology, and other sciences. In psychological literature, the term 'perceived age' was first used in a 2015 publication (Shkurko & Nikolaeva, 2015). It was first interpreted as "the result of one individual's social perception by another" (p. 79). In subsequent studies, scholars (Shkurko & Labunskaya, 2018) specify that PA is "the age attributed to a person (object of perception) by another person (object of perception, evaluator) as a result of the perception of his/her external appearance" (p. 450).

Our analysis (Shkurko & Nikolaeva, 2015; Shkurko & Serikov, 2017; Shkurko & Labunskaya, 2018) of studies in international databases starting from the first publication in 1974 (Lawrence, 1974), when the term 'perceived age' (PA) first appeared, enabled us to distinguish two main factor groups for PA of a person: (a) the selection of factors related to the object of perception that influence the construction of their age in other people's opinion; (b) the selection of factors related to the subject of perception that influence the processes of constructing the age of the perceived person. The selection of factors related to both the object of perception and the subject of perception when constructing a person's age corresponds to the methodology of modern psychology of social cognition (Andreeva, 2000; Bodalev, 2015) and the communicative approach to the study of cognitive processes in communication (Barabanshchikov, 2009).

In the first PA factor group studies ('factors of the object of perception'), recent discoveries (Uotinen, Rantanen, & Suutama, 2005; Christensen et al., 2009) made a real breakthrough, which led to an important conclusion. Thus, PA of a person is a marker of aging and risk of premature death, and to a greater extent than his/her chronological age. Therefore, the result of social cognition of one person by another, and the PA in this study and many others, is nothing more than the result of social cognition ('evaluators' of subjects' age were ordinary people, non-experts), turns out to be associated with the most complex biopsychic and psychophysiological processes.

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Today, scientists consider the following PA factors: (a) genetic factors (Christensen et al., 2009); (b) social and environmental factors (Rexbye et al., 2006; Flament, Pierre, Delhommeau, & Adam, 2017); (c) medical and aesthetic factors (Zimm, Modabber, Fernandes, Karimi, & Adamson, 2013; Chang et al., 2016); and (d) psychological factors. Scholars examined the following psychological factors: (a) subjective age (Sergienko, 2013); (b) facial expression of the object of perception (Demidov, Diveev, & Kutenev, 2012); (c) the attitude of the object of perception to his/her own external appearance (Shkurko & Labunskaya, 2018); (d) the general well-being of a person and his/her faith in the future (Uotinen et al., 2005); and (e) affective experiences of the object of perception during lifetime (Adams, Garrido, Albohn, Hess, & Kleck, 2016).

The analysis of various components of the external appearance (EA) of a person as trigger mechanisms for the perception, evaluation, interpretation of their PA represents a separate research block within the framework of the investigation of the characteristics of the object of perception. The 'EA factor' represents a separate block due to its dominant position among other factors, huge research interest, and a considerable amount of empirical data in this field. In a number of our works (Shkurko & Nikolaeva, 2015; Shkurko & Serikov, 2017; Shkurko & Labunskaya, 2018; Vorontsova, 2020a; Vorontsova, 2020b), we analyzed the differentiated effect of EA components on PA of a person.

In the second PA factor group studies ('factors of the subject of perception'), the following characteristics of the subject of perception that influence the processes of constructing the age of a perceived person were investigated: (a) gender and age factors (Nkengne et al., 2008; Voelkle, Ebner, Lindenberger, & Riediger, 2012); (b) the experience of interaction between the subject of perception and the age group to which the object of perception belongs (Rhodes, 2009); (c) special training of the subject of perception in the accuracy of recognizing the age of other people (Sörqvist & Eriksson, 2007); and (d) characteristics of the attitude of the subject of perception to his/her own EA (Vorontsova, 2020a).

Why do we study PA together with the attitude of the object of perception towards his/her EA in this study? A number of the above studies show that individuals' attitudes towards their own EA represent the most important factor in PA. A person's attitude towards his/her own EA and EA of another person in the context of a multifactorial approach to the study of attitudes towards EA in social psychology, developed by V. A. Labunskaya and her colleagues (Labunskaya et al., 2019), is interpreted as "an integral socio-psychological phenomenon, a significant, emotionally rich component of the value-meaning sphere" (p. 65), which regulates individuals' experiences, their relationships with others, affects satisfaction with themselves and their lives. Within the framework of the social psychology of EA, a "multifactorial model for studying attitudes towards EA" has been developed (p. 82). In the context of this model, the PA of the object of perception can serve as an indirect indicator for the assessment of an individual's EA by others, since it is a kind of resultant of the impression that a person makes, his/her EA in the process of social perception.

In our study, we examined the severity of the Big Five and Dark Triad components of the object of perception as psychological factors of PA and attitudes towards EA. The choice of these factors is due to their high prognostic value, the considerable interest of world scientists, and the lack of sufficient research into the Big Five and the Dark Triad components in relation to PA and attitudes towards EA. In the most general sense, we were interested in what affects individuals' PA to a greater extent (whether they look younger or older than their age) and their attitudes

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to their own EA – the severity of positive or negative traits of their personality. Without focusing on analyzing the characteristics themselves, which is presented in sufficient detail in a number of works (Sitnikova, 2020; Khromov, 2000), let us consider works that examine their correlations with PA and attitudes towards EA.

We have not found any studies establishing PA associations with the Big Five and Dark Triad components. As modern studies have shown, among the Big Five traits, the factors of extraversion and neuroticism have the largest number of associations with EA and attitudes towards EA. A study by Pfund, Harriger, & Hill (2021) on video chat use during the pandemic found that higher extraversion was associated with more frequent use of video chats both before and after the pandemic, with neuroticism predicting more frequent comparison of participants' appearance. Von Soest, Kvalem, Skolleborg, & Roald (2009) works showed that cosmetic surgery patients have higher rates of extraversion than women in a representative sample not resorting to surgery; at the same time, 6 months after the operation, the scores of extraversion even increased. Benford & Swami (2014) examined the correlation between the Big Five factors and male body image. They found that neuroticism predicted men's desire for muscularity; neuroticism combined with extraversion predicted male body evaluation. Leikas, Verkasalo, & Lönnqvist (2013) conducted an interesting study showing that extraversion can be successfully modeled by study participants by means of their EA. Unlike the other Big Five factors, extraversion may also be successfully perceived by others from their photographs.

Analysis of works on the components of the Dark Triad shows that most researchers associate EA characteristics with attitudes towards EA and narcissism (Dmitrieva, 2010). A study by Boursier & Gioia (2020) showed an association between pathological female narcissism and appearance anxiety. A study by Vazire, Naumann, Rentfrow, & Gosling (2008) showed that EA reflects the personality of narcissists, their preoccupation with the beauty of EA and desire to be in the spotlight; it is a means of promoting their status. Giacomin & Rule (2019) show the contribution of various facial features, especially brows, to the identification of the narcissism of the object of perception. In a study on the identification of the Dark Triad components in facial perception Shiramizu, Kozma, DeBruine & Jones (2019) showed that the perceiving subject statistically reliably identifies male and female narcissism and male psychopathy and is not able to identify high Machiavellianism, regardless of the gender of the object of perception. A study by Semenyna, Vasey, & Honey (2019) showed that all components of the Dark Triad are associated with women's sexual competitiveness, which includes the desire to improve their appearance. The authors point out that the "dark side" of female personality stimulates greater competition in the marriage market" (p. 77). Holtzman & Strube (2013) demonstrated that individuals with high levels of certain dark personality traits, such as narcissism and psychopathy, can be physically attractive. The authors wondered what exactly makes them attractive. In the study, they compared attractiveness based on physical EA (the authors called it "unadorned attractiveness") and social EA (so-called "effective decoration" using EA design – clothes, accessories, etc.). Based on the fact that "dark" personalities actively create positive first impressions, the authors discovered that the combination of Dark Triad components – Machiavellianism, narcissism, and psychopathy – correlates with "effective decoration". Therefore, the scholars concluded that individuals with strong Dark Triad components "construct their appearances that act as social lures, possibly contributing to their cunning social strategies" (p. 461). When analyzing studies on the influence of personality factors on attitudes towards EA, V. A. Labunskaya (2019) noted

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a study by Lipowska & Lipowski which shows that "the influence of an individual's narcissistic tendencies on satisfaction with his/her own EA may vary depending on the physical organization of the subject of the assessment" (Labunskaya et al., 2019, p. 82). Regarding psychopathy, several studies (Kreidun, 1990) emphasize the role of EA defects in the formation of various psychopathy and deviant behavior.

Several studies demonstrate interrelations between the features of self-presentation in social networks and the severity of the Dark Triad components. A study by Podbutskaya, Knysh, & Bogdan (2019) showed that individuals using professional photos for self-presentation in social media (unlike those who use amateur photos) are characterized by a high level of all components of the Dark Triad – narcissism, Machiavellianism, psychopathy. McCain et al. (2016) report an association of narcissism with the amount and motivation for using selfies on social media. N. V. Vodyanova (2009) emphasized that the tendency to narcissism is a common characteristic of modern individuals in the modern era, where they "appear to be passive consumers, prone to narcissism; they are market personalities looking, among other things, to sell themselves profitably, 'men of Proteus' ready for endless transformations" (p. 10). As shown in the works of V. A. Labunskaya and other scholars (Labunskaya, 2021; Vorontsova & Labunskaya, 2020; Pogontseva & Labunskaya, 2019), EA is a kind of individuals' 'investment' in their well-being. Scientists emphasized that in modern times, the EA has 'investment power', which is the key to a successful career, marriage, etc.

Thus, we can conclude that the components of the Big Five and Dark Triad were not considered as a personality factor of PA and individuals' attitudes towards their own EA in the Russian sample, which enabled us to formulate the objectives and hypotheses of this study.

This study aims to investigate the characteristics of PA and individuals' attitudes towards their own EA in a sample of adults with different severity of the components of the Big Five and Dark Triad.

Subject of the study: PA; parameters of individuals' attitudes towards their own EA (evaluation of EA components, satisfaction, integral assessment); the severity of the Big Five and Dark Triad components among the objects of perception.

Study hypotheses:

1. The severity of the parameters of individuals' attitudes towards their own EA and the difference between chronological age and PA may be associated with the severity of the components of the Big Five and Dark Triad among the objects of perception.

2. The relationship between the parameters of individuals' attitudes towards their own EA, the difference between chronological age and PA, the severity of the Big Five and Dark Triad components among the objects of perception may be mediated by their belonging to the 'young'/'mature' age groups.

3. The difference between chronological age and PA as well as the severity of the components of attitudes towards EA in individuals belonging to the 'young'/'mature' age groups may vary.

Methods

1. The procedure of Photo-video Presentation of EA by T. A. Vorontsova (Shkurko, 2018) was used as an instrument for studying a person's PA. The participants of the study (objects of perception, n = 103) were photographed in full height and waist-length (portrait photo). Then photographs were randomly included in the album (first, a portrait photo of a respondent, then

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his/her own full-height photo, 2 photos per spread). Then, we offered the album to 'evaluators' (subjects of perception, n = 36) to assess the age of the objects of perception. We obtained 36 age estimates for each object of perception (a total of 3708 estimates). The average age estimate obtained by each perception object based on 36 observations was considered by us as the PA of the participants in the study. Next, we calculated the difference between the chronological age (CA) and PA of the objects of perception – the CA–PA index, which is called 'years saved' (Zimm et al., 2013). The higher the level, the larger the difference between CA and PA is, the younger the person is perceived by others.

2. The questionnaire for Individuals' Evaluative and Meaningful Interpretation of Their Own EA and Its Compliance with Gender and Age Constructs by V. A. Labunskaya (2009) was used to study the cognitive and emotional components of the respondents' attitudes towards their own EA. This instrument provides information on the assessment of both individual elements of EA (face, physique, design of EA, expressive behavior), and integral assessments – attractiveness, sexuality, compliance of EA with gender and age constructs, and also contains the parameters of 'EA satisfaction' and 'integral assessment of EA'. The questionnaire contains the following 14 factors: FA – assessment of individual face; BA – assessment of individual physique; EADA – assessment of individual EA design; EBA – expressive behavior assessment; DAREA – degree of acceptance of individual reflected EA; ACA – assessment of correspondence between EA and age; GCA – assessment of correspondence between EA and gender; GRCA – assessment of correspondence between EA and gender roles; PRCA – assessment of correspondence between EA and professional roles; AAAEA – assessment of age attractiveness of EA; AEA – attractiveness of EA for an opposite-sex partner; SA – assessment of the sexuality of individual EA; SEA – satisfaction with individual EA; IAEA – integral assessment of EA.

3. The Five-factor Personality Questionnaire by H. Tsuji modified by A. B. Khromov (2000) was used to diagnose basic personality traits using five dichotomous scales – (a) extraversion vs. introversion (E-I); (b) attachment vs. independence (A-I); (c) control vs. naturalness (C-N); (d) emotionality vs. restraint (E-R); (e) playfulness vs. practicality (P-P). Each scale includes 5 primary scales.

4. The Short Dark Triad inventory modified by M. Egorova, M. Sitnikova, and O. Parshikova (Egorova, Sitnikova, & Parshikova, 2015) was used to diagnose the severity of Machiavellianism, narcissism, and psychopathy.

Empirical object of the study

The study involved 139 subjects, of whom 103 individual participants (65 women, 38 men) aged 18 to 77 years (M = 34.14) were the objects of perception and 36 individual participants (29 women, 7 men) aged 21 to 65 years (M = 39.11) were the subjects ('evaluators') of perception. To test the hypotheses, the sample of research objects was divided into 2 subgroups by age – the first subgroup included respondents aged 19 to 34 (n = 58, 34 females and 24 males); the second subgroup included respondents aged 35 to 77 (n = 45, 31 females and 14 males). When dividing the sample into age stages, we used D. B. Elkonin's periodization (Elkonin, 1971). As a result, we called the first subgroup "young" (it included respondents whose age corresponded to the age period of 'youth') and the second one – 'mature' (it included respondents whose age corresponded to the 'mature' and 'old age' periods).

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Results

Correlations among the parameters of the study participants' attitudes towards their own EA, the CA-PA index, and the severity of the Big Five and Dark Triad components

To prove the first hypothesis, we carried out Spearman's correlation analysis. Tables 1–3 present the results.

Table 1
Significant correlation coefficients of the CA-PA index and the severity of the Big Five components among the objects of perception (Spearman's correlation coefficient / significance level)

Components of the Big Five (upper-case letters indicate the underlying factors, lower-case letters indicate the primary scales)	Spearman's correlation coefficient	Coefficient significance level
"Young" subsample (respondents aged 19–34 years)		
Activeness – passiveness	0.287	0.029
EMOTIONALITY – RESTRAINT	0.474	0.000
Anxiety – carelessness	0.416	0.001
Tension – relaxation	0.405	0.002
Depressiveness – emotional comfort	0.449	0.000
Emotional lability – stability	0.563	0.000
PLAYFULNESS – PRACTICALITY	0.349	0.007
Dreaminess – realism	0.368	0.004
Plasticity – rigidity	0.399	0.002
"Mature" subsample (respondents aged 35–77 years)		
Credulity – suspiciousness	0.292	0.051
CONTROL – NATURALNESS	0.283	0.059
Artistry – non-artistry	0.302	0.044

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The correlation analysis of the relationship between the parameters of attitudes towards EA and the severity of the Big Five components showed numerous associations among both primary and basic factors. Therefore, we should, in this case, limit ourselves to analyzing basic factors (Table 2).

Table 2
Significant correlations between the parameters of the attitudes towards EA and the severity of the Big Five components among the objects of perception (Spearman's correlation coefficient / significance level)

Components	E-I	A-I	C-N	E-R	P-P
"Young" subsample (respondents aged 19–34 years)					
FA				–0.513/0.000	
BA	0.273/0.038			–0.428/0.001	
EADA				–0.373/0.004	
EBA				–0.388/0.003	
DAREA				–0.289/0.028	
GCA				–0.406/0.002	
GRCA				–0.376/0.004	
PRCA	0.316/0.016		0.345/0.008	–0.452/0.000	
AAAEA				–0.473/0.000	
AEA	0.285/0.030			–0.317/0.015	
SA	0.326/0.013			–0.456/0.000	
SEA	0.307/0.013			–0.556/0.000	
IAEA	0.325/0.013			–0.494/0.000	
Number of correlations	**6**	**0**	**1**	**13**	**0**
"Mature" subsample (respondents aged 35–77 years)					
FA	0.422/0.004		0.415/0.005		0.579/0.000
BA			0.520/0.005		
EADA			0.337/0.024		0.343/0.021

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Table 2
Significant correlations between the parameters of the attitudes towards EA and the severity of the Big Five components among the objects of perception (Spearman's correlation coefficient / significance level)

Components	E-I	A-I	C-N	E-R	P-P
EBA	0.319/0.033		0.330/0.027		0.507/0.000
GCA	0.318/0.033	0.432/0.003	0.370/0.012		0.606/0.000
GRCA					0.328/0.028
PRCA					0.363/0.014
AAAEA				–0.370/0.012	
AEA	0.397/0.007		0.374/0.011		0.377/0.011
SA	0.374/0.011	0.286/0.057	0.408/0.005		0.406/0.006
SEA			0.323/0.030	–0.322/0.031	
IAEA			0.406/0.006		0.467/0.001
Number of correlations	**5**	**2**	**9**	**2**	**9**

Table 3 shows significant correlations between the parameters of attitudes towards EA and the Dark Triad components. No significant correlations were found between the Dark Triad components and the CA-PA index.

Table 3
Significant correlations between the parameters of attitudes towards EA and the severity of the Dark Triad components among the objects of perception (Spearman's correlation coefficient / significance level)

Parameter of attitude towards EA / the Dark Triad component	Machiavellianism scale	Narcissism scale	Psychopathy scale
"Young" subsample (respondents aged 19–34 years)			
FA	0.262/0.047		
EADA	0.268/0.042		
GRCA		0.240/0.037	
PRCA			0.261/0.048

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"Mature" subsample (respondents aged 35–77 years)		
FA	0.419/0.004	0.286/0.057
BA		0.303/0.057
EADA		0.304/0.042
EBA	0.330/0.027	0.324/0.030
GCA	0.364/0.014	
AEA		0.322/0.031
SA	0.310/0.038	0.354/0.017
IAEA	0.314/0.036	0.364/0.014

Analysis of data presented in tables 1-3 enabled us to draw several conclusions.

In the "young" subsample (respondents aged 19–34 years):

1. The CA-PA index is associated with (a) the primary factor "activeness – passiveness". More active respondents are perceived to be younger than their age; passive ones are perceived to be older. The CA-PA index is also associated with (b) the generalized factor "emotionality – restraint" and with the primary factors "anxiety – carelessness", "tension – relaxation", "depression – emotional comfort", "emotional lability – stability". Respondents under 34 years old who look younger than their age, have increased emotionality, are anxious, tense, depressive, and emotionally labile. As noted by the developers of the questionnaire, these individuals are not able to control emotions and impulsive drives. Moreover, the CA-PA index has associations with (c) the generalized factor "playfulness – practicality" and with the primary factors "dreaminess – realism" and "plasticity – rigidity". Individuals with high scores on these scales have a high CA-PA score, that is, they are perceived to be younger. On the contrary, young respondents who look older than their age had high scores of such Big Five components as "passiveness", "restraint" (carelessness, relaxation, emotional comfort, stability), and "practicality" (realism, rigidity).

2. We found numerous correlations between the parameters of attitudes towards EA and the severity of the Big Five components, including the factor "extraversion – introversion" (6 correlations) and the factor "emotionality – restraint" (13 correlations). An increase in emotionality, the inability to control emotions, set a low level of almost all parameters of attitudes towards the EA – from face assessment to satisfaction and integral assessment of EA. On the contrary, extraversion sets a high level of self-assessment of EA elements (e.g., physical assessment) and its integral characteristics – assessment of conformity with a professional role, attractiveness, assessment of sexuality, satisfaction with EA, and an integral assessment of EA as a whole.

3. Three components of the Dark Triad are associated with the parameters of attitudes towards EA. Machiavellianism is related to face assessment and EA design assessment. Narcissism is associated with evaluating the conformity of EA with gender roles. Psychopathy is associated with evaluating the conformity of EA with professional roles.

In the "mature" subgroup (respondents aged 35–77 years):

1. Compared to the "young" subsample, the CA-PA index is less related to the severity of the

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Big Five components. We observed correlations with the primary factor "trustfulness – suspiciousness" (more trustful respondents are perceived to be younger than their age), the generalized factor "control – naturalness" (individuals with a high degree of voluntary regulation are perceived as younger than their age), and with the primary factor "artistry – non-artistry" (more artistic respondents are perceived to be younger than their age).

2. Respondents aged 35–77 years have the parameters of attitudes towards their EA set by completely different personal factors than those in the "young" subsample – namely, the factors of "control – naturalness" and "playfulness – practicality". A high degree of voluntary regulation of behavior ("control – naturalness" factor) sets a high level of almost all parameters of attitudes towards EA – assessment of face, physique, EA design, expressive behavior, EA conformity with gender, EA attractiveness, assessment of sexuality, EA satisfaction, and integral assessment of EA. A similar picture is provided with the relationship of the "playfulness – practicality" factor. The high score of this factor is associated with a high level of self-assessment of the EA elements (e.g., assessment of face, design of the EA, expressive behavior) and its integral characteristics – assessment of conformity with gender and professional roles, attractiveness, assessment of sexuality, integral assessment of EA as a whole.

3. We found general tendencies typical for the "young" / "mature" subgroups. Thus, the "extraversion – introversion" factor is associated with EA attractiveness and the assessment of sexuality. The "emotionality – restraint" factor is inversely proportional to satisfaction with EA and the assessment of EA age attractiveness.

4. In contrast to the "young" subgroup, the "mature" subgroup showed more strong associations between attitudes towards EA and the severity of such components of the Dark Triad as narcissism and psychopathy. Narcissism was associated with the assessment of face, expressive behavior, EA conformity to gender, assessment of sexuality, and the integral EA assessment. Psychopathy was also associated with the assessment of face, physique, EA design, expressive behavior, EA attractiveness, assessment of sexuality, and the integral EA assessment.

Comparative analysis of CA-PA ("years saved") and the components of attitudes towards EA among "young" and "mature" study participants

A comparative analysis of the above parameters was conducted using the Mann–Whitney test. The results are shown in Table 4.

Table 4

Comparative analysis of CA-PA and the severity of the components of attitudes towards EA among "young" (19–34 years old) and "mature" (35–77 years old) respondents, the Mann–Whitney test

Comparative analysis parameters	Average rank of group 1	Average rank of group 2	Z	Significance level
CA-PA	39.08	68.66	–4.997	0.000
FA	59.84	41.90	–3.024	0.002
BA	62.66	38.26	–4.114	0.000

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Table 4
Comparative analysis of CA-PA and the severity of the components of attitudes towards EA among "young" (19–34 years old) and "mature" (35–77 years old) respondents, the Mann–Whitney test

Comparative analysis parameters	Average rank of group 1	Average rank of group 2	Z	Significance level
EADA	60.62	40.89	–3.327	0.001
EBA	57.33	45.13	–2.057	0.040
DAREA	61.06	40.32	–3.497	0.000
ACA	59.03	42.94	–2.722	0.006
GCA	61.25	40.08	–3.573	0.000
GRCA	54.03	49.39	–0.784	0.433
PRCA	56.83	45.78	–1.894	0.058
AAAEA	61.01	40.39	–3.487	0.000
AEA	59.83	41.91	–3.026	0.002
SA	60.00	41.69	–3.090	0.002
SEA	61.07	40.31	–3.551	0.000
IAEA	62.10	38.98	–3.897	0.000

We can conclude that almost all components of attitudes towards EA (except for EA compliance with gender roles) have age-related dynamics. This dynamics is negative. Therefore, assessments of both EA components and integral EA assessments significantly decrease with age.

Discussion

Comparing data from different age samples, we can conclude that the first and second hypotheses are confirmed. The severity of the parameters of individuals' attitudes towards their own EA and the difference between CA and PA are associated with the severity of components of the Big Five and Dark Triad among the objects of perception. Furthermore, these relationships are mediated by the study participants' belonging to the "young" / "mature" age groups. However, we found no associations between the CA-PA index and the parameters of the Dark Triad. That is, our assumption that negative personality characteristics may be associated with the "years saved" index was not confirmed. On the contrary, it turned out that the number of "years saved" is not associated with negative personality characteristics, but with the severity of positive personality traits – trustfulness, artistry, and control (in the "mature" subgroup); activeness, emotionality, and playfulness (in the "young" subgroup). The data obtained are consistent

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with studies of the influence of positive emotional experiences throughout life and faith in the future on PA (Uotinen et al., 2005; Adams et al., 2016).

Throughout our study, we found a general pattern – a decrease in the positivity of attitudes towards EA with age. At the same time, at the age of 35–77 years, high parameters of attitudes towards EA are demonstrated by those individuals who have high levels of severity of such Big Five components as "control" and "playfulness" and such Dark Triad components as "narcissism" and "psychopathy". These data are consistent with the data from other studies on the relationship between individuals' narcissism and attitudes towards their own EA. We have proven that this relationship plays an important role in maintaining a positive attitude towards the individual appearance of adults and the elderly. Interestingly, the "young" subgroup shows almost no correlations between the Dark Triad components and the parameters of attitudes towards EA, except for the Machiavellian scale. Consequently, participants in the "young" subgroup, with high Machiavellianism rates, assess their face and EA design as positively as possible. We can assume that respondents with high Machiavellianism understand the functional value of EA, its investment importance, and consciously (or unconsciously) fix this in a positive assessment of their face as a key component of EA.

The CA-PA index was significantly higher in the "mature" subgroup. This means that the "mature" subgroup shows more pronounced "years saved", compared to the "young" subgroup. The older the person, the more his/her PA can differ from the chronological one. In the subgroup of young people, respondents who are percieved as older than their age are more interesting from a practical point of view. The data obtained in this study allow us to identify the personality variables that determine the process of age constraction at different stages of individual development.

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Socially Important Personal Qualities of Students with Different Sibling Positions

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Abstract

Introduction. This paper brings new insights into the study of the sibling position of students to examine their socially important personal qualities in connection with this factor and to understand what short- and long-term individual and social consequences this may entail. This paper presents the results of a study of socially important personal qualities of students with different sibling positions, including empathy, personality orientation, altruism, life position, and the degree of adequacy of the view of life. According to these parameters, we carried out a comparative analysis of the data gathered from students – the only, the eldest, and the youngest children in the family. **Methods**. A sample of 150 students was randomly drawn and divided into three groups – the only children in the family, the eldest siblings, and the youngest siblings. The study used the following psychological assessment tools: (a) the questionnaire for Diagnosis of the Level of Polycommunicative Empathy Level by I. M. Yusupov, (b) the Bass Orientation Inventory, (c) Altruistic Orientation test, and (d) the Hardiness graphic technique, which assesses life positions and the degree of adequacy of views of life. **Results**. The findings of the study indicated that socially important personal qualities are more characteristic of students who are the only children in the family. There are more similarities than differences between first-born students who are the eldest and the only children in their families. However, students who are the only children in their families have more differences than similarities with those who are the youngest ones. In the group of students who are the youngest children in their families, the scores are lower compared to those in the other two student groups (except for altruism). **Discussion**. The data obtained in three student groups are interpreted and addressed to specialists in family counseling, psychotherapists, social service psychologists, curators of student groups, and inquisitive parents. The information about advantages and vulnerabilities of students' sibling position can form a scientific basis for creating programs for the development of their socially important qualities in the educational process of the university.

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SOCIAL PSYCHOLOGY

Keywords
sibling problem, students, sibling position, personal characteristics, empathy, type of orientation, altruism, life position, view of life, comparative analysis

Highlights
▸ Students who are the only children in their families are characterized by empathy, orientation toward 'business', activity, and adequacy in their views of life; altruism is characteristic of them to a greater extent than of those who are the eldest siblings, but to a lesser extent than of those who are the youngest siblings.
▸ Students who are the eldest siblings are more focused on themselves, less altruistic and less adequate in their views of life; they are more empathic toward the elderly and fictional characters.
▸ Students who are the youngest siblings are aimed at relationships to the detriment of themselves; they are characterized by a high level of altruism but a low overall level of polycommunicative empathy and less activity.

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Introduction
The issues considered in this article enter the subject area of the *sibling problem* posed by scientists at the end of the 19th century (Baskaeva, 2021; Zyryanova, 2008; Lapteva, Valueva, & Shepeleva, 2019). From the very beginning, its essence was the assumption of the importance of relationships between siblings for their individual personal development, socialization, and social adaptation. Gradually, researchers moved from studying the factors that determine the quality of relationships between children born and raised in the same family (considering birth order, number of children, gender, age difference) and the influence that siblings have on each other's development, to the study of personal characteristics of children depending on their sibling position, and then on the contributions that they make to society as socialization expands.

In the gradual process of developing a sibling problem, we can note the following most noticeable points: 1) an emphasis on finding a connection between the birth order of children and their achievements (at the beginning of the 20th century, E. Hawilock showed a connection between the order of birth of children and their success in life) (Matveeva, 2001); 2) the analysis of sibling relationships as a central phenomenon of family life and a key social condition for personality development, presented in the studies of A. Adler (Adler, 1997); 3) the study of the influence of the individual environment and the formation of the scientific direction of 'behavior genetics'. The idea of the individual environment became the theoretical basis for rethinking the mechanism of socialization: not the family but the child himself/herself with his/her own unique developmental environment became the unit of socialization (until the second half of the 20th century); 4) the search for approaches to the detection of specific factors of the individual environment (from the second half of the 20th century to its end). By the end of the 20th century, the need to develop a more adequate theory to explain the differences between siblings and the correct methodology

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for their study was identified (Baskaeva, 2021). At the beginning of the 21st century, in the abstract to the review entitled Early Sibling Studies N. M. Zyryanova noted: "The birth order effect turned out to be more complex than most researchers thought in 1920–1965. Elucidation of the role of the birth order effect in personal development is a topic for future research" (Zyryanova, 2008, p. 1); 5) modern studies of sibling relationships (21st century).

Currently, there is a greater search for answers to the following questions: how do parents establish and/or maintain relationships with their children depending on the order of their birth? How do children with a particular sibling position form relationships with peers under different social conditions? How do relationships develop between siblings throughout life? How is sibling position related to a person's social status outside the family? Researchers agree that sibling relationships that have developed within the family, continuing into adulthood, determine the quality of relationships in the society where children are included as they grow older and expand socialization (Russ & Vladimirova, 2012; Yakimova, 2013; Alibegashvili, 2019; Lapteva et al., 2019; Baskaeva, 2021).

In the 21st century, Russian psychologists touched upon such aspects of sibling issues as: a) the influence of birth order on cognitive development, intelligence and other personal characteristics of children (Alekseeva, 2008; Varaksina, 2015; Lapteva et al., 2019). Analysis of statistical data on 224 Nobel laureates of the 20th century showed that 46.9 % of them were first-borns, 18.8 % – second-borns, 17.9 % – third-borns; b) the ability for leadership, management behavior, and creative self-realization of young people with different sibling positions in the family (Sai, 2009; Gurova & Surkova, 2012), etc. The findings of scientists indicate a certain superiority of first-borns – the only and oldest children in the family. Perhaps, for this reason, first-borns attracted more attention from Russian researchers. At the end of the last century, T. K. Karatsuba completed her dissertation work on the characteristics of the life and professional development of the only children in the family (Karatsuba, 1998), and a decade later, M. V. Sai published the results of a gender analysis of the personal leadership potential of children with and without siblings (Sai, 2009). There is an evidence indicating the features of the psychology and social adaptation of the only children in the family and their family parenting (Balandina & Silina, 2010; Varaksina, 2015; Kovalenko, Sarkisyan, & Gundar', 2015; Gitman & Podol'naya, 2016), substantiating the connection between birth order and behavior of the individual in conflict (Groshev & Utenysheva, 2015).

Foreign scientists also continue research in this area and sometimes refute earlier conclusions, for example, about the relationship between birth order and intelligence (Kristensen & Bjerkedal, 2007). The American Reference Module for Neuroscience and Biobehavioral Psychology has an article on Birth Order by psychologist F. J. Sulloway (Sulloway, 2017). American psychologists A. Bleske-Rechek and J. A. Kelley studied the influence of birth order on the personality of first-born, older, middle, and younger children in a family (Bleske-Rechek & Kelley, 2014). English psychologists have studied the association of birth order with the ability to cooperate in preschool children (Prime, Plamondon, & Jenkins, 2017). Swedish researchers analyzed the relationship between the sibling position and the field of specialization that children chose in college (Barclay, Hällsten, & Myrskylä, 2017). Other Swedish scientists found that male older children in the parental family are "more emotionally stable, persistent, sociable, ready to take responsibility, and able to take initiative" than those born younger and asked the question whether older children born to lead? (Black, Grönqvist, & Öckert, 2018). An article by R. Kuba, J. Flegr, and J. Havlíček, published in the Dutch journal entitled Intelligence, shows the influence of birth order on the probability of

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entering university (Kuba, Flegr, & Havlíček, 2018). In the publication of the German researcher J. Grabmeier, the influence of the sibling position on divorce was noted. Thus, as the number of siblings increases, the probability of divorce in adulthood decreases (Grabmeier, 2013). In 2021, a Russian-language translation of the book by the Australian teacher M. Grose (Why First-borns Rule the World and Later-borns Want to Change It) was published. In it, the author summarized numerous studies and existing theories and also put forward assumptions awaiting verification by scientific methods and life. In particular, he argues that about 50 % of people around us – active first-borns – are the only or eldest children in the family, and an exponential increase in the number of first-borns among the total number of children entails great consequences for any society (Grose, 2021).

In the current situation of social development, the *relevance* of the sibling problem remains, on the one hand, due to the continuation of the scientific study of sibling relationships in order to methodically equip the family psychological and pedagogical aspects (correction of interpersonal relations between children in the family, helping parents in creating conditions for the formation of a sense of acceptance and expression support in the children's subsystem of the family, etc.), and on the other hand, the urgent need to study it outside the family context. The relevance of studying human psychology depending on the birth order (sibling position) in a wider society is argued by the fact that it is important from a practical point of view, for example, for the scientific explanation and levelling of some conflictogens in interpersonal communication and interaction in friendly and loving relationships, in professional and labour sphere, and to predict possible solutions that certain politicians will offer, leaders and managers at various levels of social management will take. In other words, it is important to know not only what children with different sibling positions become in life. It is also about knowing what socially important personal qualities they have at every stage of growing up and, consequently, what social and psychological consequences for society we can predict right now.

In our opinion, we should look for an answer to this question among students – students are already adults who have made their first serious choice (profession) but are still very susceptible to educational influence, especially in accordance with their ontological reality and if there is an opportunity to change something. So far, they rarely fall into the sample groups of empirical researches of psychologists, linking the personal qualities of adults with the order of their birth. In this regard, the publication by A. A. Moiseeva "The Relationship between Family Structure and Birth Order and the Altruistic Orientation of the Personality" is especially valuable for us (Moiseeva, 2016). And if empathy among students is quite studied (Nikishov & Osipova, 2015; Dmitrieva & Khamzina, 2020; etc.), then publications about the features of their personal orientation (Nikandrova, 2015; Pavlenko, 2019), as well as their life position (Gurova & Surkova, 2012; Filippova, 2015; Ivchenkov & Malinskii, 2018) are single. The degree of adequacy of views of life has not been studied among students. These aspects of the sibling problem still remain little studied in the radically changed conditions of Russian reality. However, the parameters of student youth as the only, older, and younger children in the family considered here (empathy, altruism, personality orientation, life position, degree of adequacy in the view of life) are important for understanding the society in which we live, predicting the nature of social interaction and the vector of its development.

The scientific novelty of this research lies in determining the personal characteristics of students with different sibling positions – the only, older, and younger children in the family and

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establishing differences between them in such socially important personality characteristics as empathy, type of personal orientation, altruism, life positions, adequacy of perception life, which have a noticeable impact on the socio-psychological atmosphere in any society. The obtained data contribute to the development of sibling research in social psychology.

Determining the level of development of socially important personal characteristics of students with different sibling positions was *the aim* of the research. We solved the following objectives to achieve it: 1) identifying among students (the only, older, and younger children in the family) the general level of polycommunicative empathy and its particular indicators – indicators of empathy toward children, parents, elderly, strangers and unfamiliar persons, animals, and fictional characters; type of personality orientation and level of altruism; life positions and the degree of adequacy of their views of life; 2) performing a comparative analysis of indicators for of the same measured personality parameters and to check the reliability of intergroup differences; and 3) providing generalized socio-psychological characteristics of the three student groups.

The study tested *the hypothesis* that there were significant differences among the three surveyed student groups, identified, depending on the sibling position of the subjects, in such socially important personality traits as empathy, type of orientation, altruism, life position, and adequacy of view of life. We assumed that in the group of the eldest siblings, the studied personality parameters would have the highest rates and such students would be more socially oriented.

Methods

The sample comprised 150 senior students aged 19–23 years (median: 20.5 years) from several Moscow universities (mainly, MSUPE, RSSU, and MSRU). The empirical study was conducted in Moscow between March and June 2021 under the guidance of Professor N. A. Tsvetkova as a part of a practical course "Processing data from socio-psychological studies" at the Faculty of Extreme Psychology, Moscow State University of Psychology and Education. Women made up 62.67 % of the sample, and men – 37.33 %. The sample was formed randomly using a Google table. A distinctive feature of the sample (the predominance of female students) is explained by the predominance of girls in those study groups where the empirical material was collected. The total student sample was divided into three groups: I – the only children in the family (n = 58); II – the eldest children in the family (n = 36); and III – the youngest children in the family (n = 56). We should note that the first and second groups of students were first-borns (n = 94).

The following socio-psychological diagnostic tools were used: (a) the questionnaire for Diagnosis of the Level of Polycommunicative Empathy Level by I. M. Yusupov to assess empathy toward children, parents, elderly, strangers and unfamiliar persons, animals, and fictional characters; (b) the Bass Orientation Inventory (Self, Relationship, Business); (c) Altruistic Orientation test (Fetiskin, Kozlov, & Manuilov, 2002); and (d) the Hardiness graphic technique (Koroleva, 2005), which assessed life positions of students at the moment of our survey, including 'victim', 'contemplator', 'activist', as well as the degree of adequacy of their views of life. The students were offered to draw a spider and two flies: one of the flies should remain outside the net, and the other should get stuck in it. When analyzing the drawings, we determined the following: the character depicted first (the position of the author) and the distances among the three characters (the degree of adequacy of the view of life was determined based on the R. Likert scale in the range from 1 to 10 points, depending on how the location of the spider and flies resembled an equilateral triangle; a high and extra high degree of adequacy of view of life was counted from 6 points).

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Mathematical and statistical data processing was carried out using the MS Office Excel package, IBM SPSS Statistics 23. The significance of differences in the indicators of three student sample groups was determined by the Kruskal–Wallace H-test and Mann–Whitney U-test in pairs. The choice of criteria is due to the distribution of the studied indicators and the types of scales of psychodiagnostics tools.

Results

Results of diagnostics of polycommunicative empathy

The results of the analysis of indicators of the general level of polycommunicative empathy in three student groups are presented in Table 1.

Table 1
Results of data analysis for the general level of polycommunicative empathy in three student sample groups

Groups of students	Min.	Max.	Arithmetic mean	Dispersion	Levels					
					High		Average		Low	
					n	%	n	%	n	%
Only children	33	66	48.37	92.54	6	10.3	49	84.5	3	5.2
Eldest siblings	35	76	49.92	103.28	2	5.6	31	86.1	3	8.3
Youngest siblings	26	61	44.63	113.37	0	0	46	82.1	10	17.9

Table 1 shows that in all three sample groups, the indicators of the general level of polycommunicative empathy are in the range of average values. At the same time, students who are the only children in the family, as well as the eldest ones surpass the youngest ones in this parameter. Compared to the other two student samples, most of the students who are the youngest children in the family have a low overall level of polycommunicative empathy (about 18 %); none of the respondents had high scores.

The results of a more detailed analysis of empirical data on students' empathy levels, depending on the order of birth, are presented in Table 2.

Table 2
Results of data analysis for individual components of the general level of polycommunicative empathy in three student sample groups

Structural components of polycommunicative empathy	Only children		Eldest children		Youngest children	
	Mean	Dis.	Mean	Dis.	Mean	Dis.
1 – children	8.92	9.4	8.75	7.56	7.79	12,06
2 – parents	9.53	5.04	9.33	4.34	8.34	7,39

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Table 2
Results of data analysis for individual components of the general level of polycommunicative empathy in three student sample groups

Structural components of polycommunicative empathy	Only children		Eldest children		Youngest children	
	Mean	Dis.	Mean	Dis.	Mean	Dis.
3 – elderly	7.29	5.35	7.50	8.83	6.25	7,61
4 – strangers and unfamiliar persons	8.71	9.12	8.58	6.94	9.09	12,08
5 – animals	7.54	8.88	7.42	5.05	6.50	7,20
6 – fictional characters	6.80	5.96	8.33	5.89	6.66	4,23

Table 2 shows that the indicators of students who are the only children in the family, as well as those of the oldest children in the family, are higher in almost all structural components of the general level of polycommunicative empathy compared to the indicators of the group of youngest children in the family. The exception is the component "empathy toward strangers and unfamiliar persons". In the sample group of the youngest children in the family, it is the highest. The rating of the structural components of polycommunicative empathy in the sample of students who are the only children in the family, as well as the eldest ones, is headed by empathy toward parents (9.53 and 9.33, respectively). In the sample group of the youngest children in the family, that was empathy toward strangers and unfamiliar persons (9.09), followed by empathy toward parents (8.34). The lowest level of empathy in the sample of students who are the only children in the family is observed in the component of "empathy toward fictional characters" (6.80), in the sample group of the eldest children in the family – "empathy toward animals" (7.42), in the sample group of youngest children – "empathy toward the elderly" (6.25).

The results of the study of personal orientation

Students' personal orientation, depending on the order of birth, included an analysis of empirical data in the following four parameters: orientation toward 'self', 'relationship', 'business', and 'altruism'. The obtained data are presented in Table 3.

Table 3
Distribution of students by the types of personality orientation, and the share of subjects with an altruistic orientation in three student sample groups

Samples of students	Types of personality orientation: Self			Relationship			Business			Altruistic orientation		
	%	mean	dispersion	%	mean	dispersion	%	mean	dispersion	%	mean	dispersion
Only children	38.0	27.00	45.05	3.4	20.59	50.47	58.6	32.98	36.69	13.8	7.51	10.91

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Table 3
Distribution of students by the types of personality orientation, and the share of subjects with an altruistic orientation in three student sample groups

Samples of students	Types of personality orientation: Self			Relationship			Business			Altruistic orientation		
	%	mean	dispersion	%	mean	dispersion	%	mean	dispersion	%	mean	dispersion
Eldest siblings	58.3	29.33	27.31	8.3	20.33	20.80	33.3	30.75	30.88	0	6.17	9.40
Youngest siblings	30.4	25.02	18.93	25	24.95	24.74	44.6	29.89	40.24	19.6	8.48	5.82

Table 3 shows that in the sample of students who are the only children in the family, as well as in the sample of those who are the youngest children, the orientation toward 'business' is more pronounced than the other two types of orientation. Moreover, it is most pronounced in the group of the only children (mean score of 32.98). In the samples of students who are the only and the eldest children in their families, the orientation toward 'relationship' has low scores. In the sample of students who are the youngest children in the family, its indicators (number of students, percentage in the group, and mean score) are obviously higher. In the group of students who are the eldest children there is a significant proportion of respondents who have a pronounced orientation toward 'self' (58.3 %).

The data analysis of three student samples on the parameter of the altruistic personal orientation showed that the highest percentage of altruists were noted in the sample of the youngest siblings (about 20 %); in the sample of students who were the only children, altruists made up about 14 %; the sample of students who were the eldest siblings consisted entirely of egoists.

The results of the study of life positions and the degree of adequacy of views of life in three student samples

The data obtained using the Hardiness graphic technique are summarized in Table 4.

Table 4
Students' life positions and the degree of adequacy of their views of life, depending on birth order

Samples of students	Life positions: Average score	Dispersion	Position: Activist	Contemplator	Victim	Degree of adequacy of the life view: % with a high degree	Average score	Dispersion
Only children	2.56	0.56	55.2	29.3	15.5	63.8	5.80	5.67

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Table 4
Students' life positions and the degree of adequacy of their views of life, depending on birth order

Samples of students	Life positions: Average score	Dispersion	Position: Activist	Contemplator	Victim	Degree of adequacy of the life view: % with a high degree	Average score	Dispersion
Eldest sibling	2.25	0.71	50.0	25.0	25.0	41.7	4.08	5.91
Youngest siblings	2.23	0.69	25.0	26.8	48.2	67.9	5.45	6.87

Table 4 shows that an active life position is more characteristic of students who are the only (55.2 %) and the eldest children (50 %) in their families. In these samples 'activists' make up about half; in the sample of the youngest siblings this indicator is a quarter of the entire sample. Among the youngest siblings, there are at least half as much students in the 'victim' position as in other two samples. An unexpected result was obtained in the sample of the eldest children in terms of the degree of adequacy of their view of life. It was noticeably lower than in the samples of students who were the only and youngest children in their families. When calculating the index of life position, we found that all student samples gravitate toward an active 'spider'. The students who are the only children in their families do it best (the group-wide score was 2.56 out of three required by the 'activist'), then the eldest ones (2.25) and, finally, in the youngest ones (2.23).

According to the Kruskal–Wallace H-test, statistically significant differences between the three student groups at a significance level of $p \leq 0{,}01$ were found in the integrative parameter of 'polycommunicative empathy'; for personality orientation – in all three scales ('self': $H = 12.128$ at $p = 0.002$; 'relationship': $H = 18.537$ at $p = 0.000$; 'business': $H = 8.734$ at $p = 0.013$); for the degree of adequacy of the view of life ($H = 9.678$ at $p = 0.008$). Table 5 presents the results.

Table 5
Statistical significance of differences in the studied indicators among three student sample groups, Kruskal–Wallace H-test

Indicators	Polycommunicative empathy types: Altruism	Parents	Animals	Elderly	Children	Fictional characters	Strangers and unfamiliar persons	General level of polycommunicative empathy	Orientation: Self	Relationship	Business	Life position	Adequacy of the view of life
H	8.23	7.84	4.75	5.93	2.96	10.56	0.43	4.60	12.13	18.54	8.73	0.88	9.68

Table 5

Statistical significance of differences in the studied indicators among three student sample groups, Kruskal–Wallace H-test

	Polycommunicative empathy types									Orientation				
Indicators	Altruism	Parents	Animals	Elderly	Children	Fictional characters	Strangers and unfamiliar persons	General level of polycommunicative empathy		Self	Relationship	Business	Life position	Adequacy of the view of life
p	0.02	0.02	0.09	0.05	0.23	0.01	0.81	0.10		0.00	0.00	0.01	0.65	0.01

When conducting the comparative analysis of the indicators of students who are the eldest and youngest children according to the Mann–Whitney U-test, in addition to the indicated, significant differences were found in the 'altruism' parameter (U = 673.5 at p = 0.007).

These results are presented in Table 6.

Table 6

Statistical significance of differences between the samples of eldest and youngest children, Mann–Whitney U-test

	Polycommunicative empathy types								Orientation				
Indicators	Altruism	Parents	Animals	Elderly	Children	Fictional characters	Strangers and unfamiliar people	General level of polycommunicative empathy	Self	Relationship	Business	Life position	Adequacy of the view of life
U	673.5	768.0	789.0	774.0	840.0	618.0	951.0	793.5	579.0	504.0	982.5	994.5	684.0
p	0.01	0.05	0.08	0.06	0.18	0.00	0.65	0.09	0.00	0.00	0.84	0.91	0.01

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Thus, a comparative study of the studied indicators of socially important personality characteristics among the samples of students who are the only, the eldest, and the youngest children in their families established a high level of confidence of the differences.

Discussion

The findings of this study enabled us to discuss the following generalized socio-psychological characteristics of three student groups, identified on the basis of birth order:

1) Compared to the students who are the eldest and youngest siblings, *students who are the only children in the family* have a higher level of polycommunicative empathy; they have a pronounced type of personality orientation toward 'business'; they take a more active life position and have a higher degree of adequacy in their views of life; the 'altruistic' orientation is characteristic of them to a greater extent than of students who are the eldest siblings, but to a lesser extent than of students who are the youngest siblings.

2) Compared to the students who are the only children and the youngest siblings, *students who are the eldest siblings* are characterized by a higher level of 'self' orientation, a significantly lower level of altruism, a lower degree of adequacy in their views of life, a somewhat higher overall level of polycommunicative empathy and, in particular, empathy toward the elderly and fictional characters.

3) Compared to the students who are the only children and the eldest siblings, *students who are the youngest children* have a significantly higher level of personality orientation toward 'relationship' and a lower level of orientation toward 'self', a higher level of altruistic orientation, a lower overall level of polycommunicative empathy, including its structural components such as empathy toward children, parents, elderly, and animals, but it is higher in the indicator of "empathy toward strangers and unfamiliar persons"; they have a less active life position.

The only children and the eldest siblings are first-borns. They are probably more similar than different. They are probably completely similar in terms of the following parameters: 1) orientation toward 'relationship' (for students of both compared groups, relations are third-rate, and this type of orientation is equally expressed in them); 2) they have very close values in the 'general level of polycommunicative empathy', including the following indicators: empathy toward children, parents, elderly, animals, strangers and unfamiliar persons.

The differences between them are established in terms of the level of empathy toward fictional characters (it is higher in the group of students who are the eldest children, which can be explained by the responsibility imposed on them by their parents for their younger siblings, which caused negative feelings and incited them to search the ideal relationships and explanations of their positions) and in terms of the degree of adequacy of their views of life (it is significantly higher among the students who are the only children in their families, which is explained by the ability of the parental family to provide the child with conditions for wider socialization and greater activity). The strongest difference was found in the indicator of personality orientation toward 'business' ($U = 1905.5$ at $p = 0.003$); students who are the only children significantly exceed their peers in this parameter.

The indicators of the group of students who are the youngest children are lower in almost all socially important characteristics, compared to the indicators of the other two student groups.

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Conclusion

Summarizing the results of our empirical study and comparing them with the hypothesis put forward at the beginning of the study, we note that its first part was confirmed. Indeed, we found the statistically significant intergroup differences. However, it was also found that there are more similarities than differences between first-born students (the only children in the family and the eldest siblings). First-born students have more differences than similarities with the students who are the youngest siblings. The student group of the youngest siblings is somewhat 'inferior' to the groups of first-borns in terms of the level of development of the socially important personality characteristics that we studied, except for altruism (its general group indicator is higher and the proportion of altruists is larger).

The second part of our hypothesis – the assumption that in the sample of students who are the eldest siblings, the studied personality parameters may have the highest scores and that this group will be more socially oriented – was not confirmed. This sample turned out to be significantly more selfish and less adequate in the view of life, although more empathic toward the elderly and fictional characters. We should note that a high level of orientation toward 'self', combined with a low degree of adequacy in the view of life, lays the ground for the formation of illegal behavior. Presumably, this result is explained by the insufficient attention of parents to the needs of their older children. Thus, in some families, parents gave them to be raised by grandparents (that is why older children have a relatively high level of empathy toward the elderly and a low level of empathy toward parents); in others, they were charged with looking after younger siblings, were demanded to share toys, sweets, and other benefits that are valuable for an older child.

We found that students who are the youngest siblings lack the orientation toward 'self' and 'business', as well as empathy toward children, parents, elderly, and life activity.

In addition to the abovementioned, we distinguished a group of students – these were the only children in the family with high scores in all the studied socially important personality characteristics: the orientation toward 'business', active life position, realistic view of life, polycommunicative empathy. At the same time, altruism was not alien to them. The public need for young people with such qualities is high. However, society will not be able to ensure its reproduction if it takes a guideline to support one-child families. Besides that, not every one-child family creates conditions for raising a child with pronounced socially important qualities.

The scientific novelty of the obtained data lies in determining the level of development of a number of socially important personality traits in students (altruism, polycommunicative empathy, orientation toward 'business', active life position, and realistic view of life) in connection with their sibling position, as well as prospects for improving these qualities.

The practical significance of the study lies in the fact that the scientific basis has been obtained for developing programs of socio-psychological work with students, considering the advantages and vulnerabilities of their sibling position. The programs may contribute to the development of their socially important personal qualities. Such programs can be included in the educational process of the university. They can be implemented in the system of social services for the population. The results of this study will be of interest to specialists in family counseling, psychotherapists, social service psychologists, students and curators of student groups, as well as inquisitive parents. The development of this issue can be continued in other student samples (larger ones, including university students not only in the social and humanitarian field).

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Author Contribution

N. A. Tsvetkova worked with sources and wrote the overview part of the article, contributed to the experimental design of the study, developed tools for psychological testing and a summary table for research results, systematized early results, summarized the cumulative results of the study, and prepared the manuscript for publication.
K. E. Lagvilava performed the whole work on mathematical and statistical data processing and described the results.
E. A. Petrova performed the analysis of modern scientific publications on sibling studies in foreign psychology, ensured the participation of students in psychological testing, and collected early results.

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