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Can We Improve Learning Outcomes of Schoolchildren from the Poorest Families by Investing into Their Non-Cognitive Skills? Causal Analysis Using Propensity Score Matching

G.A. Avanesian, M.A. Borovskaya, V.S. Ryzhova, V.A. Kirik, V.A. Egorova, A.G. Bermous

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Abstract

The research aims to discover how non-cognitive skills influence students` academic achievement. Particular emphasis was put on how non-cognitive skills influence academic achievement in students from families with low socio-economic status. The study uses the data of the Programme for International Student Assessment (PISA) collected in Russia in 2018. The PISA-2018 provides nationally representative data that contains information from more than 7,000 students in the 9th grade in Russia. For data analysis, propensity score matching was used as one of the causal analysis methods used in econometrics. The study results reveal that the development of such non-cognitive skills as growth mindset, self-efficacy, and grit lowers students' probability to become low achievers. The effect is particularly strong for the students from the poorest families. In conclusion, the authors suggest recommendations for educational policy on the inclusion of socio-emotional learning programs in educational standards of school education.

Keywords

non-cognitive skills, socio-economic status, human capital, academic achievements, propensity score matching, growth mindset, grit, self-efficacy.

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Quality education is one of the development priorities for the international community. The Sustainable Development Goals adopted by the United Nations General Assembly in 2015 and lie at the core of the 2030 Agenda for the development of world economies, prioritize, among other things, "ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all" (Sustainable Development Goal 4). One of the prerequisites for achieving this goal is educational equity when vulnerable and socio-economically deprived groups have the same opportunities as more advantaged groups to access quality education. In other words, belonging to a vulnerable group should not be a factor that constrains a child in the accumulation of human capital. Sustainable Development Goal Indicator 4.1.1 (c) measures the proportion of children achieving a minimum proficiency level in reading and mathematics at the end of lower secondary education. In Russia, it was 78% in both reading and mathematics in 2018, which was a significant decline compared to 2015, when the indicator had reached 84% and 81%, respectively[1]. It is likely that without targeted public policy measures the proportion of schoolchildren who do not achieve the minimum proficiency level can hardly be reduced to zero by 2030.

Hence, without targeted policy interventions, the country could face a significant deficit of human capital needed for sustainable socio-economic development, and urgent measures need to be taken today to improve the skills of young Russians. Prospective government efforts to address inequity in education gain particular relevance in this context . Evidence from international comparative studies confirms that socio-economic status of a child's family appears to be a notable factor of low academic achievement [OECD, 2016a]. For example, in Russia, it explains about 7% of the variation in the learning outcomes of schoolchildren in lower secondary school. In addition, low achievers in reading often also underachieve in mathematics, which points to a high probability of overlap between the two statistical distributions [OECD, 2016b].

Socio-economic status is consistently associated with cognitive skills [Farah, 2017] and influences child's cognitive abilities through-

[1] UNESCO (2021) Sustainable Development Goals: 4.1.1 Achieving at Least a Minimum Proficiency Level in Mathematics at the End of Primary: http://data.uis.unesco.org/index.aspx?queryid=3692

out all stages of learning. Evidence from behavioral neuroscience confirmed the long-term nature of this relationship: the difference in IQ between children from the wealthiest and poorest classes at age two, which is only 2, increases over the course of life, reaching 15 at the age of sixteen years old [Stumm von, Plomin, 2015].

Thus, education systems that do not adopt targeted measures to compensate for the socio-economic disadvantage of schoolchildren inevitably reproduce inequality in human capital accumulation, thereby blocking channels of upward social mobility. Inequality in learning outcomes can also be caused by factors other than socio-economic ones, such as pedagogy, school climate, and parental involvement. However, sustained, equity-focused improvement in educational outcomes begins "at the tail end" — with targeted support for those with the lowest educational outcomes [Crouch, Rolleston, 2017; Crouch, Rolleston, Gustafsson, 2021; Akmal, Pritchett, 2021].

In other words, reducing the proportion of schoolchildren who fail to meet a minimum proficiency level in reading and mathematics will not only ensure progress toward the achievement of Sustainable Development Goal Indicator 4.1.1 (c) but will also eliminate inequality in the key skills gained through the lower secondary education. Closing the opportunity gap that results from differences in family status should become a priority in education policy. This will not only ensure equitable opportunities for human capital accumulation in general school education but will also lay the groundwork for overcoming persistent poverty: the experience of some countries confirms that high academic achievement among 15-year-old schoolchildren from the poorest families is a strong predictor of upward mobility [OECD, 2018].

In seeking ways to reduce the prevalence of low academic achievement, contemporary researchers in economics, psychology and sociology are examining non-cognitive skills as a driver of academic achievement. Non-cognitive skills are defined as patterns of thought, feelings and behavior of individuals that may continue to develop throughout their lives and that play an important role in the educational process [Garcia, 2016]. In other words, in addition to academic knowledge, learners should develop behavioral strategies, skills, and attitudes necessary for academic success that are not captured by cognitive test scores [Farrington et al., 2012]. In the scientific literature, non-cognitive skills are also known as socio-emotional skills [Attanasio et al., 2020; Zhou, 2017], 21st-century skills[2], trans-

[2] UNESCO, UNPFA, UNICEF, UN (2015) Education 2030. Incheon Declaration and Framework for Action for the Implementation of Sustainable Development Goal 4. Towards Inclusive and Equitable Quality Education and Lifelong Learning for All: http://uis.unesco.org/sites/default/files/documents/education-2030-incheon-framework-for-action-implementation-of-sdg4-2016-en_2.pdf

versal skills [Cinque, Carretero, Napierala, 2021], or soft skills [Koch, Nafziger, Nielsen, 2015; Laker, Powell, 2011].

In this paper we seek to answer the following research question: to what extent can non-cognitive skills improve the educational outcomes of schoolchildren, especially those from families with low socio-economic status? To put it differently, how strong is the causal effect of non-cognitive skills on academic achievement, and does the strength of this effect change in interaction with the socio-economic status of the child's family?

The results of Russian schoolchildren in the Program for International Student Assessment (PISA) in 2018 were adopted as the data of the study. The data were analyzed by propensity score matching, a method used in econometrics for causal evaluation of the effects of public policy [Caliendo, Kopeining, 2008; Essama-Nssah, 2006; Heinrich, Maffioli, Vazquez, 2010; Basu, Meghani, Siddiqi, 2017]. The research on the influence of non-cognitive skills on learners' academic competencies as applied to Russia potentially contributes to incrementing scientific knowledge about the effect of socio-economic status on learning outcomes. The insights suggested in this paper can serve as a basis for the development of public policy measures aimed at closing the gap in human capital accumulation between schoolchildren from different socio-economic status groups by investing in their non-cognitive skills.

Review of Research on the Role of Non-Cognitive Skills in Learning

The importance of non-cognitive skills for human capital accumulation is reflected in both international and Russian educational development agenda. Indicators 4.1, 4.4, and 4.7, which measure the achievement of Sustainable Development Goal 4, describe the non-cognitive, social and emotional development of learners. According to the Incheon Declaration *Education 2030*, adopted at the World Education Forum in 2015 as a guide to achieving the SDGs in education, the education content and learning process should be focused on the development of non-cognitive skills in learners in addition to cognitive ones. The Federal State Educational Standard of Basic General Education, approved by the Ministry of Education and Science of the Russian Federation, enshrines the need to develop students' emotional intelligence, communication skills, self-control and many other non-cognitive characteristics.

A positive correlation has been empirically established between the level of non-cognitive skills and academic performance [Wanzer, Postlewaite, Zargarpour, 2019; Destin et al., 2019; Komarraju, Nadler, 2013]. Researchers particularly focus on assessing whether the negative effect of socio-economic status on academic performance can be compensated by improving the non-cognitive skills of learners from families with low socio-economic status [OECD, 2019; Claro, Paunesku, and Dweck, 2016; OECD, 2021a].

Despite the extensive research on non-cognitive skills in recent years, there is still no consensus among scholars regarding their taxonomy. Several authors [Kankaraš, Suarez-Alvarez, 2019; Lipnevich, MacCann, Roberts, 2013; OECD, 2017; Humphries, Kosse, 2017] consider the Big Five personality traits — openness to experience, conscientiousness, extraversion, agreeableness, and emotional stability (neuroticism) — as non-cognitive skills. This taxonomy is the most common, but not the only one [Danner, Lechner, Spengler, 2021]. Studies that focus on non-cognitive characteristics such as growth mindset, self-efficacy, grit/perseverance [Duckworth, 2016], self-control [Schmidt et al., 2020], achievement motivation [Steinmayr et al., 2019], and sense of belonging at school [Urvashi and Singh, 2017; Lee, 2020] also showed plausible results. Some of these skills have been tested in PISA in different years. For its Study on Social and Emotional Skills (SSES), the OECD has developed a new taxonomy that resulted from attempts to adapt the Big Five to the context of human capital accumulation in the school education system. The taxonomy includes 15 skills that make up a five-factor model and are measured in 10- and 15-year-old schoolchildren.

Previous research has identified several stable non-cognitive skills that influence academic performance, particularly among schoolchildren from low-status groups. Development of a growth mindset, a trait defined as an individual's belief in ability to develop their own capacities and intelligence, refers to one of particular factors that increase academic performance [OECD, 2019; Costa, Faria, 2018; Blackwell et. al., 2007]. As shown in a large-scale nationally representative study, schoolchildren from low-status groups are less likely than their more advantaged peers to develop a growth mindset, but targeted interventions to build this skill in low-achieving learners from poor families have a consistently positive effect on their learning outcomes [Claro, Paunesku, and Dweck, 2016; OECD, 2021a]. Thus, a growth mindset may be one of the mechanisms by which economic vulnerability affects academic performance.

The sense of belonging at school refers to the degree to which a student feels included in the social environment of the school [Goodenow, 1993] and has a need to build and maintain trust-based interpersonal relationships. The sense of belonging is consistently correlated with higher academic achievement [OECD, 2019; OECD, 2017; Abdollahi, Noltemeyer, 2018]. In particular, it has been found that the sense of belonging at school has a positive effect on the average academic performance of students from poor racial and ethnic minority families [Shook, Clay, 2012].

Self-efficacy, defined as an individual's belief in their ability to solve complex problems and cope with life's challenges [Bandura, 1997], is considered as another predictor of academic performance [Hwang et al., 2016; Köseoglu, 2015], A 1-point increase in self-ef-

ficacy leads to a 6-point increase in the average reading score of schoolchildren [OECD, 2019]. A comparative economic study of child poverty in four developing countries has found that self-efficacy, educational motivation and households' living conditions are significantly associated with each other [Dercon, Krishnan, 2009]. Deficit of self-efficacy in children from poor families consistently correlates with low self-efficacy in their parents, suggesting the intergenerational transmission of psychosocial characteristics of those living in poverty [Krishnan, Krutikova, 2013]. Children with poor self-efficacy do not strive for high educational and professional achievements [Bandura et al., 2001] and therefore fail to escape poverty [Wuepper, Sauer, 2016; Chiapa et al., 2012; Tafere, 2014; Pasquier-Doumer, Brandon, 2015].

Task mastery, or, in other words, dispositional commitment to work hard to achieve specific goals, is another skill that positively influences academic achievement in mathematics and reading [Józsa, Molnár, 2013; Broussard, Garrison, 2004; Suprayogi, Ratriana, Wulandari, 2019]. Its effect is especially visible in primary grades but, according to researchers, does not remain constant throughout schooling and tends to decrease in adolescence [Józsa, Kis, and Barrett, 2019].

Grit has a positive impact on learners' academic achievement at all levels of education [Wolters, Hussain, 2015; Lee, Sohn, 2017; Lam, Zhou, 2019]. In one experimental study, grit-enhanced interventions in the educational process increased the number of students completing courses satisfactorily by 6.4% [Paunesku et al, 2015]. The evidence regarding the impact on academic achievement of fear of failure, that is, a student's lack of confidence in themselves and their own abilities, is mixed. In countries where schoolchildren receive above-average reading scores in international surveys, the lack of self-confidence is positively related to academic achievement, while in countries with low scores on reading tests, confident students demonstrate higher academic achievement [OECD, 2019].

The level of development of both cognitive and non-cognitive skills in schoolchildren is determined by environmental factors, which are often more significant than hereditary factors (up to 60%) [Vukasović, Bratko, 2015]. Family socio-economic status is highly likely to be a confounding variable, that is, it may have an effect on both cognitive and non-cognitive skills of a child and determine the nature of the relationship between them. On the one hand, non-cognitive skills are relatively stable; on the other hand, they are flexible in childhood and adolescence, meaning that the education system could improve them through targeted social programs of human capital development [Heckman, Kautz, 2014].

Economic studies have shown that the most effective programs for non-cognitive skills development are those conducted in early

childhood, in the preschool stage [Heckman, 2006; Almlund et al., 2011]. The econometric analysis confirmed that the return on investment in non-cognitive skills development is the higher the earlier the investment is made, especially when it comes to stimulating the achievements of the poor [Heckman, 2000]. Socio-emotional learning programs have succeeded in improving the academic achievement of the poorest children, and longitudinal measurements have confirmed the upward social mobility of participants in these programs [Knudsen et al., 2006]. As a consequence, the statement "skills beget skills" has become popular among scholars, cementing the relationship between cognitive and non-cognitive characteristics.

Studies on the impact of non-cognitive skills on individuals' educational and occupational outcomes conducted on a Russian sample, show, in particular, that non-cognitive components of human capital generate a stable return in the labor market, influencing both employability and labor remuneration [Гимпельсон, Зудина, Капелюшников, 2020; Рожкова, 2019; Maksimova, 2019]. The majority of economic studies have been conducted on an adult sample. At the same time, experts agree that the development of non-cognitive skills is a new challenge for the theory and practice of education in Russia [Кузьминов, Сорокин, Фрумин, 2019].

During the pilot phase of the Survey on Social and Emotional Skills launched by the Organization for Economic Cooperation and Development, it has been found that in a representative sample of 10- and 15-year-old Moscow schoolchildren inequality in key skills increases depending on family economic status, and schoolchildren from the poorest households are identified as a vulnerable group in terms of accumulation of non-cognitive components of human capital [OECD, 2021b. P. 23]. Moreover, schoolchildren with poorly developed non-cognitive skills have fewer channels for social mobility, judging by their expectations regarding higher education and choice of profession [Ibid. P. 13–16]. The findings of the OECD study correspond to the results obtained by Russian economists on a representative national sample that has confirmed the influence of non-cognitive skills on the intention to receive higher education and on the choice of the field of study [Рожкова, Рощин, 2021a; 2021b]. Increased scientific knowledge in this area could contribute to the development of recommendations for public policy aimed at creating inclusive education systems in which the accumulation of human capital in schoolchildren from the poorest families is built on the principle of equity and provides them with the skills and competencies necessary for intergenerational upward mobility.

Data and Methodology

The study adopted PISA 2018 data for Russia, which provide nationally representative sample of more than 7,000 schoolchildren at the age of 15 years old. In addition to information on academic achievement, the PISA questionnaires contain data on a number of non-cognitive characteristics of schoolchildren. This study measures such non-cognitive skills as growth mindset, sense of belonging at school, task mastery, self-efficacy, grit, and self-confidence[3]. The proposed questions have undergone cognitive and validity tests in all countries participating in the survey and have been included in the PISA questionnaires since 2009. The questions used to measure the non-cognitive skills analyzed in this study are presented in Appendix 1. In order to calculate the aggregate indices for the above non-cognitive characteristics, the OECD used item response theory regression models. For the analysis, we standardized the variables to the mean of the Russian sample. The sample parameters, as well as descriptive statistics on learning outcomes and aggregate scores for non-cognitive skills, are presented in Table 1. The breakdown of standardized scores for non-cognitive skills and learning outcomes by key groups is presented in Appendix 2.

Table 1. **Sample Parameters and Descriptive Statistics**

Gender							
Male: 3.747			Female: 3.861				
Residence							
Urban: 5.536			Rural: 1.691				
Learning outcomes							
	Min	Mean	Median	Max	*SD*	Skewness	Kurtosis
Reading	183	480	482	746	90	–0.14	–0.26
Mathematics	213	489	490	747	78	–0.11	–0.17
Non-cognitive skills							
Growth mindset	–1.88	0	0.32	1.42	1	–0.22	–0.75
Sense of belonging at school	–3.47	0	–0.06	3.86	1	1.23	4.63
Task mastery	–2.74	0	0.26	2.45	1	0.36	0.78
Self-efficacy	–3.08	0	–0.16	2.88	1	0.67	1.93
Grit	–2.15	0	–0.24	1.52	1	0.1	–0.69
Self-confidence	–2.31	0	0.05	1.97	1	–0.13	0.09

Source: authors' calculations based on the PISA 2018 data for Russia.

[3] In the PISA, fear of failure is a measure of a schoolchild's confidence in their ability to learn. To create a positive connotation, the values of this scale were transformed so that the most self-confident students, who had the lowest values on the original scale, would receive high scores.

When choosing the method of data analysis, we assumed that belonging to a group with high or low academic achievement was not random and that the distribution of schoolchildren who did not achieve the minimum proficiency level in reading and mathematics was the result of several confounding factors. In other words, we selected an approach to estimating the effect of non-cognitive skills on academic performance that is not affected by the existing sample bias. Since in non-experimental cross-sectional measurements a researcher has no control over sample parameters, we used the method of propensity score matching, which estimates the causal effect of treatment in a quasi-experimental manner based on observational data . This method is often used in economics to evaluate the effectiveness of particular social programs or public policy measures, as it reduces the effect of confounding factors.

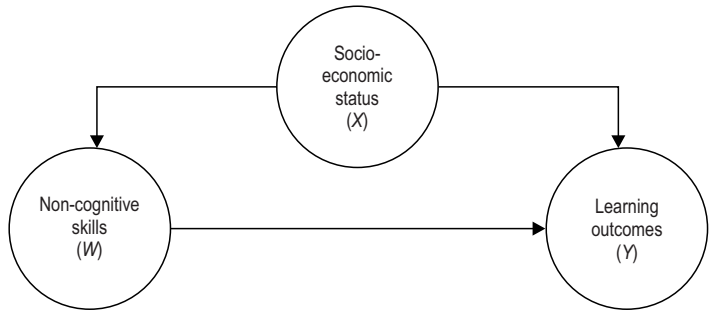
In this study, the dependent variable Y is binary. It indicates whether a schoolchild belongs to the group of low achievers in reading and mathematics. In PISA, low-achieving schoolchildren are those who do not reach the second level of difficulty in the relevant subject tests, which is considered to be the basic proficiency level necessary for full participation in society and competing in the labor market [OECDb, 2016. P. 37]. Schoolchildren with test results below Level 2 can answer a question on a text that requires direct inference, but are not capable of holistic logical thinking and are not able to solve more complex problems that are routinely encountered by adults in everyday life in modern economies.

The treatment variable is a non-cognitive skill W_i. Since this study focuses on six skills, six different iterations of propensity score matching are needed, each of which measures the effect of a particular non-cognitive characteristic on the probability of a student belonging to the low-achieving group. We are primarily interested in the skills that have the strongest negative effect on the likelihood of low achievement, as investing in these skills will reduce the proportion of schoolchildren who do not reach the minimum proficiency level in key competencies at the end of basic general school. By the logic of propensity score matching, six continuous variables were dichotomized to statistically discriminate students based on their levels of a particular non-cognitive skill. A borderline value of 0.5 standard deviation was applied. With this borderline value, on average about 25% of schoolchildren were assigned to the treatment group, depending on the distribution of a particular skill. Data on the size of the treatment group for each skill are presented in Appendix 3.

A measure of socio-economic status as a major confounding factor for both academic achievement and non-cognitive skills is the PISA index of economic, social, and cultural status (ESCS). This indicator is based on family information such as parental education and

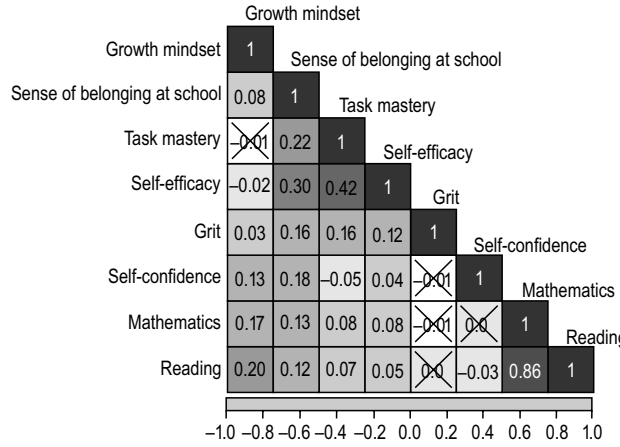
occupation , family wealth, and possession of cultural goods . Thus, ESCS that combines several social, economic and cultural characteristics not only reflects the state of family finances but also serves as a proxy for the comprehensive relationship between family resources and the external environment in which a child's personal development, socialization and human capital accumulation take place. ESCS is a continuous variable, an index standardized to the mean. We transformed it into an ordinal variable, the levels of which (poorest, poor, middle , rich, richest) represent equal-size twenty-percent cohorts of the sample — quintile groups. Child's gender and area of residence (urban or rural) were the control variables in the model. The relationships between the main variables used in the study are shown in Figure 1. The source code in the statistical programming language R, the source datasets, and detailed graphs and descriptions of the models presented in this article are available online on the Open Science Framework platform at the following DOI: 10.17605/OSF.IO/BYFTW

Figure 1. **Causal Model Used in the Study**



Results The correlation analysis using Spearman's coefficient (r) revealed statistically significant correlations between a number of cognitive and non-cognitive skills. As shown in Figure 2, most correlations, while statistically significant, were nonetheless weak or moderate. This confirms that the non-cognitive characteristics analyzed represent personality traits that are different in their features. In particular, among the non-cognitive skills, the strongest positive correlation is observed between self-efficacy and the motivation to master tasks (r = .42, p < .05). Self-efficacy also moderately correlates with the sense of belonging at school (r = .30, p < .05). In turn, the sense of belonging is weakly correlated with the task mastery (r = .22, p < .05) and grit (r = .16, p < .05). Academic achievement is most strongly correlated with a growth mindset (r = .17 for mathematics and r = .20 for reading, p < .05). Of particular note in this context is the high correlation between learning outcomes in

Figure 2. **Matrix of Correlations Between Non-Cognitive and Cognitive Characteristics**

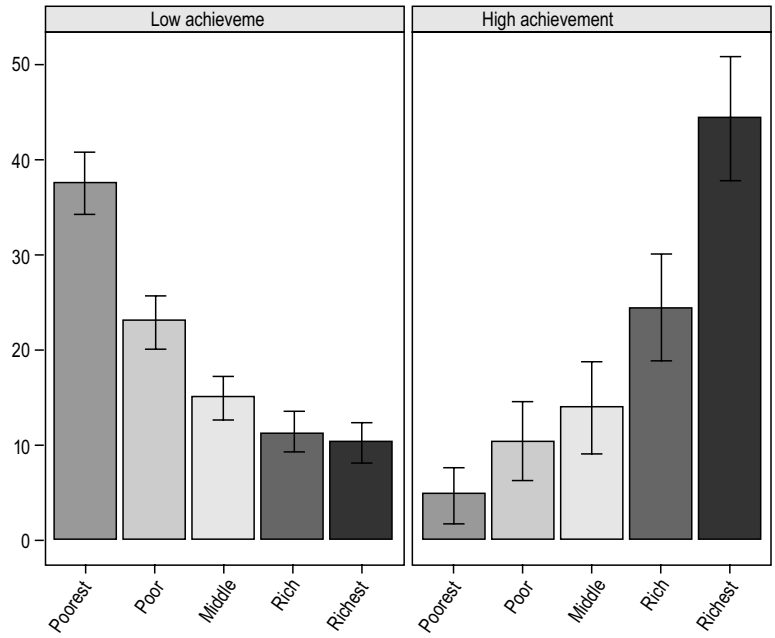


Source: authors' calculations based on the PISA 2018 data for Russia.

reading and mathematics (r = .86, p < .05). Apparently, the ability to make inferences and to logically comprehend and understand information assessed in the reading tests also lies at the core of mathematics proficiency. The high correlation between proficiency in reading and mathematics suggests that schoolchildren with low achievement in one subject area are likely to have low proficiency in the other. Our calculations based on the PISA 2018 data for Russia support this conclusion: low achievers in mathematics make up 19% of the sample, in reading — 21% of the sample, and the proportion of schoolchildren with low achievements in both domains accounts for 14%. Among low achievers in mathematics, 75% also score poorly in reading; that is, three out of four learners who do not reach the minimum proficiency level in mathematics do not reach it in reading either.

Figure 3 shows the relationship between learning outcomes and status. The higher the family's socio-economic status, the more likely the schoolchild is to demonstrate high academic achievement and vice versa. Among schoolchildren with low scores in both subject areas, 38% come from families in the lowest quintile of the PISA index of economic, social, and cultural status, and nearly half (44%) of the high achievers come from the wealthiest families in the sample, the fifth quintile. Low-achieving and high-achieving students are almost equally likely to come from the middle families (third quintile) — at approximately 15%. Among students who do not reach the minimum proficiency level in reading and mathematics skills, the lowest proportion (11%) comes from the wealthiest families; conversely, among students with outstanding academic achievement, the lowest proportion comes from the poorest families (4%).

Figure 3. **Low- and High-Achieving Students by Family Socio-Economic Status**



Source: authors' calculations based on the PISA 2018 data for Russia.

The effect of socio-economic status on cognitive and non-cognitive skills was estimated using logistic regression models. The models summarized in Table 2 test the assumption of socio-economic status as a confounding factor in the relationship between non-cognitive skills and academic achievement. In the first two models, the binary dependent variables are used to assess the association between socio-economic status and a child's belonging to the group of low (Model 1) and high (Model 2) achievers in reading and mathematics. The other four models examine the relationships between family socio-economic status and the likelihood that a particular non-cognitive characteristic is strongly present in a schoolchild.

Regression analysis shows that groups of schoolchildren from the poorest and wealthiest families have clearly unequal statistical odds of both high academic achievement and proficiency in a range of non-cognitive skills important to academic performance. This suggests the potential role of socio-economic status as a confounding factor with respect to the probability of both high academic achievement and proficiency in non-cognitive skills. For ease of interpretation, the logarithms of the odds ratios from Table 2 are converted to marginal effects and expressed in probabilities. Figure 4 shows the marginal effects of socio-economic status and other factors on the probabilities of low and high academic achievement. For example, the probability of belonging to the group that

Table 2. **Results of the Logistic Regression Models for Estimating the Impact of Family Socio-Economic Status on Children's Cognitive and Non-Cognitive Skills (Before Matching)**

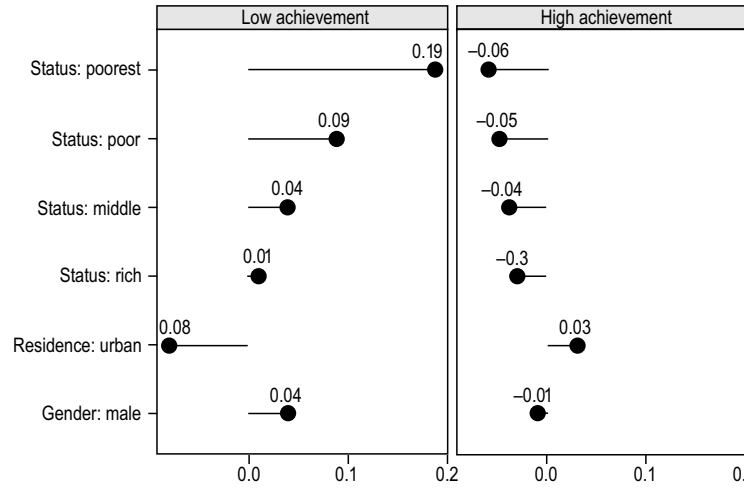
	Low academic achievement	High academic achievement	Growth mindset	Sense of belonging at school	Task mastery	Self-efficacy	Grit	Self-confidence
Status: poorest	1.42 (0.12)***	–2.03 (0.32)***	–0.7 (0.1)***	–0.59 (0.1)***	–0.8 (0.1)***	–0.91 (0.11)***	–0.18 (0.09)*	–0.22 (0.08)**
Status: poor	0.82 (0.12)***	–1.4 (0.24)***	–0.53 (0.09)***	–0.41 (0.09)***	–0.58 (0.1)***	–0.43 (0.1)***	–0.04 (0.09)	–0.22 (0.08)**
Status: middle	0.41 (0.13)**	–1.15 (0.21)***	–0.36 (0.09)***	–0.38 (0.09)***	–0.54 (0.1)***	–0.43 (0.1)***	–0.18 (0.09)*	–0.07 (0.08)
Status: rich	0.15 (0.14)	–0.6 (0.17)***	–0.34 (0.09)***	–0.27 (0.09)**	–0.34 (0.09)***	–0.34 (0.09)***	–0.04 (0.09)	–0.1 (0.08)
Residence: urban	–0.62 (0.08)***	1.27 (0.29)***	0.18 (0.08)*	–0.01 (0.08)	–0.16 (0.08)*	0 (0.08)	–0.19 (0.07)**	–0.04 (0.06)
Gender: male	0.33 (0.07)***	–0.27 (0.14)	0.21 (0.06)***	0.05 (0.06)	0.06 (0.06)	0.14 (0.06)*	–0.25 (0.05)***	0.53 (0.05)***
Intercept	–2.11 (0.12)***	–3.62 (0.3)***	–1.23 (0.1)***	–1.06 (0.1)***	–0.9 (0.1)***	–1.15 (0.1)***	–0.6 (0.09)***	–0.75 (0.08)***
Pseudo 0,07 R^2	0.07	0.01	0.01	0.01	0.01	0.004	0.01	
N	6727	7063	6745	6570	6584	6614	6726	6601

Note. The following categories were chosen as the reference: richest for socio-economic status, rural for residence, and female for gender.

***p < .0001; **p < .001; *p < .01.

Source: authors' calculations based on the PISA 2018 data for Russia.

Figure 4. **Marginal Effects of the Predictor Variables on Belonging to High-Achieving and Low-Achieving Groups of Schoolchildren**



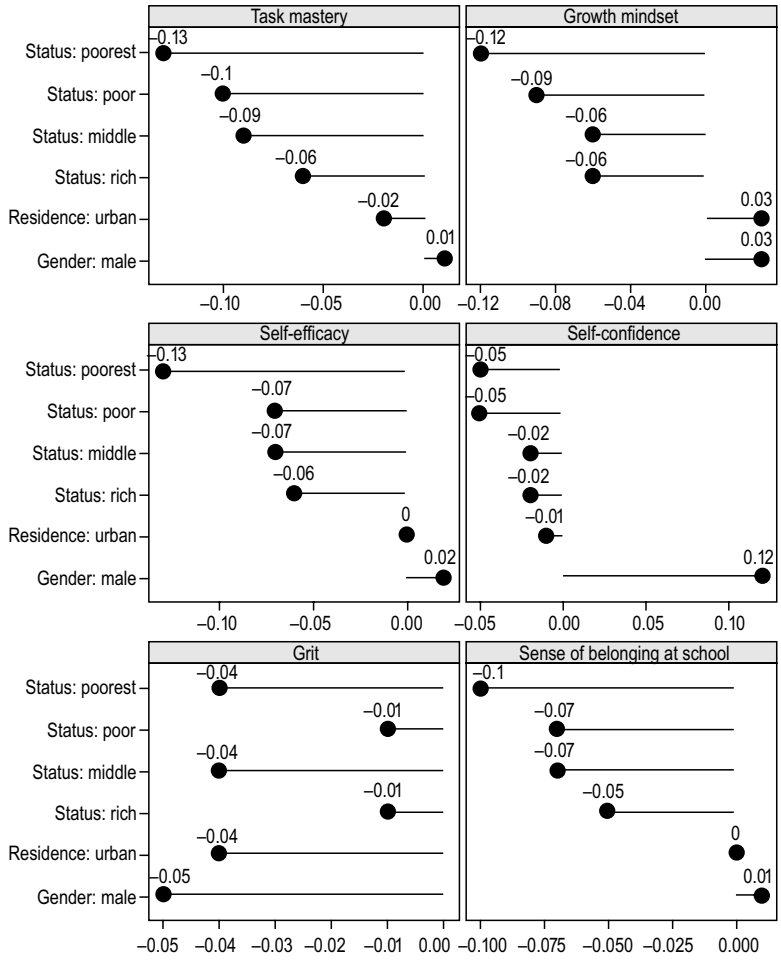
Note. The following categories were chosen as the reference: wealthiest for socio-economic status, rural for residence, and female for gender.

Source: authors' calculations based on the PISA 2018 data for Russia.

does not reach the minimum proficiency level in reading and mathematics is 19% higher for schoolchildren from the poorest families than for those from the wealthiest families. Schoolchildren from the poorest families are on average 10% less likely to be proficient in the six non-cognitive skills studied compared to children from the wealthiest families. The marginal effects are shown in Figure 5.

In order to answer the key research question of this paper — how strong is the effect of a schoolchild's non-cognitive skills on the probability of their belonging to those not reaching the minimum proficiency level in reading and mathematics, and how different is the effect of non-cognitive characteristics on academic achievement across socio-economic status groups — we conducted an analysis using propensity score matching. This method was chosen because it controls for sampling bias due to non-random

Figure 5. **Marginal Effect of Socio-Economic Status on Proficiency in Non-Cognitive Skills**



Note. The following categories were chosen as the reference: wealthiest for socio-economic status, rural for residence, and female for gender.

Source: authors' calculations based on the PISA 2018 data for Russia.

selection. The belonging to the group of schoolchildren with low academic achievement in reading and mathematics is a dependent variable (*Y*). A binary variable indicating whether a schoolchild has a high proficiency in a particular non-cognitive skill is the treatment variable (*W*). Socio-economic status, residence and gender of a child are control variables (X_n). To account for the heterogeneous effects of non-cognitive skills on low achievement across status groups, we introduced the interaction effect between a particular skill and socio-economic status.

Task mastery has a significant effect on the learning outcomes of schoolchildren, both in interaction with family socio-economic status and independently of it. While proficiency in this skill alone predicts up to a 6% probability of not joining the group of low achievers, when it interacts with the *poorest* category the probability becomes twice as high (12%). Self-confidence, self-efficacy or grit alone have no statistically significant effect on poor academic performance on average across the sample, but in interaction with socio-economic status, their effects increase, reaching their maxi-

Table 3. **Results of the Logistic Regression Models for Estimating the Impact of Non-Cognitive Skills and Socio-Economic Status on Low Academic Achievement (After Matching)**

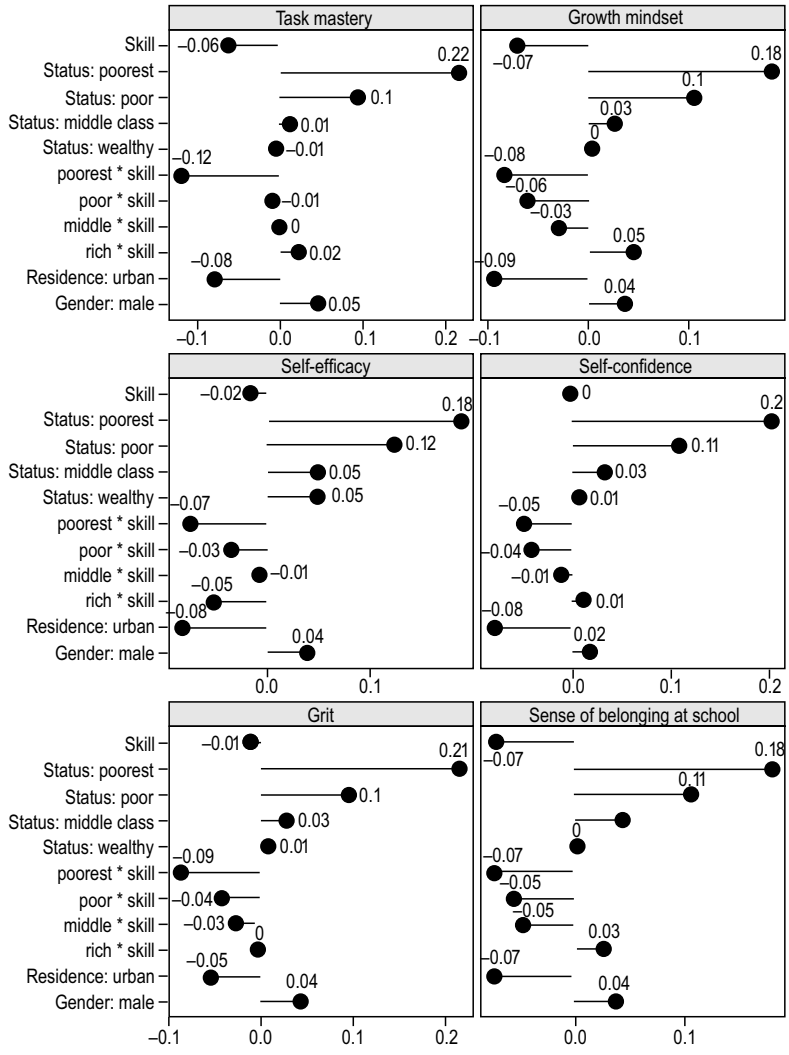
	Growth mindset	Sense of belonging at school	Task mastery	Self-efficacy	Grit	Self-confidence
Skill	–1.5 (0.37)***	–1.55 (0.39)***	–1.02 (0.3)***	–0.39 (0.31)	–0.18 (0.26)	–0.06 (0.24)
Status: poorest	1.24 (0.13)***	1.24 (0.13)***	1.37 (0.13)***	1.57 (0.15)***	1.6 (0.15)***	1.59 (0.16)***
Status: poor	0.86 (0.13)***	0.85 (0.13)***	0.74 (0.12)***	1.2 (0.14)***	0.94 (0.16)***	1.07 (0.17)***
Status: middle	0.28 (0.14)*	0.43 (0.14)**	0.13 (0.14)	0.66 (0.15)***	0.38 (0.18)*	0.46 (0.18)**
Status: rich	0.04 (0.14)	0.05 (0.15)	–0.05 (0.14)	0.67 (0.15)***	0.15 (0.18)	0.13 (0.19)
poorest * skill	0.57 (0.44)	0.69 (0.46)	–0.01 (0.38)	–0.17 (0.4)	–0.34 (0.3)	–0.2 (0.28)
poor * skill	0.32 (0.46)	0.49 (0.47)	0.52 (0.37)	0.02 (0.37)	–0.23 (0.32)	–0.27 (0.3)
middle * skill	–0.16 (0.54)	–0.11 (0.54)	0.26 (0.42)	0.12 (0.39)	–0.29 (0.36)	–0.11 (0.31)
rich * skill	1.17 (0.45)**	0.94 (0.48)	0.5 (0.4)	–0.54 (0.44)	–0.01 (0.35)	0.16 (0.33)
Residence: urban	–0.7 (0.09)***	–0.55 (0.08)***	–0.58 (0.08)***	–0.63 (0.09)***	–0.44 (0.08)***	–0.61 (0.08)***
Gender: male	0.36 (0.08)***	0.34 (0.08)***	0.41 (0.08)***	0.37 (0.08)***	0.41 (0.08)***	0.17 (0.08) *
Intercept	–1.86 (0.13)***	–1.97 (0.13)***	–1.89 (0.12)***	–2.37 (0.14)***	–2.37 (0.15)***	–2.37 (0.15)***
Pseudo R^2	0.08	0.07	0.07	0.07	0.07	0.07
N	5947	5947	5947	5947	5947	5947

Note. The following categories were chosen as the reference: wealthiest for socio-economic status, rural for residence, and female for gender.

****p* < .0001; **p < .001; *p < .01.

Source: authors' calculations based on the PISA 2018 data for Russia.

Figure 6. **Marginal Effects of Non-Cognitive Skills on Low Academic Achievement (After Matching)**



Note. The following categories were chosen as the reference: wealthiest for socio-economic status, rural for residence, and female for gender.

Source: authors' calculations based on the PISA 2018 data for Russia.

mums in schoolchildren from the poorest families and decreasing the probability of low achievement by 5%, 7%, and 9%, respectively. The marginal effect of having a growth mindset and a sense of belonging at school is equally strong in magnitude both on average across the sample and on students from the poorest families. This suggests a more universal role of these characteristics in reducing the proportion of poorly performing schoolchildren.

All models reveal significant effects of students' gender and residence. Boys are more likely (probability of up to 4% on average across all models) to become low achievers than girls. The statistically significant effect of residence emphasizes the issue of reach-

ing the minimum proficiency level in reading and mathematics by schoolchildren from rural areas. Figure 6 shows marginal effects across all variables in the six models.

Limitations

This study has several limitations due to the specifics of the input data and analytical procedures applied. First, PISA is a program for comparative studies, and its research tools are adapted for more than 80 countries, meaning that the psychometric properties of tests used for assessing non-cognitive skills inevitably differ across contexts. Second, the PISA data are cross-sectional. To best assess the impact of non-cognitive skills on learning outcomes, large-scale longitudinal measurements need to be conducted. In this study, we apply the method of propensity score matching to calculate the effects of non-cognitive characteristics in a quasi-experimental manner, that is, without undertaking the interventions themselves. This leads to a third major limitation of this study — the extent to which the statistical data allow for pseudo-randomization of the observations. In other words, sampling bias may be stronger than what we can capture with the available variables used as confounders.

Fourth, according to the research design, the effects of non-cognitive skills on academic achievement are measured separately rather than together. However, these characteristics are not isolated from each other, and their combined impact should also be measured. The approach we have chosen is statistically justified, and, in economic logic, it is more informative for policy regulation. Figure 2 shows that non-cognitive characteristics are not strongly correlated. It means that the taxonomy of skills used in this study captures quite autonomous and stable personality traits. Although non-cognitive characteristics do not exist in isolation from one another, interventions in practice often focus on only one of them. The approach we have chosen allows us to evaluate in a quasi-experimental manner the effectiveness of potential interventions targeting individual skills. Given the weak correlation between the non-cognitive skills, we can assume that interventions aimed at developing one of them will have no significant effects on the others.

Finally, another notable limitation of the study is the loss of information due to the dichotomization of non-cognitive characteristics that were initially captured on a continuous scale. In econometrics, continuous variables are used when researchers are interested in elasticity, or the average coefficient of change. In particular, they might want to know how, on average, academic achievement will change when the score for a non-cognitive skill increases by one unit. In this study, however, we were interested in how the probability of low academic achievement would change if a schoolchild

(particularly one from the poorest household) with a certain fixed set of control characteristics and low scores for non-cognitive skills had highly developed non-cognitive skills. The method of propensity score matching with the binarization of non-cognitive characteristics into treatment variables used in this study helps answer this question from a counterfactual perspective.

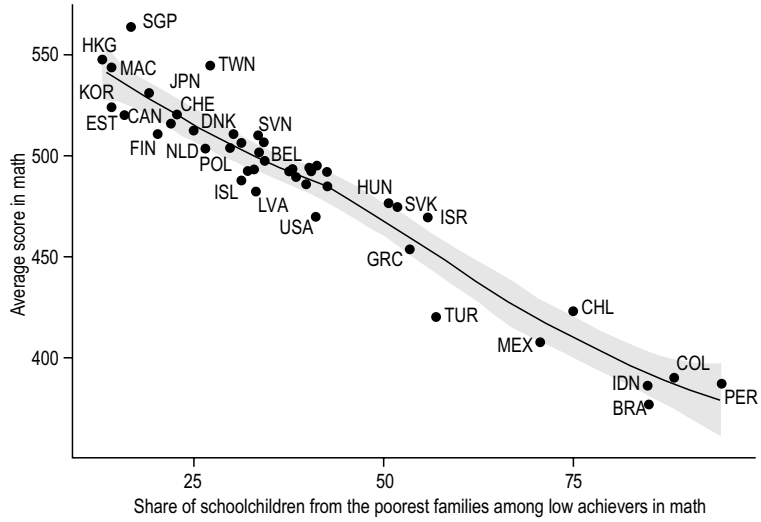
Discussion

This study, based on the econometric methods of causal analysis, provides a rationale for prioritizing interventions that support schoolchildren from families with low socio-economic status. This group of schoolchildren is the key focus of interventions aimed at developing effective and equitable education systems. Our analysis has confirmed a causal relationship between the socio-economic status of a child's family, their academic achievement, and proficiency in non-cognitive skills. Cross-country comparisons also reveal a strong statistical association between the phenomenon of low achievement among schoolchildren from the poorest families and the overall effectiveness of the education system. Figure 7 presents aggregate PISA scores [OECD, 2016b], which show that countries and territories where the majority of low achievers in mathematics come from the poorest families receive low average scores in PISA for this subject. There is a clearly identifiable cluster of countries and territories with less than 25% of low-achieving schoolchildren coming from the poorest families — and with the highest average scores. They are Hong Kong, Macao, Singapore, Taiwan, Finland and Estonia. Conversely, the countries where learners from the poorest families account for more than 75% of low achievers perform worst in educating schoolchildren. These countries are Indonesia, Colombia, Brazil and Peru. Thus, government support for the education of children from the poorest families can be considered one of the ways to ensure sustainable development of the education systems.

Public programs that focus on the development of non-cognitive skills can significantly improve the academic performance of schoolchildren, and the impact of investments in non-cognitive competencies will be greatest for the most vulnerable student groups — children from the poorest families. Although the current educational standard mentions non-cognitive skills as one of the priorities of general education, it lacks specific solutions for building and developing these competencies.

The experience of incorporating socio-emotional learning (SEL) programs into educational standards suggests that these programs have social and economic benefits beyond the education systems. For instance, a meta-analysis of 213 SEL programs implemented in preschools and schools around the world and involving more than 270,000 learners showed that participants in these programs sig-

Figure 7. **Scatter Plot: Average Mathematics Score by Country/Territory as a Function of the Proportion of Schoolchildren from the Poorest Families among Low Achievers in Mathematics**



Source: PISA 2015 aggregated cross-country scores.

nificantly increased their social and emotional competencies, which ultimately improved the quality of education at the macro-level [Durlak et al., 2011]. Moreover, these programs helped build positive relationships between teachers and students, which in its turn strengthened learners' attachment to school and contributed to a safe educational environment that encouraged prosocial behavior. Improving non-cognitive skills through SEL programs develops a positive sense of self in students and, in addition to enhancing academic performance, encourages prosocial behavior, contributes to addiction prevention, and improves their mental health [Sklad et al., 2012].

A benefit-cost analysis of SEL programs' effectiveness has confirmed that investments in these programs are economically justified [Lee et al., 2012; Jones et al., 2008; Miller, Hendrie, 2009]. For example, returns from New York City's three-year SEL program called 4Rs (Reading, Writing, Respect & Resolution), which focuses on non-cognitive skills, literacy, and aggression reduction in preschool and primary school children, are $1.2 million per 100 learners, while the program implementation costs are $55,000 per 100 learners [Jones et al., 2008; Belfield et al., 2015]. In the empirical studies of non-cognitive skills, economists focus on a social group often excluded from psychological research — the poorest population cohorts in developing countries [Wuepper, Lybbert, 2017].

Such support programs are critical for low-achieving schoolchildren at risk of dropping out of school, as without a completed secondary education these children might join the ranks of the unem-

ployed [Dianda, 2008]. Transition from basic to secondary school is a nother phase of schooling that requires support programs for low achievers , as the learning challenges that arise during this period can lead to a major delay in human capital accumulation in adulthood [Yeager et al., 2019].

SEL programs targeting the development of specific skills have been implemented both at the micro-level (in individual schools) and at the national scale. For example, in Finland, targeted development of self-efficacy and task mastery improved the achievements of primary school students with poor numeracy skills [Koponen et al., 2021]. Self-efficacy intervention programs yielded positive results in promoting a healthy lifestyle and consumption culture among students with psychological barriers to physical activity [Lee, Arthur, Avis, 2008; Bouwman et al., 2020] as well as in addiction prevention [Hyde et al., 2008]. An economic program aimed at developing self-efficacy and improving self-esteem in children and adolescents from the urban slums of Mumbai resulted in a one standard deviation increase in self-efficacy and self-esteem measures; this increase in non-cognitive skills had an impact on students' final examination scores, choice of labor market strategies, and long-term goals [Krishnan, Krutikova, 2013].

Programs aimed at developing a sense of belonging have proved successful in cultivating an inclusive educational environment [Allen et al., 2021], which is especially relevant in multicultural Russian society. Developing a sense of belonging at school and a growth mindset in schoolchildren contributes to an inclusive and harmonious environment in educational institutions with ethnic and racial minorities [Walton, Cohen, 2011; 2007].

Implementing growth mindset interventions as part of educational programs is one of the most effective intervention strategies for students at risk of poverty, expulsion from school, underachievement, and social rejection. These programs are based on the belief that intelligence and skills can improve if students work hard at challenging tasks, seeing obstacles as an opportunity for effort and growth rather than as a failure [Paunesku et al., 2015]. An eight-hour course in growth mindset development taught by psychologists improved the mathematics scores of low-achieving 7th graders [Blackwell, Trzesniewski, Dweck, 2007]. As a result of extensive online training in growth mindset conducted for more than 1,000 learners in different geographic regions of the United States, the semester grades in key subjects of high school students increased, and the proportion of schoolchildren with failing grades decreased by 10%. The training proved particularly effective for students who were at risk of dropping out of school: in this group, the average standardized score in key subjects increased by 0.14 standard deviation after the training [Paunesku et al., 2015].

In the United States, an experiment with a nationwide sample of more than 6,000 high school students showed that an online, low-cost program in growth mindset development led to higher average scores in key subjects among low-achieving students at risk of poverty. In the academic literature, this experiment is the most extensive effort in implementing a growth mindset program that has produced results at the level of the entire education system rather than individual schools [Yeager et al., 2019].

In order to respond promptly to the challenges of time, the Russian education system must transform in accordance with the demands of the economy and society. The analysis undertaken in this paper suggests that there is a causal relationship between socio-economic status, learning outcomes, and non-cognitive skills of schoolchildren. Incorporating socio-emotional learning programs into a state educational standard of basic education is certainly not a universal solution to the problem of poverty and social exclusion in Russian or any other society. Still, the acquisition of key skills and competencies necessary to compete successfully in modern economies by at-risk schoolchildren can help them out of poverty by creating channels for upward social mobility. Integrated measures combining both economic policy and interventions aimed at the psychological factors of poverty are more effective than working exclusively with the institutional causes of poverty [Wuepper and Lybbert, 2017; Banerjee and Duflo, 2011; Banerjee et al., 2015].

Recommendations

Elimination of poverty and reduction of the risks associated with inequality refer to the key objectives of the public stakeholders with regards to the accumulation and reproduction of human capital. Effective education policy can make a significant contribution to the solution of this problem. The results of this study suggest that the development of certain non-cognitive skills in students can alleviate the effects of poverty on learning outcomes and thus contribute to reducing the inequalities reproduced in the education system. Programs for the development of non-cognitive skills should be deployed at the federal level as well as in the framework of regional and municipal initiatives and public-private partnerships.

While this article has examined the effects of such non-cognitive characteristics as growth mindset, grit, self-efficacy, sense of belonging at school, self-confidence, and task mastery, potential socio-emotional learning programs should also target characteristics not included in this taxonomy. The implementation of these programs requires further cooperation between psychologists and economists: the former should focus on research on key personality traits and approaches to their development, the latter on scaling up these initiatives to the regional and national levels, as well

as measuring the benefits from developing these skills. Modernizing the education system by incorporating socio-emotional learning programs into the state standard of basic education will improve learning outcomes, creating positive triggers for the transformation of the socio-economic system.

It is needed to expand the value-normative basis of education policy and modernize it based on the principles of meritocracy. To achieve the targets of Sustainable Development Goal 4, it is necessary to accelerate the introduction of social inclusion into the education system, thus creating opportunities for the accumulation of human capital regardless of students' ascribed characteristics. In other words, educational programs should be adapted so that they ensure compensatory development of non-cognitive skills in children from vulnerable social groups to bridge the gap in learning outcomes between them and students from families with higher socio-economic status.

The modernization of the education system by including socio-emotional learning programs requires the development of a set of psychological techniques to facilitate program implementation and provide institutional support for groups with unconventional educational demands. Supplementary education and extracurricular programs, training and intensives focusing on the development of non-cognitive skills and targeting low achievers and children at risk of poverty will contribute to the transformation of the education system on the principles of social inclusion and equitable opportunities.

There is a gap in the education system between the special educational demands from socially and economically deprived groups and the ability of the education system to provide institutional mechanisms to meet these demands in a socially inclusive manner. In particular, there is a lack of skilled personnel: the education system urgently needs to revise the occupational standard of the school psychologist and social pedagogue, launch massive training programs for these jobs and form a new competence profile of general education staff.

These recommendations can be incorporated in the strategic planning documents being developed for education, such as the Concept of Teacher Training for the General Education System Until 2030. Whether students' performance can be improved in practice by investing in their non-cognitive skills will depend on how flexible the professional community and education policy makers will respond to the identified challenges.

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Appendix 1
Descriptive Statistics for Questions on Non-Cognitive Skills, %

No.	Question	Strongly disagree	Disagree	Agree	Strongly agree
	Growth mindset				
1	Your intelligence is something about you that you can't change very much	21	38	30	11
	Sense of belonging at school				
1	I feel like an outsider (or left out of things) at school	8	18	52	22
2	I make friends easily at school	14	54	26	6
3	I feel like I belong at school	14	57	24	5
4	I feel awkward and out of my place in my school	7	25	50	18
5	Other students seem to like me	11	52	30	7
6	I feel lonely at school	7	20	50	23
	Task mastery				
1	I find satisfaction in working as hard as I can	7	29	54	10
2	Once I start a task, I persist until it is finished.	4	24	56	16
3	Part of the enjoyment I get from doing things is when I improve on my past performance	4	15	66	15
4	If I am not good at something, I would rather keep struggling to master it than move on to something I may be good at	5	22	57	17
	Self-efficacy				
1	I usually manage one way or another	4	29	58	9
2	I feel proud that I have accomplished things	4	20%	62	14
3	I feel that I can handle many things at a time	4	35	52	9
4	My belief in myself gets me through hard times	5	20	59	16
5	When I'm in a difficult situation, I can usually find my way out of it	3	15	65	17
	Grit				
1	Trying hard at school will help me get a good job.	31	48	14	7
2	Trying hard at school will help me get into a good university (institute, college).	35	52	7	6
3	Trying hard at school is important.	28	49	16	7

No.	Question	Strongly disagree	Disagree	Agree	Strongly agree
	Fear of failure				
1	When I am failing, I worry about what others think of me.	14	33	42	11
2	When I am failing, I am afraid that I might not have enough talent.	13	39	39	9
3	When I am failing, this makes me doubt my plans for the future.	15	36	38	11

Source: authors' calculations based on the PISA 2018 data for Russia.

Appendix 2
Average Values of Standardized Scores for Non-Cognitive Skills by Gender, Residence and Socio-economic Status of Schoolchildren

Skills	Gender		Residence		Socio-economic status	
	Male	Female	Urban	Rural	Poorest 20%	Wealthiest 20%
Growth mindset	–0.03	0.03	0.02	–0.07	–0.1	0.07
Sense of belonging at school	0	0	0	0	–0.09	0.13
Task mastery	–0.01	0.01	–0.01	0.02	–0.11	0.17
Self-efficacy	0.04	–0.04	0.01	–0.04	–0.16	0.22
Grit	–0.07	0.07	–0.02	0.06	0.01	0
Self-confidence	0.13	–0.13	–0.01	0	–0.05	0.01
Reading	467.66	492.63	490.54	447.63	441.11	511.84
Mathematics	491.51	486.1	498.14	459.99	450.93	521.58

Note. Non-cognitive characteristics are standardized to the mean. General descriptive statistics for the sample are presented in Table 1 in the body of the article.

Source: authors' calculations based on the PISA 2018 data for Russia.

Appendix 3
Proportions of Schoolchildren With Well-Developed Non-Cognitive Skills and Poor Reading and Mathematics Skills, Total and by Their Gender, Residence and Socio-economic Status (%)

Skills	Total	Gender		Residence		Socio-economic status	
		Male	Female	Urban	Rural	Poorest 20%	Wealthiest 20%
Growth mindset*	19	21	18	20	16	15	26
Sense of belonging at school*	19	19	19	19	18	15	24
Task mastery*	18	18	18	18	18	13	25
Self-efficacy*	17	18	17	17	15	11	24
Grit*	26	24	29	25	28	26	28
Self-confidence*	32	37	27	32	32	30	35
Reading**	21	26	16	18	31	34	15
Mathematics***	19	19	19	16	29	34	10

* Schoolchildren with well-developed non-cognitive skills include all schoolchildren who have a value of 0.5 or higher on the scale standardized to the mean.
** Schoolchildren with poor reading and mathematics skills include all who score below a certain threshold on a standardized test in the OECD classification.

Source: authors' calculations based on the PISA 2018 data for Russia.

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Teachers' Agency in Shaping the Educational Success of Schoolchildren: Roles and Beliefs

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Abstract

All over the world, educational and, particularly, curriculum reforms cannot take root if their stakeholders are not engaged in the process. To implement reforms successfully, policymakers should seek to foster teacher agency—their proactive autonomous activity to question and then change their usual schooling routines. Yet, to adopt such an agentic attitude, teachers should feel confident that they have the capacities, ways, and opportunities to bring about a positive change in their students' learning.

Our study seeks to explore teachers' perceptions about the main factors of students' academic success—how it the latter are distributed between the school, the family, and students themselves. We use a mixed methods strategy to analyze the results of 12 focus groups (over 100 participants) and a Russian national survey of over 4,000 teachers.

As our results reveal, over half of the teachers believe that their efforts and other school factors do not affect students' academic success. The teachers are convinced that it is mostly children's own learning efforts, as well as support from their families, that contribute to academic success—and see both as lying beyond their immediate control. School, thus, is but an framework to unleash students' potential planted by the family. This brings us to the conclusion that, currently, teachers' beliefs are unlikely to allow for the level of agency needed to reconsider and transform usual routines, as may be required for a successful curriculum reform.

Keywords

teachers agency, educational reform, curriculum reform, academic success of schoolchildren.

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Over the last decades, the education system in Russia, as well as in the rest of the world, has been undergoing continuous reform. One of the main components of today's reform is the regular updating of educational standards and programmes (curriculum). The educational standards are designed to regulate the so-called educational outcomes, which include not only the traditional subject outcomes but also metadisciplinary (universal) (e. g. students' ability to independently define goals and ways to achieve them, the ability to set up collaborative learning and joint activities, the ability to communicate) and personal ones (e. g. students' willingness and ability to engage in self-development and self-education and the competence of communicating with same-age peers). The new categories of educational outcomes aim to reinforce the traditional subject-specific, knowledge-oriented teaching with the development of metadisciplinary and personal competencies. The latter should enable students to apply knowledge in various situations, master new knowledge efficiently, i.e. to be capable of learning, and achieve personal and professional success both in the learning community and modern society.

The current standards of general education were adopted in the early 2010s. That version of standards gave schools more leeway in designing educational programmes and implied schools and teachers' active involvement in developing curricula. In 2020–2021 the standards were updated again. In particular, the 2021 version, which will soon be introduced in schools, describes metadisciplinary and personal competencies in a more detailed and systematic way, which is in line with the current policy of expanding the range of expected educational outcomes. In other words, according to the current standards as well as the new ones being introduced, teachers should both provide subject-specific knowledge and develop students' universal competencies.

The changes in the standards listed above imply a significant revision of teachers' pedagogical practices. Although the current version of the standards is already 10 years old, experts and researchers agree that it works for the most part only on paper [Dobryakova, Froumin, 2020]. The educational process and teachers' practices have not changed as was expected when the standards were being developed and introduced. Frontal instruction still prevail in schools. Knowledge transfer remains the main goal of teaching, and the development of competencies set out in the standards is not considered the school's responsibility at all [Dobryakova, Yurchenko, Novikova, 2018].

Some researchers consider the gap between the planned educational reform and its implementation to be quite understandable and predictable [Tyack, Tobin, 1994]. The fact that ambitious

education reforms are rarely implemented exactly as intended and only a few of them turn out to be sustainable and long-lasting was already discussed a lot in the 1990s. As much as reform transforms schools, schools transform the reform; it has even been proposed to redefine the success criteria for this kind of initiatives [Cuban, 1998]. By the 2010s, the indication of the discrepancy between intention and practice had become commonplace in studies on curriculum reform [Priestley et al., 2012]. At the same time, there is no agreement among researchers on the causes and mechanisms of this discrepancy and, consequently, the ways to reduce it. Some examine the quality of the policies being pursued and organizational arrangements for reform, for instance, assess the role of regulatory documents in the reform of educational standards [Bergqvist, Bergqvist, 2017]. Others highlight the role of the attitudes, motivations, and behaviours of the change agents: teachers, administrators, and other stakeholders [Kasprzhak et al, 2015].

The empirical evidence suggests that the relation between teachers' beliefs and the ideas that the reforms are based upon — whether they concur or conflict — is closely associated with the success of change implementation [Levin, Nevo, 2009]. However, the beliefs prevailing among teachers alone cannot be used to predict the outcome of reforms. The success or failure of reforms often depends not so much on teachers' beliefs and informed choices, but rather on the cognitive processes that take place when teachers are making sense of the reforms [Spillane, Reiser, Reimer, 2002]. Resources available to teachers, opportunities to participate actively in the discussion and implementation of a reform, and teachers' ability to reflect on its progress and consequences play an important role here. Research has shown that teachers' willingness to change their professional practices is closely related to their opportunities to actively engage in collective sense-making and discussion of the changes, both at the conceptual and strategic level and at the level of implementation [Spillane, 1999]. Since the early 2000s, teacher engagement in education reform has been studied by many researchers using the theoretical framework of agency. From this perspective, the previous studies seem to be somewhat simplistic and one-dimensional and overlook important aspects of teachers' work.

Social sciences and psychology have a long tradition of conceptualizing the notion of agency. Contemporary research defines teachers' professional agency as a socio-culturally determined possibility and ability to make decisions and act independently in the professional environment [Eteläpelto et al., 2013; Priestley, Biesta, Robinson, 2015]. In the reform process, teacher agency refers to teachers' making sense of and interpreting the proposed chang-

es, as well as actively implementing them. Once in the reform environment, teachers make sense of the proposed ideas and imposed requirements, integrate them into their current understanding of the educational process, assess the possibilities and limitations determined by the context, and decide on how to act [Priestley, Biesta, Robinson, 2015]. Teachers' autonomous agentic actions are not always aimed at supporting the reform. Some teachers may consciously resist the changes. Therefore, active teacher engagement does not ensure the success of reform but is a prerequisite for its success.

Any significant transformation requires a shift in established practices and routines, as well as a revision of ideas and familiar roles, which cannot be achieved without teachers' active engagement in the process of change. Engagement is especially important when most of the teacher corps already have extensive work experience and established patterns of behaviour. In 2020, the average age of Russian teachers was 45–49 years; many of them had more than 30 years of experience[1].

The notion of agency is multifaceted. In this study, we focus on one of its components — self-efficacy, or teachers' belief in their ability to perform actions that influence the situation and the results of their work. A. Bandura was the first one to study the manifestations of agency through the lens of self-efficacy. In his classic article, he explicitly argues that the most important prerequisite for the manifestation of agency is an individual's belief in his or her ability to exercise control over events. [Bandura, 1989]. Bandura also managed to show empirically that self-efficacy is the key determinant of personal agency [Bandura, 2001; 2006]. Unless people believe they can influence the situation, they perform no agentic actions. The exercise of agency is also impossible when individuals have no choice and when they continuously pursue established modes of action.

During the ongoing reform of the Russian education system, teachers' role in implementing change has not been given the necessary attention. In recent years, several studies have been conducted on teachers' attitudes during the reform process. In particular, the research group of M. S. Dobryakova has set up a nationwide survey and focus group discussions with teachers who work in schools situated near Moscow to assess the teachers' attitudes and beliefs, and how these align with the focus of the education system on achieving meta-subject outcomes [Dobryakova, Yurchenko, No-

[1] Information as per the Federal Statistical Monitoring form No. OO-1 'Information about the organization carrying out educational activities according to the educational programs of primary general, basic general, and secondary general education' as of the beginning of the 2020–21 school year: https://docs.edu.gov.ru/document/ed3ca74f26a1dc055a313991f66d2fa3/

vikova, 2018]. Another study explores teachers' attitudes towards creative thinking as one of the metadisciplinary learning outcomes and how these attitudes affect teachers' efforts to change their practices [Avdeenko, 2021]. These studies certainly do not suffice and there is still a lot of work ahead to understand the specifics of Russian teachers' role in the curriculum reform.

Thus, the ongoing curriculum reform in Russia is aimed at transforming the educational process in a significant way. The list of expected educational outcomes has been extended to include metadisciplinary and personal competencies. Such reform is unlikely to succeed without active teacher engagement, which in turn requires that teachers believe in their ability to act independently and influence the outcomes. However, there is almost no data on how important Russian teachers consider their role to be in determining learning outcomes.

In this study, we seek to answer the following questions.

1. How do teachers reflect the role of school factors in achieving student educational outcomes?
2. What is the relationship between teachers' high level of agency with respect to student academic success and teachers' assumption of responsibility for achieving metadisciplinary learning outcomes?
3. How do teachers explain the role of particular factors in achieving student educational outcomes?

1. Methodology

The study uses data collected in the framework of the collaborative project *Key Competences and New Literacy* implemented by the Institute of Education of the National Research University Higher School of Economics (HSE University) and the Sberbank Charitable Foundation *Investment to the Future*. As part of the project, a national online survey of Russian teachers[2] was conducted in February–May 2018 to identify teachers' views on education, school atmosphere, as well as teaching and grading methods. 4405 teachers from 84 regions of Russia took part in the survey: 95% of the sample were women; the average age of the respondents was 45 (SD — 10 years); 21% live in cities with a population of over one million, 20% in the cities with a population of 250,000 to one million, 27% in the cities with a population under 250,000, and 31% in villages and hamlets.

In May 2018, twelve focus groups were conducted in six schools of theMoscow oblast (in the cities of Orudyevo, Dmitrov, Podolsk, Fryazino, and Voskresensk) to find out teachers' general attitudes

[2] The HSE University conducted the survey in partnership with the *Russian Textbook* Corporation.

towards their work, students, as well as towards the objectives and the process of education. Each focus group consisted of 8 to 10 primaryor secondary school teachers.

The results of the teacher survey were used to answer the first research question of this study. Teachers were asked about their responsibility for developing students' various skills and competencies: "Who do you think should be primarily responsible for ensuring that children can/know one of the following?" The answer options included "school/teachers", "clubs/groups", "family", "children". The respondents were asked to answer the question concerning the following items:

1) can think creatively and outside the box;
2) be responsible citizens interested in what is going on around them and ready to change things if necessary;
3) can express their thoughts well orally and in writing;
4) can get along and work together with different people;
5) be interested in learning new things and eager to study;
6) can manage time and prioritize;
7) can distinguish between true and untrue information (fact and fiction);
8) have a good knowledge of the main subjects of the school curriculum;
9) can apply the acquired knowledge in everyday life;
10) treat with respect all people they meet in life regardless of their status.

This list includes a group of skills that are identified as metadisciplinary and personal educational outcomes under the Federal State Educational Standards, and developing these skills is one of the goals of the standards' revision. These metadisciplinary learning outcomes are creative thinking (1), communication and collaboration (4), self-management (6), and critical thinking (7); the personal outcomes are civic responsibility (2) as well as motivation and interest in learning new things (5).

During the survey the teachers were also asked the following: "What would you consider the most important factor for children's academic success?" and "What would you consider the biggest barrier to children's academic success?" whereby they had to choose at least three of the ten answer options (Table 1). The option "Other" was available but was not used in further analysis.

Answer options 4, 6 and 10 imply the high importance of teachers themselves and the school factors, which are at least partially under the teachers' control, for children's learning success. If a respondent has chosen these answer options (we group them into the factor called "school"), this indicates the respondent's belief in

Table 1. **Answer Options to the Questions about the Factors of Academic Success and Failure**

What would you consider the most important factor for children's academic success?	What would you consider the biggest barrier to children's academic success?
1. Good innate abilities	1. Poor innate abilities
2. Children's efforts (diligence, discipline)	2. Children making no effort (not doing their best, poor discipline)
3. Children's interest in what they are learning	3. Children are not interested in what they are learning
4. Interesting instructional materials (textbooks, problem books, etc.) available in print or electronic format	4. Boring textbooks
5. Children's high ambitions	5. Lack of ambition
6. Children's positive attitude towards the school and teachers (psychological comfort at school)	6. Children do not like the school or teachers
7. High education level of parents, home environment (education is valued)	7. Low education level of parents, home environment (education is not valued)
8. Availability of financial resources in the family (private tutors, clubs)	8. No financial resources available in the family (no private tutors and clubs)
9. Parental support in the form of supervising children's learning process	9. No supervision of homework by parents
10. Teachers' good performance	10. Teachers' poor performance

his or her own ability to influence the learning outcome and, consequently, is associated with a high level of agency. Other answer options are grouped under the factors "student" (statements 1, 2, 3, 5) and "family" (statements 7 and 8). If a respondent has chosen at least one statement associated with one of these two factors, we interpret this as the selection of this factor.

To answer the second research question, a series of logistic regressions were performed. The dependent variable is the selection of the school / teachers as actors responsible for each of the skills or competencies. The independent variables are teacher characteristics (years of experience, teaching in primary school, and attitude towards work), the size of the settlement, and the selection of the answer options in the questionnaire where school factors are claimed to make an important contribution to student academic success or failure.

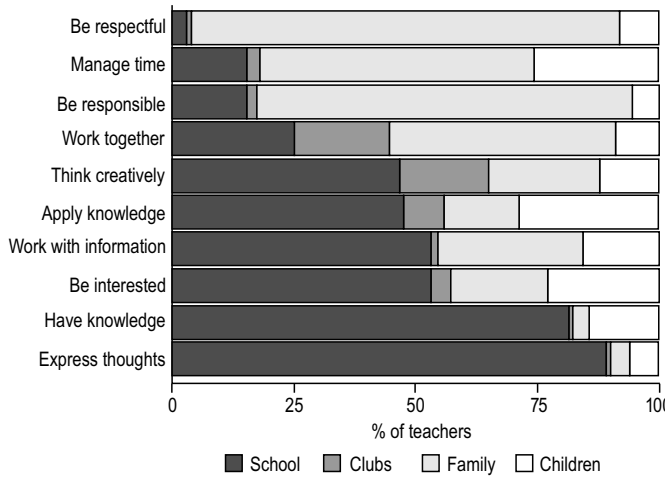
To answer the third research question, the results of focus groups were analyzed. The focus group participants discussed, among other things, teachers' understanding of the notion 'good/successful student' and the factors that help or hinder schoolchildren to achieve success.

2. Results

2.1. Teachers' assessment of the school, family and students' contribution to student academic success

Less than a quarter of the survey respondents believe that the school / teachers are responsible for developing in schoolchildren the skills of treating others with respect (3%), managing time and prioritizing (15%), and being a responsible citizen (15%) (Figure 1). According to the teachers surveyed, the development of these qualities falls under the responsibility of the family and the children themselves. More than a half of the respondents say that schoolchildren should learn to get along with others and work in a team, think creatively and apply the acquired knowledge in real-life situations outside of school — in clubs, at home, or individually. A little more than half of the respondents acknowledge that fostering students' interest in learning new things and willingness to study (53%), and developing the ability to distinguish between true and untrue information (53%) is the task of the school and teachers. Teachers most often consider the school and themselves responsible for teaching students to express their thoughts orally and in writing (89%) and ensuring that students acquire knowledge within the school curriculum (82%). Thus, teachers believe that the main role of the school / teachers is knowledge transfer, whereas the application of the acquired knowledge and the development of non-cognitive skills, such as working in a team, self-management, and creative thinking, should not be the school's responsibility.

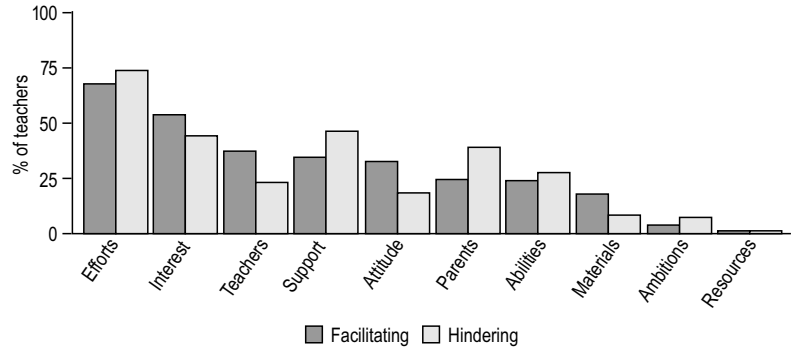
Figure 1. **The distribution of responsibility for knowledge acquisition and skills development in students, according to teachers**



The factor contributing to students' academic success that is most often mentioned by teachers is students' efforts: it is chosen by 67% of the respondents (Figure 2). The lack of effort is most often chosen as a barrier (74%). The second most frequently mentioned hindering factor is the insufficient level of parental assistance (46%),

while sufficient parental assistance is the third most frequently chosen facilitating factor (34%). The second most frequently chosen contributing factor is children's interest in what they are learning (53%), whereas the lack of such interest ranks third among hindering factors (44%). Thus, according to teachers, the three most important factors, which can both hinder and help to achieve success in school, are students' efforts, students' interest, and parental assistance. None of these factors implies a high level of teacher agency, especially given the fact that about a half of the respondents do not consider the school and teachers responsible for developing children's interest in learning.

Figure 2. **Percentage of teachers who selected a particular factor as facilitating or hindering academic success**



The factors that, if selected, would indicate high teacher agency, such as teacher performance, instructional materials, and psychological comfort at school, are considered the least important hindering factors. For these factors, the difference between how frequently they are selected as hindering and facilitating is the biggest. The positive role of the school factors in ensuring student success is much more often highlighted by the teachers. All other factors, except for children's interest in learning, are more often seen as hindering than facilitating. That is, teachers more often see them as barriers to success, while school-related factors are more often perceived as key to success.

In general, teachers are fairly consistent in their choice of students' success/failure factors (Figure 3). There are four factors, however, that are often chosen as facilitating but not as hindering ones: children's interest in learning, teacher performance, attitudes towards the school, and instructional materials.

One of the three groups of factors (related to students, the family or the school) is assessed more consistently: 95% of teachers evaluate the student-dependent factors as hindering and the same per-

Figure 3. **Percentage of teachers who selected each factor as facilitating or hindering**

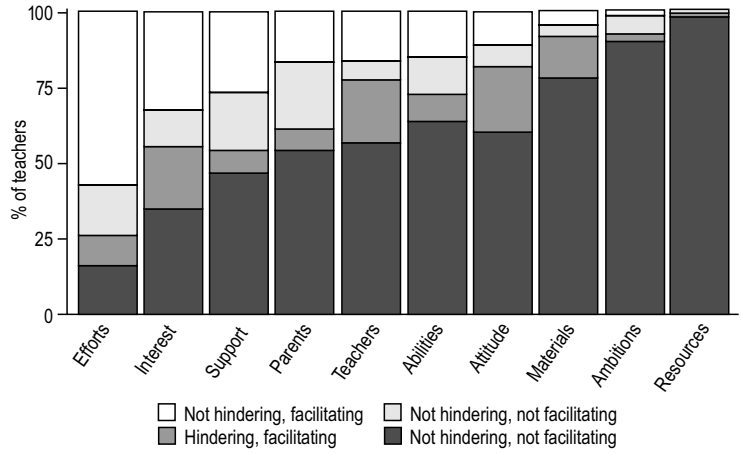
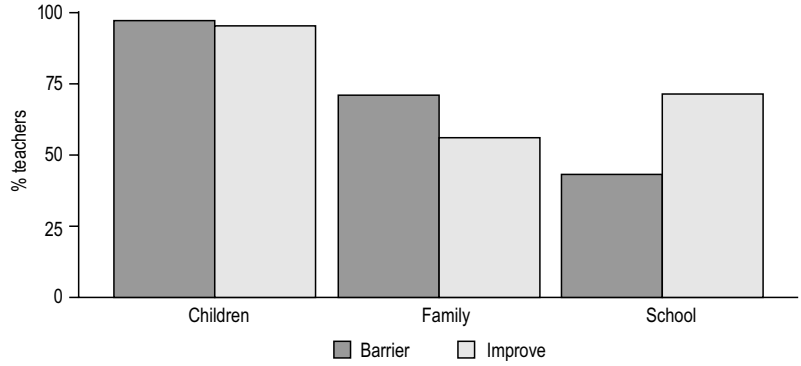


Figure 4. **Percentage of teachers who selected at least one factor from a particular group as facilitating or hindering**



centage of teachers see them as facilitating (Figure 4). While 70% of teachers perceive the school as a contributing factor, only 43% consider it a hindrance. 55% of teachers believe that the family helps to achieve academic success, while 70% think it hinders (in case the family contribution is insufficient).

The logistic regression analysis shows that the teachers who did not choose school factors as facilitating or hindering student success were less likely than others to believe that the school and teachers should be responsible for the metadisciplinary and personal learning outcomes, in particular for developing creative thinking, collaboration skills, and interest in learning (Table 2). For creative thinking and interest in learning, this relationship remains after controlling for such teacher characteristics, as years of experience, teaching in primary school, and the type of the settlement where

Table 2. **Logistic Regression Results, the Dependent Variable is the Selection of the School as Responsible for Particular Knowledge/Skills (Odds Ratio)**

	Thinking creatively	Being responsible	Working in a team	Being eager to learn	Managing time	Identifying untrue information	Applying knowledge
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Did not choose the school as hindering or facilitating academic success	0.91***	0.98*	0.96**	0.93***	0.98*	1.00	0.98
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
Constant	1.63***	1.17***	1.30***	1.733***	1.17***	1.70***	1.62***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Number of observations	4401	4403	4401	4401	4401	4401	4401
Log Likelihood	–3171.24	–1749.43	–2557.56	–3177.86	–1751.92	–3185.27	–3187.91
AIC	6346.48	3502.87	5119.12	6359.72	3507.85	6374.55	6379.82

*$p < .10$, **$p < .05$, ***$p < .01$.

a school is located (Table 3). Respondents who have been working in school longer more often choose the school and teachers to be responsible for developing creativity and critical thinking (the ability to distinguish between true and untrue information) and less often for fostering civic responsibility and collaboration skills. While primary school teachers are inclined to believe that the school and teachers should be responsible for developing creativity, compared to basic and secondary school teachers, they are less likely to recognize the school and teachers' role in developing critical thinking and the skill of applying knowledge to practice.

Thus, the majority of the respondents think that the school and teachers are responsible for transferring knowledge and ensuring that the students develop the skill of expressing their thoughts. More than half of the respondents believe that the school and teachers should not be held responsible for developing metadisciplinary learning outcomes. 50 to 75% of teachers are convinced that school factors cannot ensure student academic success. Consequently, it is assumed that the majority of teachers do not possess a high level of agency. Moreover, there is a relationship between considering school factors decisive in achieving academic success and assuming responsibility for developing other than subject-specific skills. In other words, low teacher agency applies to all learning outcomes. Using the focus group material, we will further analyze the incentives and barriers teachers identify when talking about the factors of student learning success.

Table 3. **Logistic Regression Results, the Dependent Variable is the Selection of the School as Responsible for Particular Knowledge/Skills, Control Variables Added (Odds Ratio)**

	Thinking creatively	Being responsible	Working in a team	Being eager to learn	Managing time	Identifying untrue information	Applying knowledge
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Did not choose the school as hindering or facilitating	0.91***	0.99	0.97	0.93***	0.98	1.00	0.98
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Years of experience (stand.)	1.08***	0.98***	0.98***	1.01	0.99	1.02***	0.99
	(0.01)	(0.01)	(0.01)	(0.1	(0.01)	(0.01)	(0.01)
Primary school teacher	1.07***	1.00	0.99	1.01	1.02	0.91***	0.95***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
Settlement type: village, hamlet (ref.)							
Settlement type: a city with a population of up to 250,000	0.99	0.98	1.03	1.01	0.97*	0.99	1.04*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Settlement type: a city with a population of 250,000 to 1 million	0.98	0.99	1.00	1.01	0.95***	0.98	0.98
	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)	(0.03)
Settlement type: a city with a population of over 1 million	0.95**	0.98	1.02	0.99	0.97**	1.04	1.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Definitely glad to be working as a teacher	1.06***	1.05***	1.04**	1.04**	1.03**	1.00	1.03
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
Constant	1.56***	1.15***	1.25***	1.69***	1.19***	1.76***	1.61***
	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
Number of observations	3408	3410	3408	3408	3408	3408	3408
Log Likelihood	–2391	–1320	–1948	–2457	–1394	–2443	–2461
AIC	4798.43	2656.44	3913.89	4931.14	2804.45	4902.67	4938.22

*p < .10, **p < .05, ***p < .01.

2.2. How teachers interpret the factors of students' academic success

Teachers believe that the academic success of students is closely interwoven with their personal qualities, such as "interest", "good manners", and "culture". Teachers often say explicitly that a good student is not the one with high grades, but the one who possesses a set of certain personal qualities. When speaking of success, almost none of the teachers mean academic progress (grades), and they limit the school's area of responsibility primarily to knowledge

transfer. This bias towards a student's personality has to be taken into account when interpreting the results of the focus groups.

2.2.1. Achieving academic success requires abilities, but the school and teachers cannot influence them

According to the survey results, the majority of teachers believe that student-related factors contribute most to student success and failure in school. Some 95% of teachers have chosen student-related characteristics as crucial factors of both success and failure, whereby 70% of teachers refer to children's efforts, about 50% choose their interest in learning, and about a quarter of the respondents mention abilities.

Focus group discussions have yielded similar results. Among student-related success factors, teachers primarily mentioned students' abilities and motivation. Some of them were convinced that schoolchildren possess a set of given, innate, unchangeable characteristics. In particular, they mentioned genetics, innate literacy, and certain predispositions.

> Well, if a child is not predisposed to it [literacy], I think it is unlikely to happen. Literacy development… In this case, however hard you try a child will not become a literate person (school 1, focus group 2).
> **Interviewer:** And what do you think prevents children from being what we consider "good"?
> **Respondent:** Bad genetics… Yes, that's right! You either have innate literacy or not, it is an officially recognized fact (school 2, focus group 2).
> **Respondent 1***:* Their abilities.
> **Respondent 2***:* Nature. Whatever is given by nature.
> **Respondent 3:** Some people are, for example, bad at reading, but good at counting. They were born with it (school 1, focus group 3).

2.2.2. Motivation is an important success factor, but it is a family responsibility

Interest, motivation, and its opposite — laziness — are mentioned as success or failure factors in almost every focus group discussion. Teachers often do not make a clear-cut distinction between the notions of motivation and interest. They consider this factor key to success. Moreover, interest is often mentioned as a key characteristic of a 'good' student, while the lack of interest is perceived as a serious hindrance to learning success.

> **Interviewer:** What obstacles do children face?
> **Respondent 1:** Laziness.
> **Interviewer:** What is laziness?
> **Respondent 1:** Disinclination to act.
> **Respondent 2:** Lack of willingness.

Respondent 1*:* Lack of motivation.
Respondent 3: Being unaware of the seriousness, perhaps.
Respondent 2: Passivity.
Respondent 3: Lack of responsibility (school 1, focus group 2).

While only about a quarter of the survey respondents considered the family to be responsible for developing children's interest in learning, the overwhelming majority of the focus group participants identified the family as the main source of motivation and interest in learning. When elaborating on the family's role in stimulating children's interest in learning, teachers pointed to the fact that it is important to give children a good example.

Interviewer: What helps children to become good students? What can influence children so that they become good students?
Respondent 1: Motivation.
Respondent 2: In the beginning the home situation decides it all.
Respondent 1: That's what I am saying too — motivation, or what children go to school for. They have to understand it. This is something that is instilled in the family (school 4, focus group 1).

Children look at them [parents], they set an example which the children, naturally, follow. If parents read a lot of books, their child sees it and starts reading too. And if parents don't read, but say that it must be done, the child won't start reading (school 2, focus group 1).

Apart from motivation, teachers mention another important family-related factor of academic success — parental support, including psychological one. While almost none of the survey respondents considered the family's financial situation as a major factor, the focus group participants mention the relationship between the family's wealth and children's academic success multiple times.

The current education system is structured in such a way that without the family's support he [or she] is unlikely to be a good, honors student. This is because education relies a lot on self-studying at home (school 1, focus group 1).

This implies psychological and other support from parents since it is difficult for children to manage everything and get everywhere on their own. Parents can bring them to some events, or help them to buy textbooks or other school supplies (school 1, focus group 3).

Thus, elaborating on the results of the questionnaire survey, it can be concluded that it is the family that teachers consider the main actor determining the achievements of a student. Although

teachers most often link students' academic success to students' characteristics, they believe that these characteristics, in particular malleable ones, are determined by and developed in the family.

The respondents explain the primary role of a student in his or her academic success mainly by two factors. On the one hand, there are "innate abilities", which a student is or is not born with, but which in any case are beyond the school's control, no matter how hard it tries to support and develop them. On the other hand, there is motivation (or, more often, lack of it), without which a student cannot succeed in his or her studies. According to teachers, while abilities are completely fixed, motivation is malleable. At the same time, only about half of the survey respondents consider fostering a student's interest in learning to be the area of responsibility of the school and teachers. The remaining half believes this responsibility should be shared between the family and the child.

2.2.3. "Here we only build on the foundation laid there"

The focus group results confirm the survey findings: the prevailing perception among teachers is that the school is incapable of influencing student success. Some focus group participants note that teacher performance can be a powerful incentive for successful learning. A teacher can get students interested in and enthusiastic about the subject as well as discourage them from learning.

> If a teacher has impressed children, it could spark their interest in the subject. If a teacher, on the contrary, has instilled disgust in children, even the most gifted student may simply be reluctant to study this subject, deliver any results, do anything (school 1, focus group 3).

> I don't know whether it is only my perception: a teacher has always been a role model for me. In fact, only one teacher in my life has had an impact on me. That was it. There were no other teachers like that one. What I am trying to say is that teachers can not only motivate but also demotivate. Obviously, most of them do the latter (school 4, focus group 1).

A much more common belief among the research participants is that teachers are given some kind of "material" with fixed characteristics predetermined by children and family characteristics, and the teacher's objective is only to process this "material". From this perspective, the success of teachers' work is more likely to be determined by the factors external to the school.

> If the family sets the right direction, the right direction for the child, if the child is given enough attention and does not feel unwanted, he or she studies well. This child understands what he

or she is studying for. And I think that this should primarily come from the family, of course. As for teachers, we just guide and help students to fulfill their potential: for some, it will be an A, for others a C. But even getting a C grade requires hard work… (school 5, focus group 2).

Respondent 1: In general, teachers do everything to help students to reach a certain level. But they do not always succeed, because you cannot chop wood with a penknife in most cases, and everything goes back to square one.
Respondent 2: It depends on the family, whether it provides support.
Respondent 1: It can be frustrating when you spend a lot of effort and suddenly you realize the student has not made any progress.
Respondent 3: Family is the main factor. It is all about what it has given to the child…
Respondent 1: Here we only build on the foundation laid there (school 2, focus group 2).

Thus, according to the teachers, family plays the leading role in building student success. Students' personal qualities come second and the school is only a tool to pursue opportunities that have already been defined by external factors.

Interviewer: One can distinguish between the roles of students, family, and school. Which would you put first?
Respondent 1: Family.
Respondent 2: Family.
Respondent 3: Definitely family.
Interviewer: And second?
Respondent 2: Then a student's personal qualities.
Respondent 1: Agreed.
Interviewer: And only then the school and teachers?
Respondent 1: The school brings it all together and delivers a product — let's put it that way (school 1, focus group 3).

2.2.4. "We have to do this, we have to do that — in the end, we don't have time for anything"

The attempts of some respondents to emphasize the role of the school often evoke a negative response and get rejected by their colleagues. Teachers emphasize that they are currently burdened with very demanding requirements and high expectations.

Respondent 1: I think that the school is of primary importance for personality development. I mean all aspects of the school.
Respondent 2: *How can you say that! Again the school is given the primary importance (school 1, focus group 1).*

> I believe that the family should also play a significant role, one should not shift the whole responsibility to the school. It's a sad story, because the school is, obviously, a place where a lot of skills can be developed. Really a lot. And we are now just... I mean, the scope of teacher responsibilities is expanding exponentially. We have to do this, we have to do that — in the end, we don't have time for anything. That is the main problem (school 6, focus group 2).

At the same time, many teachers are convinced that parents and children do not fulfill their duties in the educational process and shift all responsibility on the school. This causes great concern and dissatisfaction among teachers. Such perception of the family and students' contribution to the educational process might explain why teachers seek to partially shift the responsibility on parents and their children.

> Teachers are burdened with duties and obligations, while children only receive "recommendations". Besides, we are responsible for the life and health of children not only inside a school building but also outside the school. If something happens to a child there, it is our fault too... I am trying to say that parents have been neglecting their duties. They have shifted them all to school. Including upbringing. And they are teaching their children to be consumers like themselves. Children also think that we have duties. And obligations. But everyone seems to forget that children and parents have obligations too.

> I think parents should have more obligations related to the upbringing and education of their children enshrined in law. If they do not take care of their children, they should be fined (school 5, focus group 1).

Thus, the focus group materials show that teachers explain the primary importance of students' characteristics in achieving academic success by students' innate unchangeable abilities, motivation, and interest in learning. Teachers assign a leading role in determining student achievement to the family. There is a widespread belief among teachers that the school is just a tool to process given "material", and that teachers do their best to support student effort in learning but are helpless without a conducive external environment, that is, without the support from the family and children. Such avoidance of the responsibility for students' academic success is often accompanied by the reference to overload, an increased number of duties, higher external expectations, as well as the family and students' failure to perform their duties.

Conclusion

Russian teachers are not disposed to evaluate their role in determining educational outcomes as very important: most of them prefer to hold the school and teachers solely responsible for transferring knowledge and developing students' skills of expressing their thoughts. The factors of student academic success most frequently referred to by teachers are characteristics of students themselves: the overwhelming majority of teachers choose at least one of these in their answers. A quarter of teachers do not at all mention school conditions, including the quality of teachers' work, among the factors facilitating or hindering student academic success.

Teachers' opinions regarding metadisciplinary and personal learning outcomes differ: less than half of the respondents believe that the school and teachers should be responsible for them. Even when assuming responsibility for the knowledge-related component of education, only about a quarter of teachers acknowledge that the school plays a decisive role in producing the outcomes. Teachers' perception of their role in achieving learning outcomes varies depending on how the question is posed. In particular, teachers often mention their work and other school conditions as factors contributing to student success but do not see them as barriers.

The relationship between teachers' assumption of the leading role in ensuring student achievement and their belief that the school and teachers should be responsible for metadisciplinary learning outcomes is partially confirmed in this study. Teachers who identified school factors among the main factors of academic success are more likely to take responsibility for developing creativity and interest in learning. At the same time, no relationship could be found between a high level of teacher agency and the attribution to the school / teachers of responsibility for developing the skills of time management (self-management) and distinguishing between true and untrue information (critical thinking). To further study the relationship between these beliefs and attitudes, it is necessary to clarify, in particular, how teachers interpret the proposed questions and how they relate them to the outcomes outlined in the educational standards.

There is a certain fatalism in teachers' reasoning. The prevalence of such statements as "you cannot chop wood with a penknife" and the metaphor of "processing of given material" illustrate their belief that school is not capable of significantly influencing the final results. Teachers believe that they are doing their best, but the outcome is more dependent on external factors than on their efforts. According to many teachers, the key characteristics that determine student success either are given or result from something different than the school's effort. Teachers who say the latter particularly emphasize the importance of students' abilities and motivation (interest in learning). Building motivation is more often con-

sidered the family's area of responsibility: the dominant role of the family is mentioned in almost every focus group. When examined in more detail, the factor that in the questionnaire is considered to be student-related turns out to be the responsibility of the family.

When teachers reflect on the role of the school in delivering educational outcomes, they highlight teachers' high overall workload and a rapid increase in the number of duties and the level of responsibility. They are also convinced that parents and schoolchildren do not always cope well with their own "duties". Based on this, teachers often negatively assess the family's role in the learning process, on the one hand, and attempt to lower the expectations about the school and teachers, on the other.

The described system of teacher perceptions is not compatible with teachers' belief in their ability to influence educational outcomes and does not contribute to a high level of teacher agency. Teachers are therefore not likely to actively change their habitual practices. Teachers' low level of agency is one of the reasons why the curriculum reform has been such a challenge. It explains why the reform does not succeed to change everyday practices. The beliefs prevalent among teachers contradict a lot of empirical evidence according to which it is school-related factors that help children cope with a negative environment and achieve academic success [Zvyagintsev, 2021].

In Russia, the modernisation of teacher practices is achieved by changing the regulatory framework and increasing the level of school accountability. Such transformations result in escalating tensions and increased job dissatisfaction among teachers. Teachers are unable to cope with the increasing workload and rising expectations and constantly refer to the failure of other groups involved in the educational process to fulfill their roles. The complex and often negative relations between the school and the family have become an acute problem that cannot be ignored when seeking to improve the quality of education.

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Mastery or Performance Orientation: Russian Adaptation of the Approach to Instruction Scale (PALS) to Assess Classroom Goal Structures

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Abstract

The present study aims to examine the construct of the classroom goal structure. Achievement goal theory of motivation suggests that two types of classroom goal structures can be identified: mastery goal structure and performance goal structure.

The study presents the results of the Russian adaptation of the Approach to Instruction (Patterns of Adapted Learning Survey) scale which can be used to assess classroom goal structures from the perspective of teacher practices. The survey is built *on a data that* comes from a survey on a sample of fifth-grade teachers (N = 656) conducted in the fall of 2020. The study includes a description of the steps for adaptation of the scale into Russian. The study presents the results of confirmatory factor analysis and describes the adjustments to the initial model. The adapted scale demonstrated a good fit to the empirical data and adequate internal consistency.

The Russian-language version of the scale can be used by researchers in future studies of the educational environment in the classroom in the context of learning motivation. The scale could potentially be employed in future studies examining the factors that determine students' educational outcomes as well as the development of social-emotional skills.

Keywords

school, teacher practices, classroom goal structure, achievement goal theory, classroom goal structure, mastery orientation, performance orientation.

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Within the school curriculum, students are expected not only to achieve academic success but also to develop their social-emotional skills, such as their ability to be persistent, achieve identified goals, cooperate, and act with empathy and tolerance [OECD, 2021]. The school learning environment should enable students both to acquire the necessary academic knowledge and to develop social-emotional skills.

The achievement goal theory suggests that the educational environment can be characterised by its dominating achievement orientation: mastery goal orientation or performance goal orientation [Ames, 1992]. According to the achievement goal theory, those goal orientations determine the classroom goal structure [Ames, 1984; Meece, Anderman, Anderman, 2006; Bardach et al., 2019].

Teachers' instructional practices are one of the factors shaping the classroom goal structure [Stodolsky, Salk, Glaessner, 1991; Ames, 1992; Kaplan et al., 2002; Meece, Anderman, Anderman, 2006]. For instance, by displaying the work of the highest achieving students as an example, teachers promote the performance goal structure. Whereas by recognizing even the slightest progress of each student, teachers bring mastery goals to the forefront and promote the corresponding goal structure in the classroom. In addition to the above, the outlined instructional practices can also determine students' perception of the learning environment and subsequently influence their personal motivational beliefs about education [Ames, 1992; Urdan, Midgley, Anderman, 1998; Anderman et al., 2001; Friedel et al., 2007; Park et al., 2016; Lüftenegger et al., 2017; Fokkens-Bruinsma, van Rooij, Canrinus, 2020]. Motivational beliefs determine what value students attribute to their education, as well as the way they interpret their academic successes and failures [Anderman, Urdan, Roeser, 2003].

Studies demonstrate that the classroom goal structure correlates with students' emotional well-being [Baudoin, Galand, 2017; Johnson, Johnson, 2005], positive attitude towards school [Roeser, Midgley, Urdan, 1996], use of effective learning and self-regulation strategies [Wolters, 2004], self-efficacy [Murayama, Elliot, 2009], and growth mindset [Dweck, Leggett, 1988].

Even though the concept of classroom goal structure is highly significant for students' academic success and their personal development, research into it hasn't so far received the attention it deserves. Specifically, very few studies have explored this subject in Russia [Korotkevich, 2019; Maloshonok, Semenova, Terentyev, 2015; Nikitskaya, 2019]. In addition, most of those studies focus on the classroom goal structure from the students' perspective [Ames, Archer, 1998; Urdan, Midgley, Anderman, 1998; Patrick, Kaplan, Ryan, 2011; Skaalvik et al., 2017], and not on teachers' self-reports about their instructional practices.

The purpose of the present study is to adapt the tool for assessing the classroom goal structure from the perspective of teachers' instructional practices using a Russian sample.

1. Classroom goal structure: development and students' perception

Research into the classroom goal structure, as well as students' personal motivational beliefs, began in the 1980s. It was part of an effort to examine educational motivation and determine predictors of students' high academic achievement. Those studies led to the emergence of the achievement goal theory [Dweck, Leggett, 1988; Elliot, Harackiewicz, 1996], which studied different types of students' educational goals and the goal structure in the classroom [Ames, 1984; 1992].

The achievement goal theory initially identified two types of personal goals in education: mastery goals and performance goals [Dweck, 1986; Nicholls, 1989]. Those who pursue mastery goals aspire to ongoing academic improvement, which is accompanied by a positive perception of effort [Ames, Archer, 1988]. Students with a mastery goal orientation enjoy completing difficult tasks, even if they make many mistakes in the process. Performance goals make students gravitate towards demonstrating their superiority. They are linked with the desire to reach externally imposed standards of success with minimal effort, which would indirectly attest to their high competence [Elliott, Dweck, 1988]. A student with a pronounced performance goal orientation would enjoy being the only one in the class who can answer the teacher's question.

The dichotomous model of classroom goal structure is analogous to students' personal motivational beliefs. The model identifies mastery goal structure and performance goal structure [Ames, 1992; Urdan, Midgley, Anderman, 1998; Wolters, 2004].

The mastery goal structure in the classroom encourages students to work towards a deep understanding of learning material and continual improvement of their skills [Ames, 1992]. In such a learning environment, mistakes are perceived as part of the learning process and students are given creative assignments associated with effort [Urdan, Midgley, Anderman, 1998]. The performance goal structure, on the contrary, implies that the purpose of studying is showcasing one's skills in comparison to the other students' skills, and thus encourages social comparison [Ames, 1992; Urdan, Midgley, Anderman, 1998]. Teachers in classrooms with performance goal structures are inclined to emphasise the importance of competition, announce grades publicly, and group students based on their academic performance [Park et al., 2018].

The classroom goal structure can affect the personal achievement motivation of students. When students perceive their classroom goal structure as mastery-oriented, they begin to mainly

pursue mastery goals [Wolters, 2004; Lüftenegger et al., 2017; Fokkens-Bruinsma, van Rooij, Canrinus, 2020]. Conversely, an environment with a pronounced orientation towards social comparison makes students focus on demonstrating their competence [Ames, 1984]. Based on this evidence, researchers see classroom goal structure as a space for interventions aimed at shifting students' orientations towards more adaptive ones — that is, towards mastery goal development [Ames, 1992].

At the same time, researchers note that students' ideas about classroom goal structure are, for the most part, subjective [Ryan, Gheen, Midgley, 1998; Midgley, Anderman, Hicks, 1995; Ames 1992]. Their perception of the classroom goal structure is influenced by teachers' approach to instruction. Teachers communicate information about a classroom goal structure to students through grading and reward systems, as well as the types of assignments offered to students [Ames, 1992].

Teachers choose their instructional practices and methodological approaches based on their beliefs about the effectiveness of these practices [Ames, 1992]. Teachers who are oriented towards the mastery goal structure aspire to instil in students the value of making effort in the learning process and the importance of a deep understanding of the learning material. Teachers oriented towards performance goal structure often motivate their students through competitiveness and normative grading [Kaplan et al., 2002; Meece, Anderman, Anderman, 2006].

However, researchers note that the same teacher can employ various practices depending on students' academic performance [Ames, 1992] or their gender [Butler, 2012; Skipper, Leman, 2017; Fokkens-Bruinsma, van Rooij, Canrinus, 2020].

2. Measuring a classroom goal structure: approaches to instruction

Most studies on the achievement goal theory concentrate on students' personal orientations [Anderman, Patrick, 2012]. A number of tools for measuring students' personal goal orientations have been developed. Their use was validated on various samples in countries including the USA, Belgium, Austria, and the Netherlands [Midgley, Anderman, Hicks, 1995; Midgley et al., 1998; Middleton, Midgley, 1997; Ryan, Gheen, Midgley, 1998; Baudoin, Galand, 2017; Bardach et al., 2019; Fokkens-Bruinsma, van Rooij, Canrinus, 2020].

When it comes to classroom goal structure, the majority of existing studies evaluate it solely based on its perception by students [Throndsen, Turmo, 2013; Kamarova et al., 2017; Skaalvik et al., 2017; Baudoin, Galand, 2017]. However, researchers advise complementing data about the perceived classroom goal structure with teachers' self-reports of their instructional practices, as well as with classroom observations [Blumenfeld, 1992; Ryan, Gheen, Midgley, 1998].

This becomes possible with the Approach to Instruction scale, developed as part of the larger Patterns of Adapted Learning Survey (PALS) [Midgley et al., 2000]. The scale measures the dominant orientation of teachers' approach to instruction — whether it is aimed at developing a performance or mastery goal structure in the classroom. Even though the survey has undergone several changes, each revision has invariably included two scales: the Mastery Goal Orientation Scale, and the Performance Goal Orientation Scale [Midgley, Anderman, Hicks, 1995; Ryan, Gheen, Midgley, 1998; Midgley et al., 2000]. Items that are used to measure those orientations — especially on the Mastery Scale — vary across different authorial versions of the scale.

For instance, in the earliest edition of the survey, both the Mastery Goal Orientation Scale (Cronbach's alpha = 0.62) and the Performance Goal Orientation Scale (Cronbach's alpha = 0.73) contained seven items each [Midgley, Anderman, Hicks, 1995]. The items used in the scale of performance-focused instructional practices describe such approaches as comparing students based on their performance and encouraging those who do well — as will be the case in the following survey revisions, too. The items used in the scale of task-focused instructional practices include examples of encouraging 'academic courage' and mutual help between students.

In its later version, the Mastery Goal Orientation Scale contains six items (Cronbach's alpha = 0.78), while the Performance Goal Orientation Scale includes five items (Cronbach's alpha = 0.72). The Performance Goal Orientation Scale items describe an active comparison of students' skills. The Mastery Goal Orientation Scale items emphasise the importance of applied effort and the development of higher-order skills [Ryan, Gheen, Midgley, 1998].

2.1. Approach to Instruction (Patterns of Adaptive Learning Survey): current version of the survey

In its updated version, the Mastery Goal Orientation Scale contains four items (Cronbach's alpha = 0.69), while the Performance Goal Orientation Scale includes five items (Cronbach's alpha = 0.69) [Midgley et al., 2000]. All survey items are presented as personal statements. Participants are offered to evaluate their level of agreement with the statements on a five-point scale from 'Strongly disagree' to 'Strongly agree'.

The Mastery Approach to Instruction items describe three characteristics of the mastery goal structure: evaluating students' progress, providing them with an opportunity to choose assignments, and matching assignments to students' needs and skill levels. The Performance Approach to Instruction items describe such characteristics as comparing students according to their skill level and encouraging them to compete with each other. This survey was validated on a sample of 6th-grade maths teachers; the information about the sample size is not available [Midgley et al., 2000].

Studies of approaches to instruction within the framework of the achievement goal structure theory were conducted on American [Urdan, Midgley, Anderman, 1998; Wolters, Daugherty, 2007; Wolters, Fan, Daugherty, 2010; Park et al., 2016] and Norwegian samples [Throndsen, Turmo, 2013]. Researchers note that the original scale may have insufficient internal consistency, and believe that further modification is necessary [Wolters, Daugherty, 2007; Wolters, Fan, Daugherty, 2010]. For instance, they offer to leave out two items from the original scale, in order to have three items on the Mastery Approach to Instruction scale (Cronbach's alpha = 0.66) and four items on the Performance Approach to Instruction scale (Cronbach's alpha = 0.76) [Wolters, Daugherty, 2007]. The present study is based on the 2000 version of the Approach to Instruction (PALS) survey [Midgley et al., 2000].

3. Methodology

3.1. Adaptation of the Approach to Instruction (PALS) scale into the Russian language

The translation of the original survey from English into Russian was done by a professional translator with native proficiency in Russian. To avoid ambiguity in the interpretation of concepts and instructional practices, the researchers conducted four cognitive interviews with mathematics, history, Russian language, and literature teachers from rural and urban schools. The interviews exposed that two items from the original scale made participants experience difficulties in interpretation: 'I give special privileges to students who do the best work' and 'I display the work of the highest achieving students as an example'. Those items were left out of the survey. As a result, the scale included seven items, four on the Mastery Approach to Instruction scale and three on the Performance Approach to Instruction scale. This version of the scale is used for the survey and for examining the psychometric properties of the tool.

In order to adapt the scale, a survey of 5th-grade teachers was conducted. The teachers expressed their level of agreement with the statements on a six-point Likert-type scale from 'Strongly disagree' to 'Strongly agree' (Appendix 1).

3.2. Sample

The survey was administered in the autumn of 2020. The sample consisted of 656 fifth-grade teachers of mathematics and the Russian language from 372 schools situated in four regions of the Russian Federation.

4. Results

4.1. Factor structure of the survey

The structure of the survey was verified using confirmatory factor analysis (CFA). Following the original theoretical model, two factors were identified: Mastery Goal Orientation (4 indicators) and Performance Goal Orientation (3 indicators). However, the goodness-of-

fit statistics lay outside the acceptable range, which indicated poor fit of the original model — Model 1 (Table 1).

Table 1. **CFA Model Fit Indices**

Model	χ^2	df	χ^2/df	CFI	TLI	RMSEA	SRMR
1	111.849	13	8.5	0.903	0.843	0.110 [0. 092; 0.129]	0.079
2	54.413	12	4.5	0.958	0.927	0.075 [0.055; 0.096]	0.045

In order to transform Model 1, we used modification indices, which offer improvements based on empirical data. Specifically, we added residual correlation between two items: 'Students who get good grades are pointed out as an example to others' (4) and 'I help students understand how their performance compares to others' (6), which almost halved the Chi-square value of the model: the difference between the two Chi-square values equalled 54.4 (Table 1). The addition of correlation between these statements was justified by theoretical premises. Both statements illustrate an instructional practice that implies the creation of a competitive environment in the classroom and comparing students with each other [Kaplan et al., 2002].

The difference between the Chi-square values of the original model (Model 1) and the model with added residual correlation (Model 2) proved to be statistically significant (Table 2), which means that Model 2 has a better goodness of fit.

Table 2. **Chi-Square Comparison of CFA Models**

	Model 1	Model 2	Difference between models
Chi-square	111.8	54.43	57.4
Degrees of freedom	13	12	1
P-value			.000

The addition of the residual correlation changed the remaining indices of fit of Model 2, with the new values within the recommended range (Table 1). Thus, the factor structure of the theoretical model was confirmed by the data gathered from the survey of teachers in Russia. Table 3 presents the items' factor loadings obtained from the confirmatory factor analysis.

Table 3. **Confirmatory Factor Analysis Results (Factor Loadings of Items)**

	Model 1	Model 2
Mastery Goal Orientation Factor		
1. I give a wide range of assignments, matched to students' needs and skill level.	1.000	1.000
2. I make a special effort to recognize students' individual progress, even if they are below grade level.	0.892 (0.078)*	0.878 (0.075)
5. During class, I often provide several different activities so that students can choose among them.	1.098 (0.094)	1.084 (0.090)
7. I consider how much students have improved when I give them report card grades.	0.764 (0.072)	0.740 (0.069)
Performance Goal Orientation Factor		
3. I encourage students to compete with each other.	1.000	1.000
4. I point out those students who do well as a model for the other students.	1.867 (0.174)	0.601 (0.109)
6. I help students understand how their performance compares to others.	2.022 (0.195)	0.669 (0.115)

Note. Standard errors are given in parentheses.

4.1.1. Mastery Goal Orientation Factor

This factor, represented by four statements in the survey, reflects teachers' orientation towards creating the mastery goal structure in the classroom, and, as a result, developing a deeper understanding of the learning material by their students. High values of this factor indicate that a teacher aims to create an environment where students recognize the importance of effort in the learning process. Besides, such a teacher strives to give students assignments that are matched to students' interests and skill levels. Those teachers support the autonomy of their students and provide them with an opportunity to choose assignments they are interested in. Low values of this factor indicate that a teacher doesn't aim at creating an environment where students understand the value of education and where their engagement is key to the learning process.

4.1.2. Performance Goal Orientation Factor

This scale is made of three statements and reflects a teacher's orientation towards creating a performance goal structure in the classroom. Teachers with high scores on this scale are inclined to create classroom conditions that encourage social comparison, in which students can compare their achievements with those of their peers. Low values indicate that teachers are not likely to compare students with one another, and do not view competition as the main way to increase motivation.

4.2. Reliability assessment

The reliability of the scales was assessed using the Cronbach's alpha coefficient. Both scales demonstrated adequate reliability: the coefficient was 0.726 for the Mastery Goal Orientation Scale, and 0.713 for the Performance Goal Orientation Scale. In other words, items within each scale are related and measure the same single construct.

4.3. Application of the scales

The Russian adaptation of the Approach to Instruction (PALS) scale can be used to evaluate the classroom learning environment when studying educational motivation. The scale, together with the evaluation of students' perceptions of the classroom goal structure, can help to understand the motivational climate of a learning environment.

The potential application area for this scale is research into the factors of students' social-emotional skill development and the improvement of their academic achievements. In particular, the scale could help to identify the specific features of a learning environment conducive to developing social-emotional competencies of the students, supporting their psychological well-being, and improving their academic performance.

5. Conclusion

The classroom goal structure can be mastery-oriented or performance-oriented. It influences students' personal educational motivation and the dynamics of relationships in the classroom. For instance, mastery-oriented instructional practices are aimed at creating an environment where students value the deep understanding of learning material, while performance-oriented instructional practices contribute towards an environment where students compete and compare themselves with their peers. International studies confirm the important role of instructional practices in the development of students' social-emotional skills [OECD, 2021].

This study presents the results of the Russian adaptation of the Approach to Instruction (PALS) scale (the 2000 version) and the evaluation of the scale's goodness of fit. The process of the survey adaptation included its translation into the Russian language, as well as conducting a series of cognitive interviews with potential respondents. The result is a Russian-language model of the scale consisting of two factors: Mastery Goal Orientation Factor (4 indicators) and Performance Goal Orientation Factor (3 indicators). Confirmatory factor analysis with the addition of residual correlation between the two items on the Performance Goal Orientation Scale confirmed the structure of the original model.

The results of the Cronbach's alpha reliability test showed adequate internal consistency between the two factors (0.726 for the Mastery Goal Orientation Factor and 0.713 for the Performance

Goal Orientation Factor). The internal consistency of the subscales of the original survey was slightly improved (0.69 for both factors).

Thus, we have obtained a two-factor version of the scale, where the mastery goal orientation factor reflects a teacher's ambition to develop a classroom learning environment that values effort and is sensitive to the interests of the students, while the performance goal orientation factor reflects a teacher's ambition to develop an environment encouraging the achievement of high normative results.

The limitations of the study stem from the fact that the analysis has been performed on an unrepresentative sample. Consequently, the findings cannot be generalised to all middle school teachers in Russia. The model needs to be reproduced using other samples in the future in order to confirm the results.

The adapted Russian-language survey can be used to study teachers' approaches to instruction on Russian samples, as well as to conduct cross-cultural comparisons of learning environments. It is also recommended to complement studies of the classroom goal structure that are based on teachers' self-reports with data on students' perceptions of the classroom goal structures and classroom observations.

The study was implemented in the framework of the Basic Research Program at the National Research University Higher School of Economics (HSE University).

Appendix 1
Approach to Instruction Survey

Please indicate the extent to which you agree or disagree with the following statement on a scale of 1 to 6, where 1 = 'Strongly disagree', 6 = 'Strongly agree'.

No.	Statements						
1	I give a wide range of assignments, matched to students' needs and skill level.	1	2	3	4	5	6
2	I make a special effort to recognize students' individual progress, even if they are below grade level.	1	2	3	4	5	6
3	I encourage students to compete with each other.	1	2	3	4	5	6
4	I point out those students who do well as a model for the other students.	1	2	3	4	5	6
5	During class, I often provide several different activities so that students can choose among them.	1	2	3	4	5	6
6	I help students understand how their performance compares to others.	1	2	3	4	5	6
7	I consider how much students have improved when I give them report card grades.	1	2	3	4	5	6

Key
Mastery Orientation Goals: 1, 2, 5, 7.
Performance Orientation Goals: 2, 4, 6.

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Education as a Source for Transformative Agency: Theoretical and Practical Issues

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Abstract

The issue of "transformative agency", which proactively improves and transforms social structures, is relevant both for theoretical discussions and practical agenda. The field of education is of particular importance in terms of shaping the potential for agency. However, the dominant areas of research in education, including the sociology of education, focus, on the contrary, on the mechanisms and factors of reproduction of social structures and related activities. The authors propose to expand the research agenda by increasing attention to the conditions and mechanisms of the formation of "transformative agency" at different levels of education and in its various segments, with an account of the processes of de-structuration that weaken the forms of institutional coercion familiar to the 20th century. The article raises theoretical questions and suggests relevant empirical phenomena for further research.

Keywords

structure-agency, social structures, social institutions, education, human capital, entrepreneurship, transformative agency.

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The structure/agency problem is historically one of the most debated issues in sociology and social theory in general. At the core of the problem is the relationship between the individual and the social environment. Of particular interest in this debate is the potential of agency to transform structures. The analysis of the theoretical debates of recent decades in general sociology reveals a contradiction between the dominant line of discussion, which emphasizes structure over agency, and the need to understand the

empirical reality, which, on the contrary, points to the decline of structures' stability [Sorokin, Mironenko, 2020; Сорокин, Фрумин, 2020; Сорокин, 2021].

The institutions of education have traditionally been of considerable interest to\ sociologists because of their important role in the reproduction of social structures. Today, given the objectively observed increase in structural volatility (associated, for example, with adaptation to distance modes of social interaction due to the global pandemic), there is an obvious need for a more detailed study of the conditions and mechanisms of agency development, especially the development of transformative agency. It refers to action that does not reproduce structures or respond to structural change in the way determined by these structures, but proactively influences them, sets the direction for their development, modifies them or creates new ones [Sorokin, Froumin 2022; Сорокин, Фрумин, 2020].

Although it would be inaccurate to say that transformative agency is completely ignored in current debates in education, most scholars and practitioners share a specific and rather narrow understanding of this concept and other closely related constructs, which is based on left-wing political ideology (see [Sorokin, Froumin, 2022] for details). Elaborating on the ideas of P. Freire [Freire, 2021], many authors see genuine agency solely as the ability to resist state and market pressures, focusing on the destructive rather than the constructive potential of agency in relation to structures [Haapasaari, Engeström, Kerosuo, 2016]. For a long time, this idea has been quite actively developed in the critical theory of education, which sees transforming and even disrupting unjust social hierarchies as a central task [Haapasaari, Engeström, Kerosuo, 2016; Фрумин, 1998]. It should be noted that the proponents of the critical theory implicitly assume the stability and rigidity of these structures.

The approach developed in this paper differs in that it asserts more than the importance of education in addressing defects in social structures. We build on the widely- and long-debated argument from the social theory that the stability of structures has been declining [Bauman, 2005]. We observe not just a loosely structured social environment, but one in which the life cycle of structures is getting shorter and change is becoming more frequent and drastic.

In this de-structured social reality, individual agency (proactive action) becomes an important component of social life [Сорокин, 2021]. In the labor market, for instance, not only is there a significant increase in the proportion of the population working outside the traditional corporate sector, including the self-employed and entrepreneurs, but also a growing need for everyone employed, among them company employees, to be proactive in enhancing business processes, forming working groups and teams, improving

products, and so forth. University employees are among those who feel nudged into innovative behavior [Namono, Kemboi, Chepkwony, 2021]. In the social sector, the importance of volunteering and grassroots initiatives of civil society, including young people in general and university students in particular, is increasing — the experience of the global pandemic has demonstrated their critical role in effective crisis management [Земцов, Яськов, 2021].

It should be emphasized that we do not suggest that the current mainstream approach in sociological research on education, which tends to focus on the reproduction of structures, is becoming any less relevant. However, the fact of de-structuration is likely to require a refinement of this research approach too. With this publication, we seek to encourage a debate on this issue.

This paper aims to critically examine and compare the research and practice agenda in education through the lens of the structure/agency problem, justify the need for research programs focused on developing the constructive potential of agency, and outline potential theoretical foundations for this research within and beyond the education debate.

In order to achieve the above aim, we will show below, first, that current educational research is dominated by a structure-oriented perspective that is not optimal for studying and understanding proactive action and individual agency; second, that this research agenda is at variance with several key practical challenges in educational management and education policy that have become urgent due to the pandemic; third, that in the rich body of educational research there are several clusters of ideas and findings relevant to the task of studying and developing agency, but they are not part of the main discourse in education sciences; fourth, that insights from allied sciences, such as economics, can also help to enhance the theoretical and methodological framework for research on corresponding issues in education. We hope that this article will contribute to broadening the debate on agency in educational research.

1. The structure/agency problem in education

In contemporary social science, the whole coming-of-age period and the first stages of socialization are often seen as a preparation for an adult "journey", which is assumed to be a succession of certain positions in the social structure. The investigation of the corresponding trajectories — "journeys" through educational and labor market structures — is what constitutes the main body of research in the sociology of education and studies of social mobility [Herbers et al., 2012; Cheng, Song, 2019; Sorokin, Mironenko, 2020].

The education system takes care of individuals until they take up their positions in the main, adult social structure, which includes

the labor market. However, the best known and most cited works in the sociology of education from the mid-twentieth century to the present day, while examining different empirical subjects from different theoretical positions, consistently reveal new dimensions of structure's dominance over agency and demonstrate how education reproduces structures and ensures intergenerational continuity of social positions [Collins, 2000; Coleman, 2019; Bourdieu, Passeron, 1990].

The underlying assumption of this line of research — which is usually confirmed, so that it sometimes seems to be a self-fulfilling prophecy — is that structural effects are so much stronger than the potential of a conditionally free action that the latter can be neglected, especially when it comes to children. Those from deprived social groups are much less likely to apply to highly selective universities, even if they have good grades in school, and girls studying medicine at university submit to internal gender discrimination in the profession and willingly — as it might seem to outsiders — choose the less prestigious and less paid pediatrics over surgery or cardiology [Смелзер, 1992]. In recent decades, Russia has developed its own tradition of sociological analysis focused on the reproduction of structures through education. A group of researchers led by D.L. Konstantinovskiy, as well as their followers, have not only empirically shown the existence of a systemic problem of inequality in Russian education but also uncovered its specific features amidst the transition to market institutions [Бессуднов, Куракин, Малик, 2017; Константиновский, 1997; 2020]. Empirical studies of the inequality dynamics in Russian education, including its impact on the choice of profession and the value-motivational sphere, have been conducted by domestic authors since the late 1970s, meaning that these efforts had started long before the current surge of interest in cultural factors of inequality reproduction [Константиновский 1977; 1997]. These studies provide a comprehensive picture of Russian education as an environment for the reproduction of broader socio-economic and socio-cultural processes, which is grounded in rich empirical data and builds on the ideas of the same structure-oriented approach that has been dominant in Western sociology for at least the last three quarter-centuries [Константиновский 2014; Константиновский, Вахштайн, Куракин, 2013].

The above logic, implicit in the vast majority of contemporary sociological theories of education, inequality and culture, is in many respects productive. It helps not only to identify the areas with the most powerful mechanisms of structural discrimination, but also to draft a structural solution to address these areas of injustice. This often yields positive results. In particular, in many developed countries, largely due to governments' targeted efforts and sometimes under pressure from discriminated groups, female en-

rolment in higher education has long exceeded that of males [Altbach, Reisberg, Rumbley, 2019]. This can be considered a victory over structural defects and injustices. However, the confidence of many researchers, especially sociologists, in the total, unconditional and inescapable nature of inequality in the modern world often does not allow for adequate consideration of positive changes (see [Гофман, 2004] for details).

The new institutionalism as interpreted by J. Meyer [Meyer, 2010] stands out against the pessimistic approaches to the problem of inequality in the sociology of education. Meyer's theory builds on the assumption that education systems around the world are increasing their coverage and are fairly homogeneous (isomorphic) and introduces the concept of the so-called expanded actorhood. This type of agency is developed mainly through culture and education and transforms (expands) local social environments according to the models determined by the so-called world society. The proposed concept recognizes the important role of individual and group agency and, at the same time, emphasizes the need for a specific supporting socio-cultural context of expanded actorhood that legitimizes the relevant behavior of actors. J. Meyer's approach implies a special role of education systems in the progressive movement of national systems towards the standards of the world society, even when the immediate structural contexts, including the labor market and political systems, do not actually make a demand for expanded actorhood or even hinder its manifestation in students and graduates of tertiary education.

The social science approaches considered, which posit the primacy of "adult" structure over the development of individual agency, do not take sufficient account of the theories and findings from such related science as psychology. In particular, these approaches ignore the data on the laws of child and adolescent development during their interaction with the social environment, obtained many decades ago, such as L. S. Vygotsky's concept of the social situation of development, and neglect dozens of recent papers on the development of autonomy in children and young people [Sutterlüty, Tisdall, 2019; Anderson et al., 2019].

Economics is another discipline with important insights related to the structure/agency problem that have been largely overlooked by educational researchers so far. While appreciating certain economic theories, such as human capital theory, researchers and practitioners in education have failed to consider the fact that in recent years the issue of national welfare factors has been approached not only from the perspective of institutional constraints but also from that of individual agency with a focus on the role of entrepreneurship [Acs et al., 2016].

2. Practice education development agenda through the lens of the structure/ agency problem

The predominant focus on the mechanisms of structure's dominance over agency in current educational research is not in line with the practice agenda in educational management and education policy. Today, there is already an established and ever growing range of initiatives in the education system that focus on the development of personal characteristics relevant to agency. Of particular note is entrepreneurship education: the debate on it most clearly shows, firstly, that there is an objective mass demand from outside, including the state, for a new type of individual (in this case entrepreneurial) agency, and secondly, that the structure-oriented education system faces serious difficulties when trying to respond to this demand [Sorokin, Froumin, 2022].

Many innovative schools, colleges and universities have made it a priority to develop the entrepreneurial attitude and entrepreneurial skills in their students. Projects of this kind are also being implemented in supplementary education. In Russia, this approach has already resulted in initiatives to develop entrepreneurial ideas in schoolchildren, in business training projects for university students, as well as in the Federal Project "The Platform of University Technological Entrepreneurship". Similar initiatives have been launched in many countries, for example in China [Weiming, Chunyan, Xiaohua, 2016]. The current state of entrepreneurial education has become the subject of a World Bank review report [Valerio, Parton, Robb, 2014].

The expansion of entrepreneurial education can be seen as an adaptation of educational institutions to the new "de-structured" economy, in which even the corporate sector is becoming increasingly interested in employees with entrepreneurial spirit [Cascio, 2019]. At the same time, the actual growth of the informal economy in many countries around the world, including Russia, not only creates more space for agency, which brings about new institutions and structures (including new companies), but also objectively pushes for it. As already mentioned, these processes can be described by the notion of "de-structuration" [Сорокин, Фрумин, 2020].

An equally important trend in the transformation of education in recent years, aimed at helping people autonomously design their journey through the social world, has been the individualization of educational trajectories, when students and even schoolchildren are provided the opportunity to make choices within previously rigid and linear educational programs [Hart, 2016]. Increasing the number of elective elements in the bachelor's trajectory, as well as the introduction of applied bachelor's degree programs are being discussed [Лаврентьева, 2014]. Although the experiences of choice and goal-setting are becoming an important component of personal growth, there is clearly a lack of theoretical models for determining an individual educational trajectory as a result of conscious choice or even a strategy, which would take into account the objectively observed transformation of structures within and outside of education.

A powerful trigger that drew particular attention of researchers to the issue of building and strengthening agency was the pandemic, when traditional structures for managing the educational behavior of schoolchildren and university students — "rules, routines and regulations", as F. Jackson puts it [Jackson, 1990], — ceased to exist or significantly weakened. Studies conducted in Russia and some other countries have found a positive correlation between engagement in forced remote learning and abilities for self-organization and proactive participation in informal student groups [Thiry, Hug, 2021; Земцов, Яськов, 2021].

The pandemic has revealed a deficit of both theoretical conceptualization of and empirical research into agency development. The dominant agenda of theoretical debate and research in education poorly meets this demand from practice. Its focus remains on the reproduction of social structures through education. Some researchers positively assess structural determinism and, for example, propose to train individuals based on corresponding cells in the matrix of labor market positions [Kuzminov, Sorokin, Froumin, 2019]. Others assess the dominance of structures critically and call for disrupting allegedly stable and unjust hierarchies [Sorokin, Froumin, 2022]. In both cases, however, an individual's agency aimed at determining his or her own trajectory and shaping new social structures and institutions is given little attention.

Next, we will consider educational research studies that take a different approach by focusing on the development of autonomy, agency and transformative action.

3. Research on transformative agency in education: from Rousseau to critical theories of education

J.J. Rousseau was one of the first to articulate the idea of educating a free individual who would build a society of free people, which was further developed by such influential thinkers as L. Tolstoy, D. Dewey, and many others. Due to the criticism of the formal education system by "free educators", school practices transformed towards valuing learners' autonomy and initiative. However, these changes have been overlooked by educational researchers in recent decades.

School leavers and, above all, university graduates have been actively involved in social change, for instance, the university students in the second half of the 19th and early 20th centuries in Russia or the youth in Europe and the United States in the 1960s [Bowles, Gintis, 1976]. Over half a century ago, B. Clark and M. Trow described four student subcultures, one of which was "non-conformist" [Clark, Trow, 1966]. However, they viewed nonconformists more as a problem for universities than as a potential source for the positive transformation of both students and universities. The existence of two fundamentally different university "products" — conformists and entrepreneurs (reformers) — has not yet been suffi-

ciently explored in educational research. This may be partly due to the fact that universities usually do not consider raising entrepreneurs (reformers) as a positive outcome [Dahlum, Wig, 2019].

Within the long-standing debate on non-conformism in universities, authors who draw on the idea that universities in particular and education in general can be drivers of social transformation usually understand transformation firstly as revolutionary rather than evolutionary development, and secondly as a result not so much of individual efforts but rather of objective structural dynamics (e.g., as conceptualized in Marxism), for which the "material" is no longer proletariat but students [Klees, 2017; 2016].

Critical theories of education remain central to the debate on the transformative potential — both the potential of education to transform other institutions and the potential of individual agency to transform social structure [Мак-Ларен, 2007; Gottesman, 2016; Haapasaari, Engeström, Kerosuo, 2016]. Aiming to address injustice and discrimination, they explore the limits of resistance to systems of domination, as well as the possible contribution of education. These works feature an important concept of transformative agency [Haapasaari, Engeström, Kerosuo, 2016], along with some other concepts, such as relational agency, expansive agency [Ibid.], and transformational resistance [Bajaj, 2009]. According to contemporary sociologists of education, "the idea of transformative agency is akin to Freire's assertion that education must heighten students' critical consciousness as they come to analyze their place in an unequal world" [Bajaj, 2009. P. 553; Correa, Murphy-Graham, 2019].

Thus, the majority of contemporary researchers and practitioners who work in the framework of critical theory associate agency primarily with overcoming inequality and other structural problems through protest action. An important element here is the "enemy image", where the enemy is understood as unjust structures — the state and the capitalist system (market) [Klees, 2017; 2016]. This perspective has an objective historical basis, in particular, the social movements of the 19th and 20th centuries, but is arguably narrow in the context of de-structuration, which is eroding previously rigid forms of social organization in both work and education.

3.1. New approaches to the study of transformative agency in education sciences

In recent decades, the sociology of education has produced a body of relevant work that goes beyond the traditional critical theories with their characteristic limitations, as described above. These works represent two relatively broad research directions: the study of agency in education that is not limited to the critical theory [Klemenčič, 2017], and the study of resilience [Wosnitza et al., 2018]. So far, the "non-critical" studies of agency are largely concerned with the relationship between the learner as an agent and the educa-

tional structure, as well as with resistance to structures in education. When examining the development of positive transformative agency, researchers working within this paradigm do not consider the application of agency outside of education. In this respect, their focus is considerably narrower than that of critical theorists. Their understanding of agency is also common for the international expert agenda, for instance, the current OECD's rhetoric on education [Сорокин, Зыкова, 2021].

At the same time, the trend towards individualization of education is gradually sparking researchers' interest in the positive aspects of agency. For instance, W. Fischman and H. Gardner identify in their new book a transformational type of educational behavior, recognizing its positive effects on the university and peers [Fischman, Gardner, 2022].

As for resilience, this personal characteristic is usually seen as derived from other social environments and structures, rather than intentionally developed within the education system [Wosnitza et al., 2018]. This is understandable: researchers of resilience focus on learners and organizations in difficult circumstances that are often regarded as potential targets of support interventions, especially in the non-Russian literature. This research perspective allows for an in-depth analysis of the structural barriers that these learners and organizations have to overcome on their way to success, interpreted primarily as the achievement of formal educational outcomes [Wosnitza et al., 2018]. At the same time, it also limits the possibility to consider factors other than structural social policy interventions that contribute to resilience development.

Thus, the participants in the debate on transformative agency in education include, on the one hand, representatives of classical critical theories who see education as a means of confronting the injustices of dominant macrostructures, and, on the other hand, authors of a growing segment of research on agency and resilience who overlook events outside educational institutions, as well as the potential of education to develop corresponding types of agency as stable personality traits.

The processes of de-structuration both within and outside of education are increasing the need for new theoretical and practical insights. Under current conditions, we need to explore not only the mechanisms of social reproduction or individual mobility through education, but also the prospects of increasing the contribution of education to structural transformations at the meso- and macro-level, with a focus not on destructive revolutionary transformations that disrupt social order, but on constructive evolutionary ones. New practices and forms of constructive interaction based on grassroots, primarily individual initiative can be a powerful response to the de-structured social reality. In order to understand

the prospects of theoretical and applied research on constructive transformative agency (and the possible contribution of education to its development), it is advisable to refer to an allied discipline — economics.

4. Economic theory approaches relevant to research on transformative agency in education

The allied sciences offer promising insights for responding to the challenge posed to educational research by a new, de-structured social reality. Due to the limited scope of this article, we will focus on the potential of integrating some ideas from economics into educational research, leaving psychology and other sciences aside.

One of the concepts that could contribute to the debate in educational research is that of the entrepreneurial aspect of human capital proposed by T. Schultz [Schultz 1975]. His approach differs from other interpretations of human capital better known to education specialists in that it rejects the idea that human capital automatically and unambiguously responds to the labor market situation and other institutional incentives [Becker, 2009]. Even when there is direct market demand, far from everyone is willing to relocate to another city, retrain for a new profession, and change jobs in search of a better life. T. Schultz suggested that the education system develops the "allocative ability" (the ability to proactively use one's resources) and thus increases human efficiency in times of rapid change, uncertainty and risk [Piazza-Georgi, 2002].

Economics offers a perspective on the relationship between structure and agency that differs from that dominating the educational studies, discussed above and associated primarily with the sociological tradition. For example, J. Schumpeter's concept of creative destruction focuses on innovation and entrepreneurship. According to this concept, the transformation and even destruction of existing economic standards and practices is a prerequisite for progress. However, in J. Schumpeter's logic, the education system cannot be a source of transformative agency, for he believed that the capacity for creative destruction as a personal characteristic is exogenous to the social system, including education [Piazza-Georgi, 2002]. His approach implies that, at best, the education system will not get in the way of innovative individuals. (Unfortunately, in practice the opposite is sometimes true.)

Over the last 30 years, there has been a lively debate in economic science about the causes of economic growth. Based on the work of modern economist Zoltan Acs and his colleagues [Acs et al., 2016; 2018], we can conclude that the point of contention in this debate is the relationship between the historically established institutional environment (consisting of companies, universities, research centers, the state, as well as the connections between them and the corresponding "rules of the game", such as laws and infor-

mal traditions) and the entrepreneurial activity of individual actors in this system. The similarities between this issue and the structure/agency problem in sociology are easy to see. However, while sociological theoretical models still give priority to structures, economists tend to consider individual agency as a central phenomenon of socio-economic development [Ibid.]. When explaining macroeconomic dynamics, the increasingly popular theory of national systems of entrepreneurship [Acs et al., 2016] distances itself from earlier theories, such as the theory of national systems of innovation, offering a new understanding of the role of individual agency. For instance, Z. Acs notes that according to the once influential theory of systems of innovation, the institutions that determine a country's innovation performance are inherited from the past, rather than constructed in the present [Ibid., P. 529].

Reviewing the earlier economic science literature, Z. Acs [Ibid, P. 529] criticizes the Austrian school of economics for devoting insufficient attention to how individual agency and institutions are related. The second half of the 20th century saw the popularity of Israel Kirzner's understanding of entrepreneurship. In contrast to the earlier ideas of J. Schumpeter, for I. Kirzner, the role of the entrepreneur was not so much in proactively disturbing the economic equilibrium, as in being the first to "discover that there is no equilibrium" (as cited in [Ibid, P. 529]). Thus, the actual engine of development is not agency as the primary source of transformation, but the understanding and usage of "natural" dynamics of the market and related structures.

The theory of national systems of entrepreneurship tries to address this limitation by placing individual agency represented by entrepreneurial activity at the center of models that explain macroeconomic dynamics (e.g., [Lafuente et al., 2019]), while also acknowledging the role of the institutional environment. Proponents of this theory argue that it is not so much the number of "formal" entrepreneurs that matters, but rather the qualitative characteristics of their activities, such as orientation towards global markets and the use of innovative technologies.

The theory of national systems of entrepreneurship is in its formative stage and is as yet far from being dominant in economic science. Moreover, from a sociological point of view, its understanding of agency is too narrow. It is true for both the content of agency (the theory focuses exclusively on entrepreneurial activity) and its effects (the focus is on traditional macroeconomic indicators). At the same time, as shown in our analysis (see also [Сорокин, Фрумин, 2020; Сорокин, 2021]), sociology in general and sociology of education in particular are at an even earlier stage in recognizing the role of agency. We hope that the present work will stimulate the development of new conceptual models and empirical research that will

contribute to a more comprehensive understanding of the role of individual transformative agency in societal development and the role of education in supporting this agency.

Fostering interdisciplinary dialogue can help not only to develop agency theories in sociology and education sciences but also to advance economic research. In particular, the sociological understanding of structures and systems of stratification is significantly more comprehensive and complete than the economic categories of the market and market equilibrium. In its turn, T. Schulz's idea of the entrepreneurial aspect of human capital as an ability to act proactively in a rapidly changing environment can be further developed by sociologists who examine various domains (not only economic) as a space where transformative agency manifests itself. Probably, the most valuable contribution that the sociology of education can make is to help identify specific indicators and mechanisms of transformative agency development. In particular, these insights may prove useful in actively developing research on entrepreneurship education, which, considering the above-mentioned insights of Z. Acs, plays an important role in ensuring success at the individual level, as well as economic growth at the macro-level [Nabi, 2017].

5. Conclusion

The analysis provided above demonstrates the need for an expanded understanding of education's role in socio-economic dynamics: education can not only support individual mobility across the levels of the "social building", but also develop the individual's capacity to transform this building, leading among other to improved welfare at the aggregate level. This understanding of the functions of education creates a demand for research not only into the mechanisms of structural domination but also into agency aimed at improving, rebuilding or replacing these structures.

A deeper understanding of education's role in socio-economic dynamics also implies the need to revise the content of education: next to the acquisition of specific specialized knowledge and competencies required to function successfully in the present-day structure, it should also ensure the development of agency and entrepreneurial skills in their broadest sense (the entrepreneurial aspect of human capital), which are especially important in times of rapid structural change.

Unfortunately, both in Russia and globally, there is currently a lack of consensus on effective practices for developing these skills, as well as on corresponding measurement tools. Reaching a consensus on this is another goal of research in the sociology of education and related disciplines that is of high practical relevance. We argue that there are three interrelated characteristics of transformative agency that should be considered in these efforts.

First, transformative agency is of complex nature: it can be represented by attributes (indicators) of different kinds and levels. In particular, the ability to resist negative influences of the environment may be considered as one dimension (or stage) of transformative agency, while the ability to proactively create new structures may represent another (see [Сорокин, Зыкова, 2021] for details).

Secondly, the development of the capacity for transformative agency is a dynamic process. Different stages of personality development through the education system may require not only different metrics to assess the dimensions of agency, but also different approaches to their development in practice. These tasks require contributions from psychologists, including the followers of L. S. Vygotsky's ideas (see [Mironenko, Sorokin, 2020]).

Thirdly, the effects of transformative agency are also complex, and indirect effects that are evident over time (e.g., changes in labor market behavior of young people as a result of the mass acquisition of basic skills related to business planning) may be more important than immediate results (e.g., number of business projects launched as a result of a specific educational initiative).

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How Are Pedagogical Practices Associated with Cheating among Students of Russian Universities

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Abstract

Student academic dishonesty is one of the most serious problems of higher education in Russia and all over the world. This problem became especially severe and widespread during a mass forced transfer to distant education followed by the Covid-19 pandemic. In this regard, it is highly demanded to find affordable measures to combat academic dishonesty, some of which can be implemented at the level of the organization of the learning process. The purpose of this study was to assess and analyze the relationship between the prevalence of passive and active pedagogical practices and academic cheating among students. Based on pieces of evidence, we hypothesized that students are more likely to cheat in conditions where their classes are organized mostly around passive educational practices such as writing down or retelling the course material. The empirical basis of this study is data gathered within the project "Monitoring of education markets and organizations" in spring 2020. Students of full-time bachelor and specialist programs of Russian higher educational institutions were surveyed. The sample includes 17,316 students from 291 Russian universities. Data analysis was carried out using a series of binary multilevel logistic regressions with the sequential addition of groups of individual and group level variables. This study was the first to show the relationship between different pedagogical practices and student cheating. The main result of this study can be considered a confirmed positive relationship between the prevalence of rewriting and retelling of the course materials during seminars (passive pedagogical practices) and student cheating. The second hypothesis about the relationship between active pedagogical practices and cheating received partial confirmation. The results of this study may be used as a base for recommendations for instructors and administrators of universities to enforce student academic integrity and reduce the prevalence of cheating among them.

Keywords

academic dishonesty, higher education, pedagogical practices, distant education, academic dishonesty, cheating.

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Academic cheating is a serious problem in higher education in Russia and all over the world. According to recent studies, 40% of Russian students cheated at least once in the academic year on a credit test or examination [Sukhanova, Froumin, 2021]; a third of students (34%) did the assignments they were supposed to do independently together with other students; and about a quarter of students (25%) photocopied lecture notes and summaries of primary sources taken by other students [Rudakov, Roshchina, 2018]. Moreover, comparative studies show that Russian students are more tolerant of cheating and use it more often than European and U.S. students [Lupton, Chaqman, 2002; Magnus et al., 2002; Grimes, 2004]. Teachers in various countries report that as universities have massively gone online due to the COVID-19 pandemic, controlling students' academic integrity has become very difficult [Mukhtar et al., 2020]. Student academic dishonesty is one of the main challenges of distance education, and it is becoming increasingly common [Guangul et al., 2020].

Cheating and other types of dishonest behavior can be combated, for instance, by introducing proctoring in quizzes and tests. This measure is an effective way to reduce the prevalence of cheating [Davis, Rand, and Seay, 2016; Karim, Kaminsky, and Behrend, 2014], but is costly and therefore unaffordable for most universities. In addition, universities are actively introducing codes of and courses on ethics aimed at instilling the values of academic integrity in students. However, research shows that these measures reduce the prevalence of cheating insignificantly [Bloodgood, Turnley, and Mudrack, 2008; Corrigan-Gibbs et al., 2015; Tatum et al., 2018]. Another solution to the problem of cheating could be to introduce a system of sanctions with strict penalties for cheating, including reporting the misconduct to the university administration by a teacher. However, only a few university teachers in Russia are ready to use this measure [Chirikov et al., 2020; Shmeleva, 2016]. Besides, some studies have provided paradoxical results: there is either no relationship between academic cheating and students' perceptions of the severity of punishment, or this relationship is positive [Passow et al., 2006; Harding et al., 2007].

Thus, there is a demand for feasible and affordable measures to combat cheating, especially those that can be implemented at the organizational level of the learning process. For example, students are less likely to cheat if they are assessed using randomized or personalized tests and classes are delivered in the form of student presentations [Guangul et al., 2020]. The objectives teachers set for the students — achieving mastery or demonstrating good performance — matter as well [Anderman, 2007]. The present study investigates how the pedagogical design of classes, namely the use of certain teaching practices, is related to student cheating.

1. Literature Review

1.1. Why it is important to study teacher behavior to prevent students' dishonesty

The prevalence of cheating is related to contextual factors determined by the educational environment, for instance, the frequency with which fellow students use dishonest practices [McCabe, Feghali, Abdallah, 2008; Megehee, Spake, 2008] and students' attitudes towards the teacher [Murdock, Beauchamp, Hinton-Dampf, 2008]. One of the major contextual factors is teacher behavior [Bluestein, 2015; Lang, 2013; Simon et al., 2004; Broeckelman-Post, 2008]. Through direct contact with students, teachers can create and maintain an educational environment in which dishonest practices are kept to a minimum.

Several characteristics of teacher behavior are particularly closely related to the prevalence of cheating: teachers' immediate reactions to cheating [Chirikov et al., 2020; Yu et al., 2016; Shmeleva, 2016; McCabe, Butterfield, Trevino, 2006], teachers' warning about the unacceptability of cheating and clarifying the consequences [Broeckelman-Post, 2008; Mahmoud et al., 2020], as well as the availability of clear requirements and relevant instructional material [Murdock, Miller, Goetzinger, 2007]. Students' decisions to cheat depend on their attitudes towards the teacher: students who disrespect their teacher and consider him or her incompetent and dishonest are more likely to use dishonest practices in the learning process [Murdock, Beauchamp, Hinton-Dampf, 2008]. Thus, a positive experience of teacher-student interaction can generate respect for the teacher in students and, consequently, reduce the likelihood of cheating behavior [Bluestein, 2015; Sivak, 2006]. At the same time, scientific literature provides little evidence on the nature of the relationship between the prevalence of cheating and the pedagogical practices teachers use in the classroom.

1.2. What is known about the relationship between academic dishonesty and the way classes are organized

Current research shows that what matters is the goals teachers set for their students (see the following meta-analysis: [Krou, Fong, Hoff, 2021]). Students whose teachers prioritize mastery are less likely to cheat in their studies than those whose teachers encourage performance-oriented learning [Anderman, 2007; Anderman, Cupp, Lane, 2009]. The mastery-oriented learning is characterized by teachers encouraging students' efforts and improvement, while the performance-oriented instruction encourages comparisons of students' performance in the classroom, promotes competition, and prioritizes grades.

Furthermore, the prevalence of cheating can be reduced if the assessment of student performance is organized in a way that limits the opportunities to cheat, for instance, by organizing classes based on student presentations, conducting randomized and personalized tests, and using the procedures and principles of case-based problem solving [Guangul et al., 2020; Toledo et al., 2021; Scott, 2017].

A pedagogical design dominated by passive learning practices can contribute to the proliferation of cheating among students. Passive practices focus on memorizing and reproducing the knowledge obtained from the instructor who provides students with the solutions [Prince, 2004]. The examples are the copying and retelling of the learning content. Traditionalism in education, which is characterized by passive learning practices, is usually opposed to the constructivist approach and active pedagogical practices that aim to engage students in the process of knowledge acquisition and let them solve problems independently [Beswick, 2007; Carr, Palmer, Hagel, 2015]. These practices include, among other things, participation in class discussions, application of theoretical concepts to case studies, and making presentations.

The relationship between particular pedagogical practices and cheating has not been studied using the Russian data yet, while current research in related fields provides contradictory results. In general, student engagement in the learning process is positively related to students' perceptions of the integrity of the educational environment, but the more involved students are in class discussions, the more likely they are to report that other students have cheated on credit tests and examinations [Maloshonok, 2016].

1.3. How classes are organized in Russian universities

In Russian universities, passive learning practices are widely used. Approximately 70% of students in economics and management programmes spend most of their class time writing down what the lecturer dictates and copying what is written on the blackboard or the projection screen [Chirikov, 2015]. According to the results of the nationwide student survey conducted in the summer of 2021, these practices prevail; about 90% of students at least in some classes have copied down the content of the slides, have written down the learning material to the teacher's dictation, and have had to memorize lecture notes or the content of a study guide, while those who reported the use of active learning practices by teachers, such as applying theories to practice, were much fewer [Sukhanova, Froumin, 2021].

Foreign studies have suggested a relationship between cheating and the predominance of copying, memorizing, and reproducing learning materials in the learning process [Pabian, 2015]. Thus, we can expect that students who are taught using mostly passive practices are more likely to cheat (Hypothesis 1). Conversely, students who are taught based on mostly active practices are less likely to cheat (Hypothesis 2).

In order to test these hypotheses, we analyze the relationship between students' responses on the frequency of cheating and those on the frequency of teachers' use of certain pedagogical

practices, namely copying and retelling the learning content (passive practices), participating in class discussions, applying theoretical concepts to case studies and making presentations (active practices).

2. Data

The empirical basis for the study is the data from the project *Monitoring of education markets and organizations*, which surveyed students of full-time education programmes at Russian higher education institutions during the distance learning period in the spring of 2020. Participants from the target group were recruited using administrative recruitment and river sampling[1]. Prior to analysis, the survey data were weighted to adjust for quotas for organizations.

Table 1. **Characteristics of the Study Sample, *N* = 17,316**

Variable	Category	Percentage (%)
Student gender	Female	66.3
	Male	33.7
Year of study	1st year	33.8
	2nd year	29.4
	3rd year	26.2
	4th year	10.6
Field of study	Humanities	9.4
	Public Health and Medical Sciences	8.9
	Engineering, Technology and Engineering Sciences	17.2
	Arts and Culture	3.3
	Mathematical and Natural Sciences	18.1
	Social Sciences	25.3
	Education and Pedagogical Sciences	14.1
	Agriculture and Agricultural Sciences	3.6
University status	Leading	14.5
	Flagship	10.9
	Other	74.6

The study sample included responses of students from 291 higher education institutions pursuing a bachelor's or a specialist's degree. Universities represented by less than 10 students were excluded from the analysis to enable the use of multilevel modeling, with

[1] River sampling is real-time recruitment of the target audience that does not guarantee control at the level of a particular organization: control is only possible at the level of the organization type. The types of organizations were identified based on the criteria used for quota allocation: type of ownership, federal okrug, type of university (flagship, leading, other).

students at the first level and universities at the second level. As a result, the final sample included the responses of 17,316 students.

Among the students in the sample, 66% were female and 78% were pursuing a bachelor's degree. 34% of the respondents were studying in the 1st year, 30% in the 2nd year, 26% in the 3rd year, and 11% in the 4th year (Table 1). Social science students were the largest group (25%), followed by those who studied mathematical and natural sciences (18%), and engineering, technology and engineering sciences (17%). 15% of the students were enrolled in leading universities[2] and 11% in flagship universities.

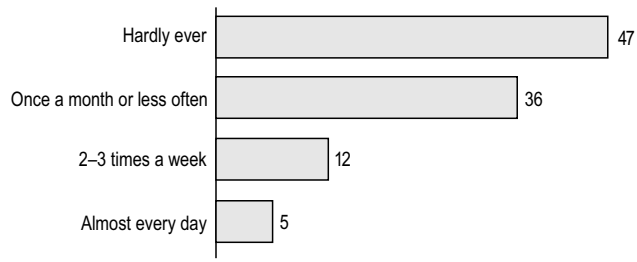
The questionnaire included questions about respondents' learning experiences in the 2019/2020 academic year. Questions on behavior (e.g. student cheating or student engagement) specified that respondents should take into account both offline and online classes of the 2019/2020 academic year.

3. Measurements

3.1. Dependent variable

The dependent variable is cheating in homework. Students were asked the following question: "How often in the 2019/2020 academic year did you copy other students' homework (also during online learning)?". The response options were "Hardly ever", "Once a month or less often", "2–3 times a week", and "Almost every day" (Figure 1). For ease of interpretation, the original variable was converted to a binary one: the value of 0 was assigned to students who hardly ever cheated (47%), and 1 to those who cheated with some regularity (Table 2).

Figure 1. **Distribution of student responses on the frequency of cheating**



3.2. Independent variables

The independent variables include individual student indicators and institutional characteristics of universities.

As the individual-level independent variables, we use the prevalence of certain passive (copying and retelling of the learning con-

[2] Leading universities include members of the Association of Leading Universities and the *Global Universities* Association, as well as national research universities, federal universities, and universities that participated in The Russian Academic Excellence Project (*Project 5-100*).

tent) and active (case studies, group discussions, presentations)[3] learning practices in seminars and practical sessions.

The control individual-level variables include the following student characteristics: gender, year and field of study, the proportion of attended in-person practical sessions and seminars[4], and the frequency of asking questions to the teacher and participating in discussions as indicators of student engagement in the learning process [Maloshonok, 2016][5]. These variables are included in the analysis to separate the effect of pedagogical practices from the effect of student engagement, as there is some empirical evidence of their correlation [Prince, 2004]. The university status has been chosen as the group-level control variable. Table 2 presents descriptive statistics for the dependent and independent variables at the individual and group levels.

Table 2. **Descriptive Statistics of Dependent and Independent Variables, *N* = 17,316**

Variable	Response options	Percentage (%)
Cheating	Yes	53.3
	Hardly ever	46.7
Proportion of attended in-person seminars and practical sessions	Up to 50% of the classes	5.3
	50% to 75% of the classes	14.5
	More than 75% of the classes	80.2
Frequency of asking questions and participating in (group) discussions	Once a month or less often	30.8
	2–3 times a week	40.4
	Almost every day	28.8

[3] Question: 'What proportion of seminars and practical sessions at your higher education institution were conducted in the following formats in the 2019/2020 academic year?» The original variable with four response options was recoded into a variable with three response categories. For several pedagogical practices, the first response option 'None were conducted in this format' had a very low frequency and was therefore merged with the second option 'Less than 30%'.

[4] Question: 'Did you always attend in-person seminars and practical sessions in the last (2019/2020) academic year?' The original variable with five response options was recoded into a variable with three response categories. The first three response options were merged into the category 'Attended up to 50% of the classes' due to their low frequency.

[5] Question: 'How often in the 2019/2020 academic year did you do the following at this university (also in online classes): asking questions, participating in (group) discussions'. The original variable with four response options was recoded into a variable with three response categories. The first response option 'Hardly ever' was merged with the option 'Once a month or less often' due to the low frequency of the former.

Variable	Response options	Percentage (%)
Copying the learning content	Less than 30%	26.2
	30 to 70%	38.3
	More than 70%	35.5
Retelling the learning content by students	Less than 30%	51.1
	30 to 70%	31.3
	More than 70%	17.5
Participating in class discussions	Less than 30%	23.7
	30 to 70%	44.1
	More than 70%	32.1
Application of theoretical concepts to case studies	Less than 30%	37.9
	30 to 70%	42.2
	More than 70%	19.9
Making presentations	Less than 30%	38.4
	30 to 70%	40.1
	More than 70%	21.5

About half (53%) of the students in the study sample have cheated. The vast majority of students have attended more than 75% of the classes, and only about a quarter of the students (29%) have asked teachers questions daily. According to the students, the most frequently used pedagogical practices were the copying of the learning content and discussions: about a third of the students mentioned these as the most common learning formats accounting for over 70% of the class time in seminars and practical sessions (36% and 32%, respectively). The least common teaching technique was the retelling of the learning material: about half of the students (51%) reported that this format of learning accounted for less than 30% of class time.

4. Analytical strategy

The purpose of this study is to assess the relationship between the prevalence of passive and active pedagogical practices and cheating among students. A series of binary multilevel logistic regressions with sequentially added groups of variables are used to assess the odds of cheating. Multilevel modeling is used for the analysis, as the data have a two-level structure: the level of students and the level of universities in which the students are enrolled. The first model includes the average predicted value of the odds ratio for cheating (intercept), taking into account the grouping of students' responses into universities. The second model with a random intercept and

fixed coefficients includes control variables of individual and group levels. In the third model with similar characteristics, we add indicators of the frequency with which different pedagogical practices are used. Each model reflects the odds ratio for cheating in relation to the values of the independent variables.

5. Results

The results of the regression analysis are presented in Table 3. The first model includes the average predicted odds ratio for cheating. The model allows us to estimate the intraclass correlation coefficient (ICC), which shows the level of similarity between students enrolled in different universities. A coefficient of 6% indicates a low variation in the odds of cheating across higher education institutions. It means that universities do not differ much in the ratio of the proportions of students who cheat and those who do not. The use of multilevel regression is justified by the two-level structure of the data and the results of the studies on the relationship between school environment and problem behavior, in which ICC values greater than 0.02 [Bonell et al., 2013] and 0.01 [Shackleton et al., 2016] are considered acceptable.

Table 3. **Factors of Cheating: Binary Multilevel Logistic Regression with Odds Ratios**

		Model 1	Model 2	Model 3	Confidence interval (95%)
Individual student characteristics					
Gender (base — male)	Female		0.66*** (0.05)	0.66*** (0.05)	[0.61–0.71]]
Year of study (base — 1st year)	2nd year		0.92 (0.08)	0.93 (0.08)	[0.85–1.02]
	3rd year		0.70*** (0.06)	0.71*** (0.06)	[0.65–0.78]
	4th year		0.66*** (0.07)	0.68*** (0.07)	[0.61–0.76]
Field of study (base — Engineering, Technology and Engineering Sciences)	Humanities		0.76** (0.14)	0.78** (0.14)	[0.65–0.94]
	Public Health and Medical Sciences		1.08 (0.19)	1.08 (0.19)	[0.91–1.28]
	Arts and Culture		0.51*** (0.12)	0.53*** (0.12)	[0.42–0.66]
	Mathematical and Natural Sciences		1.04 (0.11)	1.05 (0.11)	[0.94–1.17]
	Social Sciences		0.84** (0.09)	0.85** (0.09)	[0.76–0.96]

		Model 1	Model 2	Model 3	Confidence interval (95%)
Field of study (base — Engineering, Technology and Engineering Sciences)	Education and Pedagogical Sciences		0.76*** (0.12)	0.77** (0.12)	[0.65 – 0.91]
	Agriculture and Agricultural Sciences		0.72*** (0.14)	0.71*** (0.15)	[0.58–0.87]
Frequency of class attendance (base — less than 50% of the classes)	50 to 75% of the classes		0.95 (0.17)	0.95 (0.17)	[0.80–1.15]
	More than 75% of the classes		0.44*** (0.07)	0.44*** (0.07)	[0.38–0.52]
Asked questions, participated in class discussions (base — once a month or less often)	2–3 times a week		0.90** (0.07)	0.91* (0.07)	[0.84–0.99]
	Almost every day		0.65*** (0.06)	0.66*** (0.06)	[0.60–0.73]
Characteristics at the university level					
University status (base — other universities)	Leading university		1.06 (0.21)	1.08 (0.21)	0.90–1.31
	Flagship university		1.10 (0.23)	1.09 (0.23)	0.89–1.34
Percentage of study time spent copying the learning content (base — less than 30%)	30 to 70%			1.11* (0.09)	1.02–1.21
	More than 70%			1.26*** (0.11)	1.15–1.38
Percentage of study time spent retelling the learning content (base — less than 30%)	30 to 70%			1.11* (0.09)	1.02–1.20
	More than 70%			1.22*** (0.14)	1.09–1.36
Percentage of study time spent participating in discussions (base — less than 30%)	30 to 70%			0.92 (0.08)	0.84–1.00
	More than 70%			0.78*** (0.09)	0.70–0.88
Percentage of study time spent applying theoretical concepts to case studies (base — less than 30%)	30 to 70%			1.00 (0.08)	0.92–1.08
	More than 70%			0.96 (0.09)	0.86–1.08
Percentage of study time spent making presentations (base — less than 30%)	30 to 70%			1.04 (0.08)	0.96–1.13
	More than 70%			1.07 (0.11)	0.96–1.19

	Model 1	Model 2	Model 3	Confidence interval (95%)
Intercept	1.24*** (0.08)	4.83*** (1.09)	4.24*** (1.09)	3.42–5.25
ICC	0.06	0.04	0.04	
BIC	21 598.1	20 971.8	21 007.2	
Log-likelihood	–10 789.3	–10 393.2	–10 362.1	
Marginal R^2 / Conditional R^2	0.00 / 0.06	0.07 / 0.11	0.08 / 0.11	
Number of students / Number of universities	17 316 / 291			

***p < .001, **p < .01, *p < .50.

In the second model, control variables of individual and group levels are added. Students who have attended more than 75% of the classes are less likely to cheat than those who have attended less than 50%. In addition, students who have asked the teacher questions at least 2–3 times a week during class are less likely to cheat than those who have hardly ever done so. The odds ratios for cheating are not statistically significantly different for students from different types of universities. Model 2 explains 7% of the variance of the dependent variable by fixed effects and 11% by both fixed and non-fixed effects and correctly classifies 67% of the observations.

In the third model, indicators of the frequency with which teachers used various pedagogical practices are added. Students who were more frequently taught using passive practices (copying and retelling the learning content) were more likely to cheat. Statistically significant differences were found between the groups of students for whom these practices occupied less than 30% of class time and those for whom these practices occupied 30 to 70% of class time (odds ratio = 1.11 for the copying and retelling of the learning content). Thus, the first hypothesis has been confirmed.

The use of such an active practice as class discussions in pedagogical design is associated with a relatively low odds ratio for cheating in homework. Students for whom this practice occurred frequently (more than 70% of class time) were significantly less likely to cheat than those for whom discussions took up less than 30% of class time (odds ratio = 0.78). No significant correlation was found between the frequency of using case studies and presentations, on the one hand, and cheating, on the other. Thus, the second hypothesis has been partially confirmed.

Model 3 explains 8% of the variance of the dependent variable by fixed effects and 11% by both fixed and non-fixed effects and cor-

rectly classifies 67% of the observations. These values are not significantly different from those of model 2. Moreover, changes in the BIC and log-likelihood values indicate an insignificant increase in the explanatory power of model 3 compared to model 2. Thus, the inclusion in the model of predictors describing the frequency of use of pedagogical practices increases the explanatory power of the model insignificantly.

The maximum value of the variance inflation factor (VIF) for the models is 3.49, indicating the absence of a multicollinearity problem.

6. Limitations of the study

The present study has several limitations that should be taken into account when interpreting the results.

Firstly, since the pedagogical practices used by teachers are assessed based on a student survey the estimates of their prevalence may be biased, for example, due to some students' low class attendance (20% of the students in the study sample have attended less than 75% of the classes). To account for possible bias in the data, student attendance was considered in the analysis.

Secondly, the study uses the estimated prevalence of pedagogical practices in general, without differentiation by course, while courses may differ significantly in terms of pedagogical design. Thus, the study allows us only to draw conclusions about the prevalence of passive and active learning practices in general and its correlation with cheating can be underestimated. Future research should take into account the specific features of the pedagogical design used in different courses.

Thirdly, since the indicator of cheating used in this study is cheating in homework, the relationship between cheating and pedagogical practices applied in the classroom may be underestimated. Future studies should consider measuring the frequency of cheating in different learning activities: homework, classwork, tests, and examinations.

Fourthly, the study did not take into account any differences in participants' behavior related to the format of learning — distance or in-person. In the questions on behavior, in particular on cheating and engagement, students were asked to describe their experiences in the 2019/2020 academic year, including their experience of distance learning. Thus, the present study does not allow for differentiating students' behavior depending on the format of learning (online or offline).

7. Conclusion and discussion

In recent years, researchers have been increasingly exploring methods to actively prevent cheating and other dishonest academic practices [Eaton, Guglielmin, Otoo, 2017]. The goal of such interventions

is to cultivate and maintain a learning environment characterized by academic integrity [Simon et al., 2004] and falling under the responsibility and authority of the educational institution [DiBartolo, Walsh, 2010; McCabe, Butterfield, Trevino, 2003]. Due to the proliferation of the distance learning format, the risk of student cheating has increased significantly and cheating is becoming one of the factors reducing the quality of education [Sukhanova, Froumin, 2021]. In this context, the importance of preventing academic dishonesty has increased dramatically. The existing methods of fostering students' moral attitudes and punishing misconduct may not be enough to significantly reduce the occurrence of academic dishonesty [Bloodgood, Turnley, Mudrack, 2008; Corrigan-Gibbs et al., 2015; Tatum et al., 2018].

The purpose of this study was to examine the relationship between the frequency of using passive and active pedagogical practices and the frequency of student cheating. An important finding is that there is very little difference in the ratio of students who cheat and those who do not across universities and types of universities — leading, flagship, or other. This means that the prevalence of cheating in Russian higher education institutions does not depend on the institution type. In total, about half (53.3%) of the students have cheated, which is consistent with the results obtained by other researchers [Rudakov, Roshchina, 2018; Sukhanova, Froumin, 2021]. Previous studies have found differences in tolerance for cheating between students from selective and non-selective universities [Chirikov et al., 2020].

This study is the first attempt to assess the relationship between the use of active or passive pedagogical practices by university teachers in Russia and student cheating. Based on previous studies, which suggest that the dominance of passive practices in the classroom can provoke the use of dishonest practices [Pabian, 2015] and their proliferation is determined by the learning design [Anderman, 2007], we have hypothesized that students are more likely to cheat if passive learning practices, such as the copying and retelling of the learning content, prevail in the classroom. Using multilevel modeling, which allowed us to consider both individual student performance and the university status, we have confirmed this hypothesis.

The second hypothesis concerning the association between active pedagogical practices and student cheating has been partially confirmed. Only the frequency of discussions in seminars and practical sessions is negatively related to student cheating. As for other practices (case studies, student presentations), no significant relationships have been found. Furthermore, although there is a significant relationship between the pedagogical practices under consideration and cheating, the variables describing passive and active

learning practices do not contribute much to explaining the variation in the cheating variable. Thus, it cannot be concluded that the format in which learning is organized (at least when measured the same way as in the present study) is a key factor explaining the frequency of student cheating in Russian higher education institutions.

A correlation has been found between cheating and the indicators of students' engagement in the learning process, which were used as control variables in this study. Students who have attended more than 75% of the practical sessions and seminars are less likely to cheat than those who have attended less than 50% of the classes. Moreover, students who have asked questions and participated in class discussions once a month or less often are more likely to cheat than those who have engaged more actively in class discussions. These results are consistent with previous foreign studies [Prince, 2004], but are at odds with the findings obtained in a Russian sample of students [Maloshonok, 2016], in which students more actively involved in discussions were more likely to say that most examinations in their department could be passed easily by cheating. This discrepancy may result from the difference in measuring cheating: we measured the prevalence of cheating based on the respondents' answers to a direct question about their behavior, while Maloshonok [2016] used a less sensitive question in her study — about the possibility of cheating on examinations in general.

Given the relationship found between cheating and the way classes are organized, our key recommendation is to encourage teachers to reduce the use of passive learning practices and replace them with more engaging ones associated with a high quality of education [Carr, Palmer, Hagel, 2015]. This requires investment in teacher retraining, aimed at updating the repertoire of pedagogical practices and introducing those more suitable for distance and blended learning.

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Russian Schools during the COVID-19 Pandemic: Impact of the First Two Waves on the Quality of Education

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Abstract

International studies about the impact of the COVID-19 pandemic on the quality of general education have yielded contradictory results: educational outcomes have fallen markedly in some countries while remaining more or less constant in others. At the same time, over half of published studies attest to the growth of educational inequality during the pandemic. The present research assesses the impact of the pandemic using the data of a regional monitoring survey of all schoolchildren in grades 4, 6, and 8 in the Krasnoyarsk Region in 2019 and 2021. Tests of reading literacy in grades 4 and 6 as well as of science literacy in grade 8 have shown satisfactory psychometric quality. Multilevel regression analysis was used to show that the level of functional literacy of the "pandemic" cohort of schoolchildren, controlled for contextual characteristics, was significantly lower for students in all grades except grade 4. The biggest loss was found in scientific literacy. No correlation was found between the pandemic effect size and the socioeconomic composition of the class (the gap between children with different SES remains at the same level as it was before the pandemic). The teachers' opportunity to conduct online classes did not serve to improve the educational outcomes of schoolchildren during the pandemic.

Keywords school learning, educational inequality, educational outcomes, reading literacy, science literacy, COVID-19, socioeconomic composition of the class, regional monitoring studies.

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The COVID-19 pandemic has taken a heavy toll on the economy, as well as health care and education systems. The scientific, as well as social and political literature, has been widely discussing the potential short- and long-term effects of the pandemic on schools, schoolchildren, their families, and there is active research ongoing in this area.[1] Some authors have already conducted systematic reviews of the results of these studies [Hammerstein et al., 2021]. The current changes and school closures have been shown to increase educational inequality.[2] A wide range of compensatory practices are being discussed.[3] The forced transition to distance learning[4] in 2020 raised many questions about the education system, with no answers so far. Education policy makers voiced opposing views about whether schools would be able to move to distance education, or whether it might be better to close them altogether.[5] Most countries transitioned to distance learning for varying periods, after which children returned to learning in person.[6]

The most vulnerable groups of students: disadvantaged children, underachievers, learners with special educational needs, and so forth caused the most concern. There were no easy solutions, and some even proposed to let the most vulnerable groups of children attend schools so that they had somewhere to go.[7] Some countries did not close schools at the beginning of the pandemic. However, at the peak of the first wave in mid-April, UNESCO re-

[1] https://www.rand.org/multimedia/audio/2020/03/31/the-impact-of-covid-19-on-the-us-education-system.html
[2] Storey N., Zhang, Q. (2021) A Meta-Analysis of COVID Learning Loss. Preprint.
[3] https://www.rand.org/blog/2020/04/is-it-time-to-rethink-the-separation-between-the-high.html
[4] In this paper, by distance learning we mean online learning, as it is most relevant at the moment; we do not consider other distance learning practices here.
[5] https://www.k12.wa.us/about-ospi/press-releases/novel-coronavirus-covid-19-guidance-resources
[6] https://www.rand.org/blog/2020/04/coronavirus-will-require-changes-in-schools-when-they.html
[7] https://www.theguardian.com/education/2020/apr/14/the-schools-open-during-lockdown-for-some-kids-its-the-only-safe-place

ported that 192 countries had stopped providing in-person instruction in all their schools and universities, which affected 90% of the world's students, or almost 1.6 billion children and young people. In most of these cases, the educational process continued in a distance mode [Косарецкий и др., 2020]. Force majeure interruption of in-person schooling of this scale was an extraordinary situation in education, immediately becoming the focus of research from different perspectives [DeMatthews et al., 2020; Gao, Zhang, 2020; Ghosh et al., 2020].

The pandemic has given researchers a rare chance to study the impact of crises on the education system. The impact of force majeure events, disasters, and terrorist attacks on education quality and student well-being had been studied before. In particular, there had been some research on school closures due to snowstorms [Goodman, 2014; Marcotte, Hemelt, 2008], floods [Thamtanajit, 2020], earthquakes [Sapkota, Neupane, 2021], and even terrorist attacks [Gershenson, Tekin, 2018]. However, all of these studies examine local events that have not even affected the education system of a country's region, let alone a country or a group of countries. The COVID-19 pandemic has created entirely new research opportunities, mostly in countries that have established systems to monitor student academic achievement at different stages of general education.

This paper aims to estimate the loss in education quality due to the pandemic for Russian primary and secondary school students. We seek to answer the following research questions:

- How have the educational outcomes of the 4th, 6th, and 8th graders in 2021 changed compared to 2019 when controlling for contextual characteristics?
- How are these changes related to the socioeconomic composition of the class?
- Are the learning outcomes different for 4th, 6th, and 8th graders in 2021 who were taught by teachers with different levels of technological readiness to teach online?

The current situation with the pandemic and school closures is a good example of a natural experiment. Most schoolchildren found themselves in an educational environment that was completely new to them. No one could have anticipated the pandemic well in advance and prepared for it. Consequently, the distribution of students into experimental and control groups — those who were exposed to the pandemic in 2021 and their predecessors — was exogenous, that is, without any will of the students involved [Murnane, Willett, 2010]. It is natural to assume that 4th, 6th, and 8th graders in 2019 differ from their peers in 2021 primarily because of pandem-

ic-related circumstances. The observed difference in educational outcomes can therefore be regarded as an impact of the pandemic rather than other factors, which could also have played a role, but their significance is incomparable to the effect of the pandemic.

1. Predicting and estimating the learning loss due to the pandemic

All researchers of crises in the education system share the same opinion: students of schools closed under force majeure circumstances lose in learning. Obviously, the loss may not only be due to school closures per se but also due to general stress and disruption of routines [Goodman, 2014]. At the beginning of the pandemic, some researchers expected schoolchildren to lose 30–50% of their previous year's learning by the fall [Kuhfeld, Tarasawa, 2020]. According to estimates based on PISA 2018 data, losses in reading literacy might range from 9 to 16 points depending on the availability and quality of distance education, and the proportion of functionally illiterate students would increase by 8% if schools stayed closed for four months [Kelmendi, Gresham, Iqbal, 2020]. The proportion of "learning poor" — children at age of ten who still could not read — was expected to rise to 63% [Azevedo et al., 2020]. Economic losses for the generation of students affected by the pandemic were tentatively estimated at 3% of their lifetime earnings [Hanushek, Woessmann, 2020], and losses in low- and middle-income countries would be higher than in high-income countries [Psacharopoulos et al., 2021].

The authors emphasized that any predictions should consider several factors that were key to determining how much the pandemic would set back students' learning: the duration of school closures, the quality of distance education, the level of family preparedness and resources, and the availability of high-speed Internet for teachers and families [Косарецкий и др., 2020]. One more factor to keep in mind is the subjective well-being of students and their families, which was predicted to decline [Ghosh et al., 2020] and has actually declined, causing problems in behavior and interaction within families [Patrick et al., 2020].

The COVID-19 pandemic has significantly exacerbated educational inequalities. Any disasters and social upheavals have a greater impact on the most vulnerable and poorest segments of the population [Fothergill, Peek, 2004]. Studies of education systems show that children from families with low socioeconomic status [Sirin, 2005] and children with special educational needs [Cooc, 2019] experience the greatest loss in critical situations. Moreover, children from affluent families get an opportunity to progress better due to receiving extra time for tutoring, having access to paid online courses, and their generally better digital readiness [Stern, Adams, Elsasser, 2009]. Thus, the real effect of the pandemic is not a

general decline in performance, but rather increased stratification and larger opportunity gaps between different groups of students.

There are several ways to estimate the actual loss in the quality of general education due to the pandemic: testing the same children with equated tests just before school closures and immediately after they return to school; comparing the learning levels of children from past cohorts not affected by the pandemic and those of children in the same schooling stage who had to study during the pandemic; comparing the rate of learning progress in previous years with that observed now; finally, comparing the dynamics of educational outcomes of children who experienced distance learning and of those who did not. The academic community has already made some estimates of the actual loss in the quality of education due to the pandemic. These estimates are available for multiple countries, including:

- Belgium [Maldonado, De Witte, 2021];
- Netherlands [Engzell, Frey, Verhagen, 2021];
- Switzerland [Tomasik, Helbling, Moser, 2021];
- Great Britain;[8]
- USA;[9]
- France;[10]
- several other education systems.[11]

The general conclusion is that insignificant loss (about 1–2 months of learning) occurred even in systems where distance learning was well organized and schools were closed for a very short period. At the same time, the studies conducted in the USA and France, for example, have shown that on average there has been almost no learning loss due to the pandemic. Yet even with a minimal overall loss, the detrimental effect of the pandemic on children from families with low socioeconomic status is about 1.5 times greater than for children from wealthy families, meaning that the pandemic increases inequality. In contrast to the aforementioned countries, which are among the most successful both economically and in terms of education, India, for instance, has faced a substantially greater loss.[12]

[8] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/962330/Learning_Loss_Report_1A_-_FINAL.pdf

[9] https://www.nwea.org/content/uploads/2020/11/Collaborative-brief-Learning-during-COVID-19.NOV2020.pdf

[10] https://www.education.gouv.fr/evaluations-de-debut-de-sixieme-2020-premiers-resultats-307125

[11] https://educationendowmentfoundation.org.uk/eef-support-for-schools/covid-19-resources/best-evidence-on-impact-of-school-closures-on-the-attainment-gap/

[12] https://www.orfonline.org/research/regression-in-learning/?amp

The Russian education system has not yet undertaken research to assess the learning loss experienced by schoolchildren. In this paper, using data from the regional monitoring surveys of reading and science literacy conducted in the Krasnoyarsk Region among all 4th, 6th, and 8th graders, we investigate what educational loss Russian schools have faced as a result of the first and second waves of the COVID-19 pandemic.

2. Learning Conditions During the Pandemic: National and Regional Context

The current state of Russia's education system is such that in case of a pandemic every fourth pupil and every fifth school may have to interrupt the educational process, as the Internet speed will not be enough for proper distance learning in about 40% of Russian schools. Furthermore, every fifth teacher in Russia does not have the skills necessary to organize distance learning [Заир-Бек, Мерцалова, Анчиков, 2020]. Even during the second wave of COVID-19, in 12 constituent territories of the Russian Federation, the degree of school preparedness for distance learning was such that the experts of the Institute of Education of the National Research University Higher School of Economics classified these territories as a risk zone based on a combination of school preparedness for distance education and the level of viral threat.[13]

Families with high and low socioeconomic status differ from one another not only in overall technology readiness but also in whether parents and children have the skills needed to organize distance learning. Poor families are more likely than affluent families to report that they lack computer literacy and skills for organizing learning at home (31% against 10%); that their children are not ready for studying online (60% against 45%); that when studying in a distance mode their children have an insufficient study load and receive lower quality education (76% against 56%).[14] For more details on both learning conditions and education policy during the pandemic at the national level, see [Мерцалова и др., 2021]. In this study, we focus on the regional specifics.

In the schools of the Krasnoyarsk Region, in-person learning was interrupted on March 17, 2020. On that day, following the governor's decree, all schools in the region went on an early spring break, after which distance learning began, continuing until the end of the school year. The new school year started with face-to-face learning, but on October 28, 2020, given the complicated epidemiological situation, the Ministry of Education of the Krasnoyarsk Region recommended schools in Krasnoyarsk and ten other towns — Achinsk, Kansk, Yeniseysk, Divnogorsk, Lesosibirsk, Minusinsk,

[13] https://www.hse.ru/news/expertise/416606518.html

[14] http://pltf.ru/2020/04/24/vypusk-8-detskoe-onlajn-obrazovanie/?fbclid=IwAR30Ihle9bnwKHkgtW-L5M9KqOcW13cbmm2dbM5cqMlomngiM7MS05C4r7Y

Sosnovoborsk, Sharypovo, Zheleznogorsk, and Zelenogorsk — to transfer students of grades 5–11 to distance learning right after the fall break. Primary school students continued to study in person.

Municipalities were entitled to decide whether to transfer schools to distance learning based on the COVID-19 rate in their administrative territories. A few weeks later, four more towns — Borodino, Bogotol, Nazarovo, and Norilsk — transferred their primary and secondary school students to distance education. On December 7, 2020, ninth- and eleventh-graders were back to their classes, as well as fifth graders in all towns, except Krasnoyarsk. Only on January 11, with the start of the second half of the year, schools were able to return to the traditional mode of instruction.

Thus, for about two months schoolchildren in grades 6–8 in almost all urban schools of the Krasnoyarsk Region studied remotely. Their peers in non-urban areas and five small towns of the region with a population of fewer than 25,000 people — Artemovsk, Dudinka, Zaozyorny, Uzhur, and Uyar — continued in-person learning. While the ratio of schools providing in-person and distance education in November–December 2020 was 70 to 30, the ratio of students in grades 6–8 was almost the opposite: 65% of them studied from home and only 35% in physical classrooms.

In both the first and second waves of the pandemic, equipping participants in online learning remained a challenge. Only a handful of schools were able to provide laptops, netbooks, or tablets to schoolchildren who did not have computer hardware at home. In 2020, not all teachers had access to computers from which to teach online classes. In the region stretching from the Sayan Mountains to the Arctic coast, settlements often had an Internet connection available only in the school building or had no Internet connection at all, and a mobile phone signal could be received only at a few locations on high ground. For this reason, in many rural schools, schoolchildren handed in their completed assignments to teachers in paper form.

Due to the majority of 6th–8th graders moving to distance learning the regional diagnostic tests (RDTs) in these cohorts which had been scheduled for late fall 2020 were postponed until early 2021. The RDT in reading literacy in 6th grades was held on January 26, 2021, just 15 days after 6th graders returned to school following a period of distance learning and vacation. The RDT in science literacy for 8th graders took place on February 16. Only the RDT in reading literacy in 4th grade was held as planned on March 17, just as before the pandemic.

By the beginning of the study, all sixth- and eighth-graders had spent more than half of the school year in a distance mode of learning (about 4.5 months in the spring and fall of 2020), and fourth-graders just over two months (in the spring of 2020). Further-

more, there were almost no schools where a class, or even the entire school, would not switch to extra periods of distance learning during quarantines, thereby increasing the interruption of in-person education.

3. Methodology

3.1. Characteristics of the Monitoring Survey

The diagnostic testing in reading literacy is conducted in all schools of the Krasnoyarsk Region annually in grades 4 and 6. Since 2018, the 8th graders have been taking an RDT in science literacy. Each regional diagnostic test includes two test versions. We have used the results of the RDT administered in 2018, 2019, and 2021. Since each of the RDT has two purposes — to assess individual student achievement and the overall situation in the regional education system — they are designed as a "dual-use" procedure. Municipal observers from other schools arrive during the test to monitor the process. Completed assignments are assessed by municipal or school commissions. The type of assessment is chosen by the municipal education authority.

All RDTs are modeled on the international PISA study[15]. In measuring mathematics and science literacy, the same groups of competencies are assessed as in PISA. The reading literacy tests are based on the reading literacy assessment model developed by the Institute for Strategy of Education Development of the Russian Academy of Education under the direction of G. S. Kovaleva and also take into account the PISA experience. The tests contain both dichotomously and polytomously scored items.

Not only do the diagnostic tests vary from grade to grade, but also from cohort to cohort. The 2019 tests for the grades studied in this paper differ from tests for the same grades in 2021. To assess the impact of the pandemic and to compare the results of the 2019 and 2021 RDT, we must ensure that the test results are comparable.

3.2. Ensuring Comparability of the Test Results

In order to equate tests from multiple assessments [Карданова, Нейман, 2003] , the method of common, or anchor, item equating is usually used. Different diagnostic instruments include several common items, so that test scores can be calculated on a common scale. The number of common items in the two tests should be sufficient to consider the equating results reliable. Since the data available to us originally had no common items, we applied the equation by pseudo-common items.[16]

To obtain pseudo-common items, we selected items similar in topic, format, and scoring principle in the test versions from differ-

[15] https://www.oecd.org/pisa

[16] https://www.winsteps.com/winman/equating.htm

ent years. Then all test results were arranged in such a way that pseudo-common items could be used to "anchor" the tests from different years and place them on a single scoring scale. As a result, all parameters of test items and test takers were on the same scale. The test results from different years could then be compared to each other, albeit with some limitations, within the framework of item response theory [Нейман, Хлебников, 2000].

Thus, equating by pseudo-common items allows us to directly compare the performance of 4th, 6th, and 8th graders in 2019 and 2021 since their scores are now comparable. To increase the reliability of the procedure, we used all available test results — those from 2018, 2019, and 2021. For each cohort, the reference test version was the first version in one year out of three.

Among the models of the latent trait theory, the Rasch one-parameter logistic model [Wright, Stone, 1979] is most commonly used for equating. The study data were processed using specialized Winsteps software[17] developed for psychometric analysis using the Rasch model. The pseudo-common-item equating was therefore also conducted using the Rasch model. The procedure included the following steps:

- difficulty estimation for all items in the reference group, including common ones (pseudo-common in this case), setting the average trait score to zero;
- difficulty estimation for all items of all other test versions in the three years, for example, for the 8th graders it is Version 2 of 2019 (Version 1 is the reference one) and Versions 1 and 2 of 2018 and 2021. For all of them, the average latent trait score is also set to zero;
- calculation of the difference in the difficulty of the pseudo-common items between the reference version and each other test version. After that, the arithmetic mean difference is calculated, which is the equating constant;
- latent trait estimation for each group that took a particular test version. The measurements are carried out on a test version's own scale;
- conversion of scores on the other test versions to scores on the reference test version by adding the equating constant. Since eventually each test version will be scored on the scale of the first 2019 version (in the case of 8th graders), all these scores can be considered comparable and can be actually compared with each other.

[17] https://www.winsteps.com

After the input data are pre-processed, Winsteps autonomously runs all the following steps, which allows for simultaneous pseudo-equation of all six versions of the measurement instrument and their presentation in the framework of a partial credit model.[18]

3.3. Contextual Data and Analysis Strategy

To assess the impact of the pandemic, we used comparable test results of 4th, 6th, and 8th graders in 2019 (before the pandemic) and 2021 — a total of 165,740 schoolchildren from 1,047 schools in the Krasnoyarsk Region. The data have a three-level structure: individual student scores are grouped first by grade and then by school. The schools surveyed were the same in all years when the RDTs were conducted, while the composition of classes varied. In other words, the ability level of, for example, fourth graders in 2019 was compared with the ability level of new fourth graders in 2021.

The main dependent variable in the analysis is the standardized test results of a student, indicating his or her ability level. Other individual student characteristics considered included gender, test version, and whether the student belonged to the 2019 or 2021 cohort. At the grade level, we used a variable indicating the number of schoolchildren whose at least one parent had a university degree, to control for students' socioeconomic composition [Кершa, 2020]. In each year, based on the distribution of this variable, three equally populated groups of classes — with low, middle, and high socioeconomic composition — were identified. Drawing on the information from teachers, at a specific stage of the analysis 4th and 8th grades were divided into classes where the teacher was able to give online lessons and those in which the teacher was not. In 8th grade, tested in science literacy, we considered this ability in three types of teachers — physics, biology, and chemistry. At the school level, the type of settlement where the school was located was controlled for. We distinguished groups of schools located in small towns and rural areas, in larger cities, and separately in Krasnoyarsk. The main groups to be compared were the 2019 and 2021 cohorts, but to control for students' previous performance, the average score of the respective class in the 2018 test was also calculated. Descriptive statistics for the variables used are presented in Appendix.[19]

Since the tests in grades 4, 6, and 8 differ from each other, calculations for different cohorts were performed separately. To compare student test scores in 2019 and 2021, three-level regression models were constructed that accounted for contextual characteristics at the student, grade, and school levels [Hox, 2010]. Since one of the research goals was to see whether the change in student ability lev-

[18] https://www.rasch.org/rmt/rmt143k.htm

[19] Access the anonymized data, calculation procedures, and appendix here: doi: 10.17632/k7gv2c43bd.1

els in 2021 compared to 2019 differed by socioeconomic class composition, the analysis was conducted using a random slope model with cross-level interaction [Hox, 2010]. In addition, sub-sample analysis was conducted for groups of classes with different technological readiness, as well as for students with the highest ability level (25% of the highest scores in each wave) and the lowest (25% of the lowest scores). Models were selected and compared using goodness-of-fit measures (AIC, BIC, Log-Likelihood) and a likelihood ratio test. Models were built step-by-step, starting with an intercept-only model with fixed coefficients (Appendix). There were five models for each grade level — intercept-only model (1); one with added covariates and fixed coefficients (2); one with varying coefficients at grade level (3); one with varying coefficients at school level (4); one with cross-level interaction (5). For the subsample analysis, model (4) was used without the cross-level interaction variable. The most comprehensive model including cross-level interaction was as follows:

$$ability_{ijk} = \gamma_{000} + \gamma_{ijk}\, IND_{ijk} + \gamma_{jk}\, CLS_{jk} + \gamma_{k}\, SCH_{k} + \gamma_{ijk}\, IND_{ijk} \times$$
$$\times\, CLS_{jk} + u_{0jk}\, IND_{ijk} + u_{0jk} + e_{ijk},$$

where *ability* is a dependent variable for an individual ability level; *i* — first-level index (students), *j* — second-level index (grades), *k* — third-level index (schools); γ_{000} — model intercept; IND, CLS, and SCH — vectors of covariates at individual, grade and school levels respectively; *u* — dispersion of residuals; *e* — model residuals.

The analysis was performed using the software package for data analytics Stata/SE 16. Since the sample size is quite large, even the smallest effects can be found statistically significant in case of high accuracy of parameter estimation. Therefore, instead of the p-value, we provide the values and confidence intervals of the average marginal effects of the study year for the examined parameters [Lin, Lucas, Shmueli, 2013], expressed in standard deviations of the difference between the ability levels in 2021 and 2019. In addition, the bootstrapping procedure is also used to estimate parameters on the large sample [Yu, 2002]. To calculate each model, a subsample of 1000 observations was randomly drawn 100 times. The effect size was also calculated for groups of classes distinguished by their socioeconomic composition (low, middle, or high) and the teacher's technical ability to conduct online lessons. The effects of learning during the pandemic were also calculated for groups of schoolchildren with the highest and the lowest academic performance.

3.4. Limitations

Our study has several limitations that must be taken into account when reporting and discussing the results.

- We estimate the impact of the pandemic only in one constituent territory of the Russian Federation, as only there we were able to find the data necessary to answer the main research question — what the learning loss of Russian schoolchildren is due to the pandemic. This limitation could have been avoided if Russia had conducted regular nationwide monitoring of students' functional literacy levels using equated measurement instruments.
- The data obtained in the Krasnoyarsk Region's monitoring study cannot be considered completely reliable. Students' test scores may have been affected by the traditions and attitudes of individual schools and municipal education systems. An external observer, who is sent to monitor the RDT from another school or another municipal institution, is not always able to notice when schoolchildren are being helped or identify bias in grading. In many schools, internal incentive payments depend on the results of external evaluations. Teachers may be trapped by the reputation of their gymnasium or lyceum in which brilliant subject results are the norm. In small towns and settlements, personal motives may come to the fore: "People will say that I am the worst teacher". At the same time, there are school and municipal staff for whom "unfair play" is unacceptable at all, or municipal regulations set a very strict procedure for the RDT when students' works are taken to the municipal commission immediately after they are checked.
- The tests differ from year to year, even if only slightly. The regional authorities have never set out to compare test results of the same age cohorts from different years.
- The method of pseudo-common-item equating has some limitations compared to more traditional methods of ensuring comparability of test results. They include, among other things, the absence of identical items common for different test versions that could be used as anchors in equating, differences in scoring scales, and incomplete correspondence of item assessment procedures.
- In our multilevel regression models, we are forced to use grade- and school-level variables as control ones. For example, we have no information about the socioeconomic status of individual students, but we do have information about the socioeconomic composition of the class. Variables aggregated at the class level are significant predictors of academic achievement, but without individual characteristics, we still lose much of the information.
- There is no regional data for 2020 when the regional monitoring study did not take place. Consequently, we are comparing the results of children in 2019, when there was no pandemic, with the results in 2021 when the entire education system had

already experienced it for about a year. Moreover, children of different ages had studied remotely for different periods, which must also be taken into account when interpreting the results.
- The tests measured science literacy in grades 8 and reading literacy in grades 4 and 6. For this reason, we cannot directly compare effect sizes for different cohorts and can only capture particular losses for individual cohorts. Only the 4th and 6th grades can be validly compared with each other.

4. Results

4.1. Psychometric Analysis of Instrument Quality

In order to confirm the validity of using the monitoring results in the study of pandemic effects, we assessed the quality of the measurement instruments used. The results of this assessment show satisfactory psychometric properties of the scales used (reliability of individual tests is from 0.75 to 0.82), as well as a sufficient number of items in different test versions from different years that can be selected as pseudo-common. The tests have a quite high level of reliability and can be considered essentially unidimensional. Detailed calculations concerning psychometric properties of individual tests, selection of pseudo-common items, and pseudo-equation of test results are openly available in the Appendix.[20]

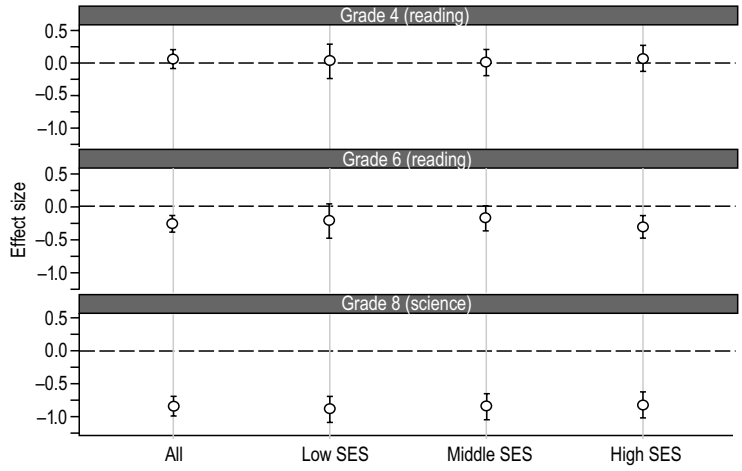
4.2. Effects of the COVID-19 Pandemic on Students' Functional Literacy

The results of the regression analysis show that 4th, 6th, and 8th graders in 2021 generally performed lower than their peers in 2019. The calculation results are presented in Figure 1 as the size of the learning effect in 2021 compared to that in 2019. The negative effect size indicates that the results in 2021 are lower than those in 2019. The largest decrease in scores after the pandemic can be observed in 8th graders (by an average of 0.87 *SD* of the ability level). In 6th graders, the decrease is not as strong (by 0.24 *SD* on average), and in 4th graders, there is no decrease at all. We have found no statistically significant differences between the impact of the pandemic on groups within the same cohort, differing in terms of the socioeconomic composition of the class.

When comparing the learning loss experienced by schoolchildren with different levels of achievement, mixed results were obtained (Figure 2). As in the previous case, 4th graders suffered no loss. For the sixth graders with the highest reading test scores in 2019 and 2021, the loss was more than twice as high (0.38 *SD*) as for those with the lowest scores (0.14 *SD*). In the science test for eighth graders, in contrast, test results of high-scoring students declined not as severely (0.72 *SD*) as those of children with the lowest scores (1.04 *SD*).

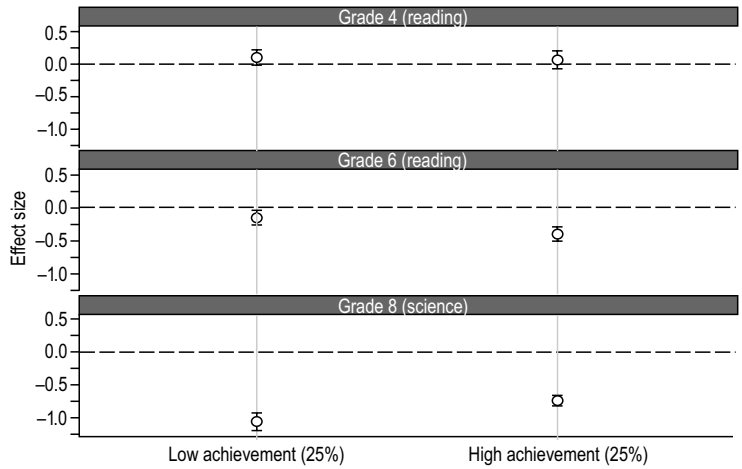
[20] doi: 10.17632/k7gv2c43bd.1

Figure 1. **The Average Marginal Effects of Learning in 2021 Compared to 2019 for 4th, 6th, and 8th Graders From Classes with Different Socioeconomic Composition**



Note. Marginal effects are calculated using a multilevel regression model with cross-level interaction. The 95% confidence interval was used for the coefficient. Effect size coefficients are presented as standard deviations of test results in 2021 compared to 2019 when accounted for covariates in the model.

Figure 2. **The Average Marginal Effects of Learning in 2021 Compared to 2019 for 4th, 6th, and 8th Graders With Different Achievement Levels**



Note. Marginal effects are calculated using a multilevel regression model with cross-level interaction. The 95% confidence interval was used for the coefficient. Effect size coefficients are presented as standard deviations of test results in 2021 compared to 2019 when accounted for covariates in the model.

4.3. Comparison of Test Results in Classes With Different Levels of Technological Readiness

The data from the survey of class teachers in grades 4 and 8 give an idea of how well teachers and students were provided with technical means for online learning. The majority of teachers in the Krasnoyarsk Region had the technical ability to conduct online lessons: almost 70% of 4th-grade teachers and 72% to 76% of 8th-grade science teachers (Figure 3).

Figure 3. **The Proportion of Teachers Who Had the Technical Ability to Teach Online Lessons When the Class Switched to Distance Learning in the Spring of 2020**

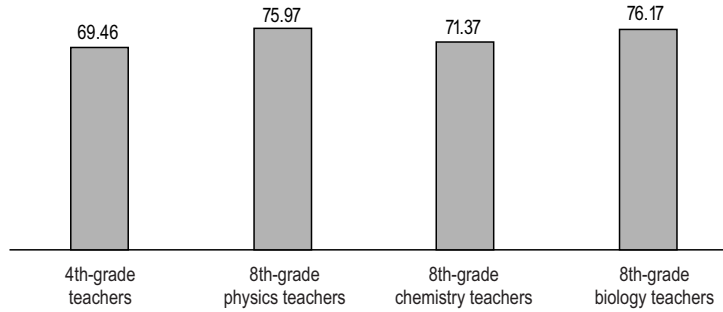
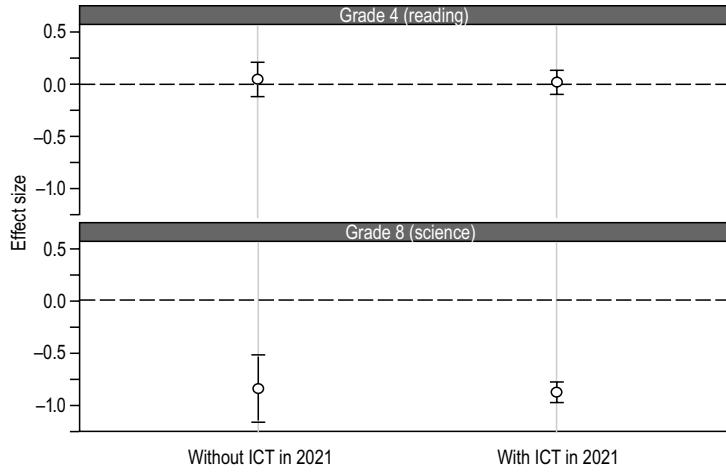


Figure 4. **Average Marginal Effects of Learning in 2021 for Groups of Classes With Different Levels of Technological Readiness**



Note. Marginal effects are calculated using a multilevel regression model with cross-level interaction. The 95% confidence interval was used for the coefficient. Effect size coefficients are presented as standard deviations of test results in 2021 compared to 2019 when accounted for covariates in the model for different subsamples of 2021 students.

The relatively small decline in student test scores in 2021 relative to those of their peers in 2019 appeared to be unrelated to the teacher's technical ability to conduct online classes in 2021 (Figure 4). In classes that were not technically ready for distance learning, the impact of the pandemic did not differ from that in classes

where the teacher had the technical ability to deliver online lessons. The functional literacy of fourth graders in 2021 did not differ from that of their peers in 2019, regardless of the teacher's level of technological readiness. Among 8th graders, there was a decrease in results for both schoolchildren whose teacher was technologically ready to conduct online classes and those whose teacher was not.

5. Discussion

The results of this study indicate that the first two waves of the COVID-19 pandemic have resulted in a certain learning loss for Russian schoolchildren. While taking into account the limitations described above, we can, nevertheless, confidently make the following conclusions:

- Fourth-grade students have suffered virtually no loss in reading literacy. Schoolchildren from the pandemic cohort — those belonging to different groups by socioeconomic class composition, as well as those differing in the level of individual achievement — score at the same level as their predecessors before the pandemic.
- Sixth graders have experienced losses in reading literacy, but these are not very large: an average of about 0.24 *SD*, which is roughly equivalent to four months of schooling [Hattie, 2015]. We observe no worsening inequality in this case, rather the opposite: scores decline more strongly in groups with high socioeconomic class composition and among high-achieving students.
- Eighth graders have suffered a serious loss in science literacy. Inequality between groups of students differing in family wealth has not increased: children from groups by the socioeconomic composition of the classes have experienced equal learning losses. At the same time, the magnitude of loss varies greatly among students with different levels of achievement: low-achieving students have lost more in learning. The average effect is 0.87 *SD*, which is more than two years of schooling.
- In all grades, the level of literacy within the same cohort is strongly related to the socioeconomic composition of the class: the higher the proportion of children whose parents have a university degree, the better the results of children in that class.
- No significant relationship has been found between whether teachers can properly use ICT and the severity of the pandemic effect.

We will first discuss the results for grades 4 and 6 due to the common subject matter of the tests they have taken. The most obvious explanation for the difference in pandemic effects on 4th and 6th graders is that 4th graders have spent much less time in distance mode, which is characteristic not only of the Krasnoyarsk Re-

gion but of the whole country [Kosaretsky et al., 2022]. Moreover, 6th graders returned to in-person learning just before the monitoring study was held, which might have made their situation less favorable as they had fewer opportunities to catch up. As for 4th graders, even if they were first falling behind, they managed to catch up in a full six months of in-person learning. The loss in reading literacy among Russian 6th graders was substantial but did not exceed the average loss found in studies of schoolchildren in other countries [Storey, Zhang, 2021].[21] In fact, the loss of the Russian sixth-graders, when expressed in years of study, was slightly less than the total time spent in distance learning, but we should take into account that there was also a summer vacation between the two waves of the pandemic.

A less obvious explanation for the difference in pandemic effects between 4th and 6th graders may have to do with how the reading instruction of primary school students is organized in the Russian education system. Russian 4th graders consistently score very high in reading literacy in the PIRLS study:[22] they always crowd the top of the list, and in 2016, Russia headed the list of leaders. By contrast, the results of the Russian 15-year-old schoolchildren on reading literacy in PISA are much worse; the best result, which was the 19th to 30th positions in the international ranking, was achieved in 2015, while in the other years the scores were even lower [Адамович и др., 2019]. In primary school, children learn to read for further learning, as well as for literary and aesthetic experience and to learn the world through literary texts (these are the main purposes of reading as stated in the PIRLS study). In doing this, children are greatly helped by their families (only 1% of parents say that they did not teach their child to read before school)[23] and the experience of autonomous reading, which still remains a cultural value and an integral part of a normal childhood in the worldview of Russian parents. In contrast, the basic school should teach reading “for life”, that is, how to compare authors’ attitudes and theses, identify contradictions and authors’ implicit goals, assess the reliability of information, work with texts from different domains with their own specifics, and use information from the text in situations not directly related to those described in the text. These reading skills are less discussed in society, they are not typically addressed in the family, and they are spontaneously developed in a relatively small number of students. The school’s role in developing these skills is therefore substantial.

[21] https://www.mckinsey.com/industries/public-and-social-sector/our-insights/covid-19-and-education-the-lingering-effects-of-unfinished-learning?cid=-soc-twi-mip-mck-oth-2107--&sid=5229869053&linkId=125555357#
[22] https://ioe.hse.ru/lepa/news/212696860.html
[23] Ibid.

The results for science literacy of 8th-grade students show a completely different picture. Even taking into account the limitations we have described, a loss of 0.87 *SD* is very high. None of the studies reviewed above, and none of the other reports[24] describe effects of this magnitude. Comparable loss (up to 0.82 *SD*) has been reported only for mathematics literacy of schoolchildren in Mexico [Hevia et al., 2022]. There are very few studies devoted specifically to science literacy. For example, there is one conducted in Great Britain, but the learning loss reported there is much less significant.[25] Assuming that the data we obtained are valid, their interpretation is problematic. Most likely, we observe a cumulative effect of all factors at once: Russian schoolchildren have never shown high results in science literacy in international comparative studies (a characteristic of the education system); eighth-graders have spent a very long time in distance learning and returned to in-person learning just before the test; it is much more difficult to study science at home than it is to maintain reading skills — primarily because of the lack of access to laboratory equipment and the necessary tools to complete practical assignments.

The worldwide trend of increasing educational inequality due to the pandemic is not supported by our data. The results of students from classes with different socioeconomic compositions vary widely, but this gap has not widened during the pandemic. First, the functional literacy of sixth- and eighth-graders from classes with different socioeconomic compositions declines by about the same value in our study, possibly because the study participants come from only one region of Russia and they are much more homogeneous in socioeconomic status than schoolchildren from different regions of Russia would be. Second, the effect of socioeconomic composition can be not very significant due to the overall poor preparedness of schools for using digital tools in the education process, that is, all schools proved to be equally unprepared. Third, the availability of in-person learning by itself may not have significantly reduced inequality among students, that is, the school was not successful in overcoming social inequality. As a result, the interruption in the students' interaction with their educational institution did not increase inequality among groups of schoolchildren with different wealth levels.

The results regarding the impact of the pandemic on groups of low- and high-achieving schoolchildren are inconsistent. The greatest loss in science literacy has been found among the lowest-performing eighth graders — over 2.5 years of study, while the

[24] https://educationendowmentfoundation.org.uk/guidance-for-teachers/covid-19-resources/best-evidence-on-impact-of-covid-19-on-pupil-attainment

[25] https://gl-assessment.co.uk/media/352700/30443-gl-assessment-analysis-report-final.pdf

best-performing students have experienced 1.7 years of loss in this competency. Studies in other education systems have also found more significant declines in scores of low achievers [Kim et al., 2021; Storey, Zhang, 2021]. Some authors believe that low-achieving students experienced the greatest reduction in organized learning time and, in the absence of adequate school and parental support, replaced it least effectively with less useful activities [Grewenig et al., 2021]. However, among the sixth graders considered in our study, the best-performing students, conversely, showed the greatest decrease in reading literacy scores. The divergent trends found in the responses to the pandemic among sixth- and eighth-graders can be related both to the specifics of the subject areas tested and age differences among students. Yet the idea that the pandemic might hit successful students particularly hard already comes forward in some academic papers.[26]

The decrease in the heterogeneity of results — the gap between the scores of high and low achievers — in the 6th grades due to the pandemic most likely indicates that for reading literacy the effect of in-person learning is much more pronounced for motivated and high-performing students, and when schools move to distance learning these students, therefore, lose more than their lower-achieving peers. Conversely, the heterogeneity of science literacy scores in grades 8 increases, meaning that the gap between the high and low achievers becomes wider. Apparently, in this subject area, in-person education is most needed by the lowest-achieving children. Otherwise, in distance education, they lose much more in learning than their better-performing peers.

The conducted study did not reveal a correlation between the teacher's technical ability to conduct online lessons and smaller losses in test results in 2021. It must be acknowledged that the overall readiness of Russian teachers for the rapid transition to instruction using digital tools is insufficient: according to one survey, 80% of teachers faced problems when transitioning to the distance mode of instruction.[27] Even when they had the necessary technology to conduct online classes, teachers still encountered many obstacles: not all children having the necessary devices, the teacher's lack of online instruction experience, and lack of methodological assistance in working with digital tools. It is probably the reason why the technical ability to teach remotely in a crisis situation was not as important a factor in reducing literacy loss. It may have been the *skill* of teaching remotely, which few people had time to master, that has played a key role.

[26] https://www.smh.com.au/national/for-high-achievers-the-pandemic-could-be-a-tipping-point-20200505-p54q2o.html
[27] https://maximumeducation.com/news/survey_teachers%20

Taking into account all the above, is there any basis for the alarmist sentiment expressed by education researchers[28] and practitioners at the beginning of the pandemic? Based on the results of our study, fourth graders suffered no learning loss because of the pandemic, and for sixth graders, the loss in reading was slightly greater than the average loss found in other studies. At the same time, the level of science literacy of 8th graders in 2021 turned out to be much lower than in 2019. However, the quality of science education in Russia had been short of satisfactory even in the past. This should have been a cause for concern well before the pandemic began.

In this study, we have found no evidence of the previously expected dramatic decline in the quality of education among the most disadvantaged children. Does this mean that we can ignore the pre-pandemic manifestations of educational inequality, such as the limited access to the basic resources necessary for learning, that apply to a large proportion of Russian schoolchildren? Definitely no; even regardless of the pandemic, new support measures for students are needed to compensate for inequality, such as dedicated vacation and summer schools, enhanced programs for at-risk schoolchildren, and extensive government tutoring programs for the poorest families.

Perhaps the main lesson of the pandemic for the Russian education system and policy makers should be the impossibility to assess the effects of the pandemic on the vast majority of the country. The reason is simple: in Russia, there are no national monitoring surveys that would ensure a stable assessment of the progress of students' basic skills at different stages of schooling. Such studies would not only allow us to estimate the effects of the pandemic validly and reliably but also build education policy based on transparent and interpretable data.

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[28] https://publications.hse.ru/view/384257919

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Is the Academic Performance of Schoolchildren Linked to the Expectations of Their Teachers? *Results of an Experimental Study*

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Abstract

Teachers' expectations may affect the academic performance of their pupils, leading to the effect of "self-fulfilling prophecies." Teachers form their expectations about the academic performance of their pupils based on the information they possess about the latter. The present study tested a hypothesis about a correlation between the teacher's disposal of information about the pupil's ranking on an initial diagnostic test at the beginning of the first grade and the pupil's academic performance at the end of the first grade. It also tested the hypothesis that the teacher's awareness of the pupil's ranking can affect their expectations about the level of the pupil's cognitive skills. In this large-scale cluster randomized controlled trial study, 4,460 first-grade students from 188 schools in a Russian region participated. The schools were divided into the experimental and control groups randomly. The teachers in the control group received information about the basic skills of their pupils. In contrast, experimental group teachers additionally received information about their pupils' ranking based on a combination of indicators of their cognitive (basic reading and math) and non-cognitive (personal and socio-emotional) skills. The results showed that there are no differences in students' academic achievements between the groups.

Keywords

teacher expectations, primary school, START, cognitive skills, non-cognitive skills.

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The teacher-student relationship is an important determinant of the educational process. Several studies show that the nature of this relationship is significantly associated with students' engagement in learning activities [Martin, Collie, 2019], academic achievements [Košir, Tement, 2013], and behavior problems [Lei et al., 2016]. Children do better in school and feel more connected to it when they have teachers they find friendly and supportive [Polivanova, Rivina, 2009; Sobkin, Fomichenko, 2015; Davis, 2003]. In primary school, a positive teacher-student relationship is especially important: the results of longitudinal studies showed that the relationship between teachers and first-graders is associated with the children's psychosocial adjustment in primary school [Buyse et al., 2009].

The nature of the teacher-student relationship is determined by a variety of factors, including such an important one as teacher expectations, i.e. "inferences that teachers make about the future behavior or academic achievement of their students based on what they know about them" [Good, 1987]. Teachers form their expectations of students' academic achievement based on the information they possess about the children, namely about their academic performance, behavior, motivation and engagement, gender, family socioeconomic status, etc. [Rubie-Davies, 2004; Good, Brophy, 2008]. Teachers' expectations can also be influenced by their beliefs about students' abilities and needs that the teachers have developed over many years in school [Rubie-Davies, 2004; Turner, Christensen, Meyer, 2009].

Teachers' expectations may affect students' academic achievement, becoming a self-fulfilling prophecy [Rosenthal, Jacobson, 1968]. Several studies have found that teachers' expectations of student success are positively associated with students' high academic performance (Pygmalion effect) [Wang, Rubie-Davies, and Meissel, 2018; Jamil, Larsen, and Hamre, 2018; Rosenthal and Jacobson, 1968], and the strength of the association may increase as students move from year to year [Jamil, Larsen, and Hamre, 2018]. At the same time, teachers' expectations of students' failure that the teachers explicitly demonstrate can lead to the students' poorer academic performance (Golem effect) [Babad, Inbar, Rosenthal, 1982; Reynolds, 2007].

Teacher expectations may increase the discrepancy in student achievement. For example, the achievement gap between groups of students formed by their family's socio-economic status is more likely to emerge if the teachers exaggerate the differences between the groups [Timmermans, Kuyper, van der Werf, 2015]. It has been found that in classes with a high level of student differentiation, teacher expectations account for 14% of the achievement gap at the end of the school year, while in classes with a low level of student differentiation it is only 3% [Brattesani, Weinstein, Marshall, 1984].

The effect of teachers' expectations on students' academic achievement is stronger for some students than for others. These differences can be related to both teacher characteristics, such as teachers' qualifications, belief systems and practices used [Brattesani, Weinstein, Marshall, 1984; Timmermans, Kuyper, van der Werf, 2015], and individual student characteristics [Babad, 1990]. Most studies of the relationship between teacher expectations and student academic achievement or the impact of teacher expectations on student achievement only control for such individual student characteristics as academic performance, behavior, family socio-economic status, learning difficulties, and ethnicity. Moreover, only one of these characteristics is usually considered. There is almost no research on the relationship between teacher expectations and academic performance of children who differ in more than one individual characteristic, particularly in the combination of indicators of their cognitive and non-cognitive (personal and social-emotional) skills.

In studies conducted in primary school, it is especially important to control not only for cognitive skills but also for non-cognitive ones, as their development level at the beginning of schooling is a strong predictor of future success both in school and in life [Kautz et al., 2014]. Moreover, the beginning of schooling is a critical period in the life of schoolchildren: their adaptation to school largely determines their academic achievement later on in school life [Margetts, 2009; Domitrovich et al., 2017; Zuckerman, Polivanova, 2012].

The levels of cognitive and non-cognitive skills in children differ, and a high level of cognitive skills does not indicate strong non-cognitive skills, since these characteristics are conceptually independent of each other [Duckworth, Yeager, 2015]. The existence of student groups differing in the levels of cognitive and non-cognitive skills has been empirically confirmed [Kardanova et al., 2018; Orel et al., 2018; Südkamp, Praetorius, Spinath, 2018].

Teachers are inclined to group students based on their cognitive and social-emotional skills. However, groups of students identified by teachers are consistent: they are characterized by low, average, or above-average levels of both cognitive and non-cognitive (social-emotional) characteristics. In other words, teachers perceive the cognitive and non-cognitive characteristics of each student as congruent and disregard possible discrepancies in student profiles, while in reality there are both consistent and inconsistent groups [Südkamp, Praetorius, Spinath, 2017].

If teachers have some information about different groups of students, it can affect their expectations of students' skill levels and academic performance. The theoretical and empirical research available so far (e.g., [Rubbie-Davies, 2004; Good, Brophy, 2008]) identifies the following main stages of the teacher expectation effect process:

1) teachers form expectations of their students' future achievements based on the information available to them. Underlying these expectations are teachers' conscious beliefs about principles of teaching and patterns of child development as well as unconscious attitudes, including social stereotypes;
2) teachers convey their expectations to students through their behavior and the different learning opportunities they provide;
3) students perceive and interpret teachers' behavior;
4) teachers' differential treatment of students and students' perceptions and interpretations of it affect student academic achievement.

The purpose of this study is to investigate the relationship between teachers' knowledge of the existence of different student groups in the classroom at the beginning of 1st grade, identified based on their cognitive and non-cognitive skills, and teachers' expectations of these students. Furthermore, the study investigates whether teachers' knowledge of the student groups affects these students' academic performance at the end of the academic year.

This study answers the following research questions.

1. Is the teacher's knowledge of the student groups at the beginning of 1st grade related to student academic achievement at the end of the academic year?
2. Is the teacher's knowledge of which group the student belongs to at the beginning of 1st grade related to the student's academic achievement at the end of the academic year?
3. Is the teacher's knowledge of which group the student belongs to related to the teacher's expectations about the student's level of cognitive skills at the end of the academic year?

1. Methodology

1.1. Measurement Instrument

We used START to assess children's cognitive and non-cognitive skills at the beginning and the end of 1st grade. START is an instrument for diagnosing children's levels of cognitive and non-cognitive skills on entry to school and their individual progress made in the first year, developed at the Institute of Education of the National Research University Higher School of Economics (HSE University) [Kardanova et al., 2018]. The START instrument has appropriate psychometric properties and high validity [Kardanova et al., 2018; Brun et al., 2016; Orel et al., 2018].

The instrument is used for a comprehensive assessment of children's development. It assesses not only cognitive but also social and emotional skills. The assessment procedure is an individual computerized, fully automated, game-based testing using an adaptive algorithm that allows children to solve tasks of the appropriate

level of difficulty. The assessment is assisted by an interviewer — usually a teacher who has received specific instructions.

The set of tasks used to diagnose children's cognitive skills consists of several blocks, including blocks with mathematics and reading tasks[1]. Quite a few studies have shown the predictive role of early reading and mathematics skills for later school success [Müller, Brady, 2001; Duncan et al., 2007; Manfra et al., 2017; Jordan et al., 2009].

The mathematics block includes five types of tasks:

- geometric sequences (identifying and continuing them);
- arithmetic sequences (identifying and continuing them);
- number line (navigating a number line from 0 to 100);
- the concept of part and whole (understanding the concepts of half and quarter);
- calculation skills (sums involving addition and subtraction with and without pictures, with and without crossing 10; solving word problems).

The reading block includes four types of tasks:

- letter knowledge;
- reading words (recognizing the graphic representation of words);
- reading a short story (decoding a text);
- reading comprehension (reading a text with "traps", where a child has to choose the most appropriate word from the three options).

In addition, personal and social-emotional skills were assessed, the role and impact of which on various aspects of children's lives had been confirmed by numerous studies [OECD, 2015; Durlak et al., 2011; Domitrovich et al., 2017]. These skills were assessed using the PSED (Personal Social and Emotional Development) questionnaire, which is part of the START tool. The questionnaire is completed by a teacher. The teacher assesses each child in his or her class on a five-point scale based on a set of questions. Each question is accompanied by a detailed description of a child's behavior that is easy for the teacher to observe in the school setting. All questions are grouped into two scales: classroom behavior and communication. The full description of the PSED questionnaire and its scales can be found in [Orel, Ponomareva, 2018; Brun et al., 2016].

The assessment using the START tool was conducted at the beginning and the end of the 1st grade to assess children's initial level

[1] For a detailed description of the instrument, see [Kardanova et al., 2018].

of cognitive and non-cognitive skills and their individual progress. As part of the study, the contextual information was also collected using teacher and parent questionnaires. At the end of each stage, teachers, school administration, and parents received feedback.

1.2. Design of the study

To find answers to the research questions, we organized and conducted a cluster randomized controlled trial study in 195 schools in one Russian region. The study was approved by the Ethics Committee of the HSE University.

Experimental studies involving the intentional change of teacher expectations can be classified according to the interventions types, e.g. providing teachers with false information [Rosenthal, Jacobson, 1968], working with teachers to change their behavior [Rubie-Davies et al, 2015], raising teachers' awareness of expectancy effects [Timperley, Phillips, 2003], addressing the beliefs underlying teacher expectations [Reiter, Davis, 2011], using special scholarship programmes [Jones, Miron, Kelaher-Young, 2012]. Several types of interventions can be used in one study. The success of interventions is usually assessed using students' academic performance and/or indicators of teacher expectations, which are defined as teachers' estimates of students' academic potential [De Boer, Timmermans, van der Werf, 2018].

The intervention that was used in this study involved raising teachers' awareness of what groups of children were there in the class and providing guidance on how to work with each of these groups. Based on the theoretical and experimental data, we hypothesized that after receiving additional information about the group to which a student belongs, the teacher may adjust their opinion about the student and, consequently, their expectations.

The experiment was performed in four stages:

- in October 2019, the baseline survey was conducted, including the assessment of first-graders' cognitive (mathematics and reading) and non-cognitive (personality and social-emotional) skills and a survey of teachers and parents;
- in November 2019, the schools participating in the study were randomly assigned to a control or an experimental group;
- in November–December 2019, teachers were provided with the children's assessment results, whereby teachers from the experimental group received additional information on the groups present in the class; webinars on how to work with the reports were conducted;
- the follow-up assessment of the students' skills as well as the additional teacher survey were initially planned for May 2020 but were postponed to September 2020 due to the COVID-19 pandemic.

1.2.1. Baseline survey

The baseline survey consisted of three parts: testing all students using the START instrument; completion by all teachers of the PSED questionnaire and a teacher questionnaire with questions on their educational level, work experience, and class size; and completion of a questionnaire by parents of pupils (questions about their children's age and gender and the cultural capital of the family).

The teacher survey also measured the extent to which teachers agreed with common perceptions of the factors important for academic and professional success. For this purpose, we used the questions about students' field-specific abilities formulated by S.-J. Leslie and his colleagues [Leslie et al., 2015] based on C. Dweck's theory of intelligence [Dweck, 1999]. The questions had been translated, modified, and localized by the developers of the START tool for the fields of mathematics and humanities. The teachers were asked to specify to what extent they agreed that success in these fields depended more on students' hard work, effort, and motivation than on their innate talent and abilities. The questionnaire included eight statements. The teachers rated their level of agreement or disagreement on a Likert scale.

The responses to the teacher beliefs questionnaire were scaled using the rating scale model [Wright, Masters, 1982]. The construct underlying the scale was essentially unidimensional. The classical reliability (Cronbach's alpha) was 0.89. A high score on the scale indicated that the teacher believed that success in mathematics and the humanities was more likely to be determined by students' hard work, effort, and motivation than their innate talent or special abilities.

Based on the children's test results and the PSED questionnaire completed by the teachers, scales for the levels of cognitive and non-cognitive skills were constructed using the methods of item response theory (IRT). Children's raw test scores were converted to ability scores on two cognitive scales — for mathematics and reading — using the one-parameter dichotomous Rasch model [Wright, Stone, 1979]. To obtain scores on the behavior and communication scales, the rating scale model [Wright, Masters, 1982] was applied. The scores had good psychometric properties. The constructs underlying the four scales (for mathematics, reading, behavior, and communication) were essentially unidimensional. All test items displayed a good fit to the model. The measurement reliability ranged from 0.79 to 0.98. The test items showed no floor or ceiling effects.

Thus, based on the baseline survey results, each student's scores were calculated on the four scales: mathematics, reading, behavior, and communication. The scores were converted to a standardized scale with a mean of 50 and a standard deviation of 10. After that, the children's average scores for cognitive and non-cognitive skills were calculated. As a result, each child was characterized

by two indicators on a 100-point scale describing his or her levels of cognitive and non-cognitive skills, respectively.

Based on the test results, first-graders were divided into 4 groups:

1) schoolchildren scoring over 50 for both cognitive and non-cognitive skills — children with advanced cognitive and mature non-cognitive skills (group 1);
2) schoolchildren scoring over 50 for cognitive and lower than 50 for non-cognitive skills — children with advanced cognitive and developing non-cognitive skills (group 2);
3) schoolchildren scoring lower than 50 for cognitive and over 50 for non-cognitive skills — children with basic cognitive and mature non-cognitive skills (group 3);
4) schoolchildren scoring lower than 50 for both cognitive and non-cognitive skills — children with basic cognitive and developing non-cognitive skills (group 4).

The use of the words “advanced”, “basic”, “mature”, and “developing” had been discussed with the Russian experts, so that the teachers could easily interpret these words.

1.2.1.1. Sampling in the first stage of the study

In the first stage, 5,392 students from 195 schools were tested. Only the students whose parents had given their informed consent participated in the study. In the vast majority of schools, one class and one teacher were selected to participate in the study. In some schools, however, more than one class, each with one teacher, was involved. The invited schoolchildren and teachers represented a total of 288 first-year classrooms. Of the entire sample, 211 (3.9%) students did not complete all stages of the testing and therefore did not participate in the experiment. A total of 5,181 schoolchildren were allocated to groups.

1.2.1.2 Randomisation

First, the sample was stratified. Each stratum (or block) out of 49 contained 4 schools with similar average scores in mathematics. Second, the schools within each stratum were randomly assigned to two groups with different experimental conditions. The control group included 97 schools and the experimental group consisted of 98 schools.

1.2.1.3. Balance testing

Appendix 1 shows the results of the balance test, i.e. the test of the significance of the differences between the control and experimental groups before the start of the experiment. Using regression

analysis, a total of 10 comparisons with different dependent variables were performed. As the independent variable, we used the allocation to the experimental group, while controlling for strata. When the variables measured at the student level were involved, we used the clustering of residuals at the school level as the dependent variables. None of the comparisons showed a statistically significant result at the 0.05 level. Thus, the balance between the control and experimental groups had been achieved and they were not statistically significantly different from each other in the characteristics important to the experiment.

1.2.2. Intervention: types of reports

Based on the results of the diagnostic assessment, the following two types of reports were developed:

1) standard reports on the results of the first stage of the START diagnostic assessment, including aggregated classroom results as well as individual student results for all four indicators on a 100-point scale;
2) an additional report on which group each student belongs to, which provided a meaningful description of each group, its potential problem areas, and recommendations for teachers on how to work with children from different groups.

Teachers from the control group schools received standard reports, while teachers from the experimental group schools also received additional reports.

Control group teachers received the same information about the test scores of their students as teachers from the experimental group but did not receive the information about the student groups. Thus, any potential differences in student performance in the experimental and control groups could be a consequence of the fact that the experimental group teachers had been given an additional report.

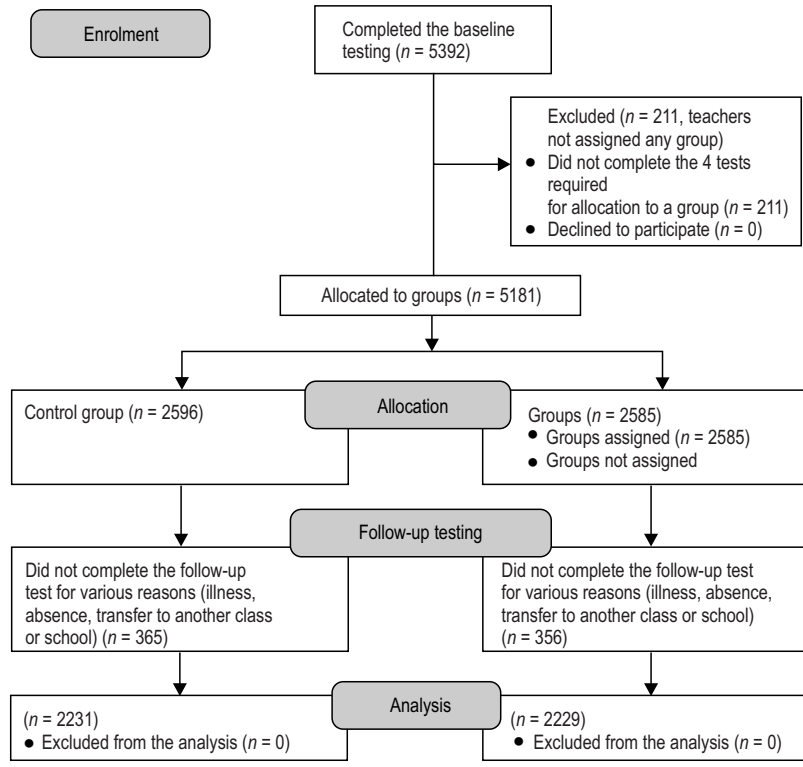
1.2.3. Follow-up survey

In September 2020, students did the final (follow-up) test, and an additional survey of the students and teachers was conducted. All students were tested again using the START tool. To determine whether the teachers' opinions and, consequently, their expectations had been affected by receiving / not receiving the information about groups of students, in the follow-up survey teachers were additionally asked to comment on each student's cognitive skills at the beginning of the academic year (retrospective evaluation).

1.2.3.1. Sampling in the second stage of the study

The final analysis used data from 4,460 students representing 188 schools (the average age of children was 7.4 years, and 50.1% of the sample were female students). The attrition rate after the follow-up testing was 13.9% (14% of the students in the control group and 13.7% of the students in the experimental group did not complete the follow-up test for various reasons). Figure 1 shows the general description of the study sample. Additional analysis was performed to establish whether the attrition was random. For this purpose, the variable that indicates missing data was constructed, taking the value 1 if a student was included in the experiment but did not complete the follow-up test. A regression model was constructed for each student-level characteristic as the dependent variable, and "allocation to the experimental group", "skipped the follow-up test", and the interaction between the two variables as independent variables, while also controlling for strata and clustering at the school level (Table 1). The results showed that the attrition patterns for the characteristics in question were not statistically significantly different between the experimental and control groups. Consequently, there was no attrition bias.

Figure 1. **The CONSORT[2] flow diagram of sampling**



[2] http://www.consort-statement.org/consort-statement/flow-diagram

Table 1. **Analysis of Attrition Patterns during the Follow-Up Testing**

	Mathematics score in the baseline test	Reading score in the baseline test	Behavior score in the baseline test	Communication score in the baseline test	Male
	(1)	(2)	(3)	(4)	(5)
Allocation to the experimental group	0.164	0.524	–0.338	0.503	–0.009
	(0.154)	(0.445)	(0.529)	(0.681)	(0.012)
Skipped the follow-up test	–1.803**	–2.977***	–3.267***	–2.192***	0.035
	(0.705)	(0.969)	(0.798)	(0.810)	(0.029)
Experimental group * Skip	–0.894	–0.782	–0.301	–0.596	–0.023
	(0.935)	(1.172)	(1.121)	(1.164)	(0.039)
Constant	35.12***	38.84***	46.37***	46.20***	0.797***
	(0.781)	(3.269)	(3.916)	(3.572)	(0.121)
Number of observations	5181	5181	5181	5181	5181
R^2	0.244	0.276	0.073	0.076	0.015

Note. Standard errors are given in parentheses.

***$p < .01$, **$p < .05$, *$p < .10$.

1.3. Statistical approach

The analyzed data have a hierarchical structure: students are nested within classes and classes are nested within schools. To answer the first and second research questions, a series of multilevel regressions were performed. This method is suitable for analyzing data with a hierarchical structure [Hox, 2002; Raudenbush, Bryk, 2002]. A two-level regression (students at level one, classes at level two) was used in the analysis since in many schools only one class was included in the sample (75%).

To answer the third research question, a series of multilevel logistic regressions were performed [Sommet, Morselli, 2017]. Two two-level logistic models were constructed to test whether there was a relationship between the teacher's knowledge of the student groups in the classroom and which group each student belonged to and the teacher's opinion about the cognitive skills of the students. R-squared was calculated using the formula proposed by T. Snijders and R. Bosker [Snijders, Bosker, 2012].

1.4. Variables and covariates

Dependent variables:

- the results of the START test in mathematics obtained in the follow-up survey were used as the *academic achievement* variable;

- teachers' expectations regarding the level of students' cognitive skills at the beginning of the 1st grade. A binary variable takes the value of 0 (basic level) or 1 (advanced level).

Predictors:

- the dichotomous variable *knowledge of student groups* denoted the use of intervention in the class, namely the provision of the additional report to the teacher. This variable takes the following values: 0 — if the teacher did not receive the additional report (teacher in the control group), 1 — if the teacher received the additional report (teacher in the experimental group);
- the variable *the teacher's knowledge of which group the student belongs to* takes one of the five values: 0 — if the teacher did not receive the additional report; 1, 2, 3, 4 — if the teacher received the additional report and the student belongs to group 1, 2, 3 or 4 respectively.

As covariates in the regression models, we used the class-level variables (class size, teaching experience, teacher education, teacher belief scale scores), as well as the student-level variables (gender and scores at the beginning of the school year on all four scales: mathematics, reading, behavior, and communication). The variables *class size* and *teaching experience* were centered on the mean.

The statistical analysis was conducted using the STATA software (2016)[3].

2. Results

2.1. Descriptive statistics

Tables 2 to 5 show descriptive statistics of the groups of study participants.

Table 2. **General Descriptive Statistics**

Variable	Mean	Standard deviation	Min.	Max.
Mathematics (baseline assessment)	50.26	9.81	11.69	93.91
Reading (baseline assessment)	50.40	9.70	25.21	68.17
Behavior (baseline assessment)	50.50	9.77	23.91	69.39
Communication (baseline assessment)	50.40	9.86	17.17	73.88
Mathematics (follow-up assessment)	60.98	11.21	25.89	94.56
Teaching experience	21.14	11.45	0	50

[3] StataCorp. (2021) Stata Statistical Software (Release 16) [Computer software]. StataCorp LLC.

Variable	Mean	Standard deviation	Min.	Max.
Class size	25.29	7.07	1	35
Teacher beliefs (logits)	0.19	2.09	–4.45	6.42

Table 3. **Prevalence of Teachers with Higher Education**

	Frequency	Percentage
Higher education	3705	83.33
No higher education	741	16.67
Total	4446	100

Table 4. **Student Groups**

	Control group	Experimental group	Total
Group 1	728 (16.32%)	717 (16.08%)	1445 (32.40%)
Group 2	385 (8.63%)	437 (9.80%)	822 (18.43%)
Group 3	422 (9.46%)	382 (8.57%)	804 (18.03%)
Group 4	696 (15.61%)	693 (15.54%)	1389 (31.14%)
Total	2231 (50.02%)	2229 (49.98%)	4460 (100%)

Table 5. **Gender Distribution in the Control and Experimental Groups**

	Control group	Experimental group	Total
Female	1127 (25.27%)	1145 (25.61%)	2269 (50.87%)
Male	1104 (24.75%)	1087 (24.37%)	2191 (49.13%)

2.2. Research question 1. Is the teacher's knowledge of the student groups at the beginning of the 1st grade related to student academic achievement at the end of the academic year?

Table 6 shows the results of the analysis of the relationship between the teacher's knowledge of the student groups at the beginning of the 1st grade and student achievement in mathematics according to the final (follow-up) assessment (an intercept-only model and a model with a predictor).

In the intercept-only model for the final mathematics test, the intraclass correlation coefficient is 0.25. This means that 25% of the variance in children's results is explained by the grouping of students by class. Model 1 with a predictor and covariates shows no significant effect of the teacher's knowledge of the student groups on the students' performance in mathematics, i.e., the provision of the additional report to the teacher did not have a significant effect on the children's mathematics results in the final test. At the same time, the children's mathematics performance in the follow-up assessment is significantly associated with their scores in the baseline testing, as well as with their gender and class size. The coefficients of the other variables are insignificant.

Table 6. **Results of the Multilevel Regression Analysis of the Relationship between the Teacher's Knowledge of the Student Groups at the Beginning of the 1st grade and the Students' Mathematics Performance in the Follow-up**

Predictors	Intercept-only model B (SE)	Model 1 B (SE)
Mixed effects		
Student-level variables		
(Intercept)	60.78*** (0.38)	61.99*** (0.70)
Mathematics (baseline assessment)		7.13*** (0.14)
Reading (baseline assessment)		0.91*** (0.15)
Behavior (baseline assessment)		0.62*** (0.14)
Communication (baseline assessment)		0.90*** (0.14)
Gender (1 — female)		–2.05*** (0.22)
Class-level variables		
Teacher's knowledge of the student groups (1 — teacher received the additional report)		0.19 (0.54)
Teacher education (1 — higher education)		–0.09 (0.69)
Teaching experience		0.02 (0.02)
Class size		–0.08* (0.03)
Teacher beliefs		0.14 (0.26)
Random effects		
Level 1 variance	96.57	42.46
Level 2 variance	32.44	15.72
–2*log-likelihood	33515.34	–29777.31
ICC	0.25	0.27
R^2 (level 1)		0.55
R^2 (level 2)		0.53

***p < .001, **p < .01, *p < .05.

Research question 2. Is the teacher's knowledge of which group the student belongs to at the beginning of the 1st grade related to the student's academic achievement at the end of the academic year?

Table 7 shows the results of the analysis of the relationship between the teacher's knowledge of which group the student belongs to and the student's mathematics performance in the follow-up assessment. Model 2 with a predictor and covariates shows no significant effect of the provision of the additional report to the teacher containing the information on the children's mathematics performance.

Table 7. **Results of the Multilevel Regression Analysis of the Relationship between the Teacher's Knowledge of which Group the Student Belongs to and the Student's Mathematics Performance in the Follow-up Assessment**

Predictors	Model 2 B (SE)
Mixed effects	
Student-level variables	
(Intercept)	61.99*** (0.70)
Mathematics (baseline assessment)	7.13*** (0.13)
Reading (baseline assessment)	0.92*** (0.15)
Behavior (baseline assessment)	0.59*** (0.15)
Communication (baseline assessment)	0.89*** (0.16)
Gender (1 — female)	–2.05*** (0.22)
Class-level variables	
Group 1 (the teacher received information about the student's group and the student falls into group 1)	0.29 (0.60)
Group 2 (the teacher received information about the student's group and the student falls into group 2)	0.08 (0.64)
Group 3 (the teacher received information about the student's group and the student falls into group 3)	0.32 (0.65)
Group 4 (the teacher received information about the student's group and the student falls into group 4)	0.07 (0.60)
Teacher education (1 — higher education)	–0.09 (0.69)
Teaching experience	0.02 (0.02)
Class size	–0.08* (0.03)
Teacher beliefs	0.13 (0.26)
Random effects	
Level 1 variance	42.46
Level 2 variance	15.71
–2*log-likelihood	–29776.88
ICC	0.27
R^2 (level 1)	0.55
R^2 (level 2)	0.53

Note. Group 0 (the teacher did not receive the additional report) is the reference group.

***p < .001, **p < .01, *p < .05.

2.4. Research question 3. Is the teacher's knowledge of which group the student belongs to related to the teacher's expectations of the student's level of cognitive skills at the end of the academic year?

Table 8 shows the results of a series of multilevel logistic regressions — an intercept-only model and two models with covariates. In the intercept-only model, the intraclass correlation coefficient equals 0.18, meaning that 18% of the variance is explained by differences between classes. The results obtained suggest that neither teachers' knowledge of the student groups in the classroom nor teachers' knowledge of which group each student belongs to is related to the teachers' expectations of the students' cognitive skills.

Table 8. **Results of a Series of Multilevel Logistic Regressions**

Predictors	Intercept-only model B (SE)	Model 3 B (SE)	Model 4 B (SE)
Mixed effects			
Student-level variables			
(Intercept)	–0.92*** (0.06)	–1.47*** (0.31)	–1.48*** (0.31)
Mathematics (baseline assessment)		0.75*** (0.06)	0.75*** (0.07)
Reading (baseline assessment)		0.91*** (0.07)	0.90*** (0.08)
Behavior (baseline assessment)		0.58*** (0.06)	0.62*** (0.07)
Communication (baseline assessment)		0.70*** (0.06)	0.72*** (0.07)
Gender (1 — female)		–0.12 (0.10)	–0.12 (0.10)
Class-level variables			
Teacher's knowledge of the student groups (1 — teacher received the additional report)		0.05 (0.24)	
Group 1 (the teacher received information about the student's group and the student belongs to group 1)			–0.02 (0.26)
Group 2 (the teacher received information about the student's group and the student belongs to group 2)			0.24 (0.28)
Group 3 (the teacher received information about the student's group and the student belongs to group 3)			0.01 (0.28)
Group 4 (the teacher received information about the student's group and the student belongs to group 4)			0.05 (0.29)
Teacher education (1 — higher education)		0.03 (0.30)	0.03 (0.31)
Teaching experience		0.00 (0.01)	0.00 (0.01)
Class size		–0.02 (0.01)	–0.02 (0.01)
Teacher beliefs		0.15 (0.11)	0.15 (0.11)
Random effects			

Predictors	Intercept-only model B (SE)	Model 3 B (SE)	Model 4 B (SE)
Level 2 variance	0.72	2.83	2.83
-2*log-likelihood	5349.25	3824.43	3822.55
ICC	0.18	0.47	0.47

Note. Group 0 (the teacher did not receive the additional report) is the reference group.

***p < .001, ** p < .01, *p < .05.

Conclusion

Since R. Rosenthal and L. Jacobson [Rosenthal, Jacobson, 1968] published their famous study, teachers' expectations have been the focus of much research. Nevertheless, there are a lot of unexplored issues in this research field. For instance, the research on factors influencing teachers' expectations has paid little attention to students' social-emotional skills, behavior, and engagement in the classroom [Wang, Rubie-Davies, Meissel, 2018]. In addition, there is little evidence on what impact teachers' expectations have on students' academic achievements depending on their cognitive and social-emotional skills [Abdurakhmanova, 2020]. There is remarkably little experimental research on how to raise teachers' expectations and prevent negative consequences of teacher bias on students' academic achievement [De Boer, Timmermans, van der Werf, 2018].

The present study has several distinctive features. First, we considered groups of students that differed in two characteristics — the levels of the students' cognitive and non-cognitive skills — and tried to find out whether they differed in academic achievement depending on the teachers' knowledge of the students' abilities. Previous studies on the relationship between teachers' expectations and students' academic achievements have mainly looked at such characteristics as students' gender, family socio-economic status, academic performance, behavior, and ethnicity [Wang, Rubie-Davies, Meissel, 2018; De Boer, Timmermans, van der Werf, 2018]. Moreover, only one of the students' characteristics was usually considered.

Second, in this study, we raised the experimental group teachers' awareness of the children's individual characteristics and advised the teachers on strategies for interacting with children from different groups. We hypothesized that the availability of information about student groups and recommendations for dealing with children from different groups might change teachers' expectations and, consequently, their behavior, and these changes might affect the academic performance of first-graders by the end of the school year. There is evidence in previous experimental studies that students' academic achievements can be improved using interven-

tions that change teachers' expectations [De Boer, Timmermans, van der Werf, 2018].

Third, an additional qualitative study was conducted to enable advanced interpretation of the results obtained. We interviewed 10 teachers (mean teaching experience — 22.2 years, standard deviation — 7.7) in both groups (5 teachers in the control group, 5 in the experimental group) to find out how they had actually used the reports provided to them. We asked the teachers how they had used the results of the initial diagnostic test in their interaction with the children, whether they had changed their behavior and work methods based on these results, and which information about students in the reports had been most important to them. Teachers were also asked to describe their expectations of students' academic achievement and explain how they chose student characteristics to form their expectations. Teachers in the experimental group were asked to give their opinion on the additional report describing student groups and on their use of the proposed recommendations.

Some teachers said that the reports had been very useful for them and had encouraged them to change their teaching practice, for example: 'thanks to the reports we have identified the *backbone* of the class and organized our work with the other children around this *backbone* group'. One interviewee noted, however, that the reports had not been helpful at all and that her observations contradicted the diagnostic results. In one case, the reports were not forwarded by the school coordinator to the teacher. Most of the teachers in the experimental group (four out of five) pointed out that having the description of the groups was better than having solely the information about the children's scores. Thus, in this study, we have tested the initial recommendations for strategies of interaction with different student groups. In the future, we plan to elaborate on and improve these recommendations based on the interview data.

In the present study, no differences in mathematics performance between children in the experimental and control groups were found at the end of the school year. There was also no relationship between the teacher's knowledge of which group the student belonged to and the student's mathematics performance at the end of the school year. Not only did we find no positive effect of teachers' expectations, but also no negative one (Golem effect). This is especially important to note since the additional reports provided to the teachers included information about the at-risk group of students, who had poor cognitive and non-cognitive skills. Interviews with teachers in both control and experimental groups showed that they tried to create a warm and positive classroom climate, motivate children to study regardless of their level of cognitive and non-cognitive skills, and level up the children's cognitive

skills by the middle of the 1st grade. Most teachers noted that they attempted not to reveal their expectations to the children, but to support the willingness of first-graders to do tasks that are difficult for their level, to give equal attention to all children, and provide objective feedback. One teacher even mentioned that 'excellent pupils can get F's too'. During the interviews, it was also found that the majority of teachers in both groups practiced group work during the lessons and, when forming groups, tried to make them heterogeneous in terms of children's cognitive and non-cognitive skills.

The absence of effects could be explained by the fact that our study started in October, i.e. one month after the teachers met their students for the first time. Moreover, the teachers admitted that they got to know most students even before the start of the school year. Many of them had attended preparatory groups at school, some came from the families the teachers already knew because the first-graders' older siblings had already attended the same school, etc. As a result, by the beginning of the school year, teachers might already have certain ideas and expectations about the children in their class. One of the teachers said, however, that he needs at least a year to get to know students well enough and to form some expectations of them.

The analysis of the teachers' retrospective evaluation of the students' cognitive skills at the beginning of the year showed that the teachers in the experimental group had not been guided by the report data when forming their opinions and expectations. However, the statistical results contradict the teachers' answers to the interview questions. The majority of the teachers said that most children had shown the results the teachers had expected from them. At the same time, teachers cared more about the children's behavior during testing rather than about the diagnostic results. Most teachers tested their students themselves. The teachers were pleasantly surprised by some of the children who did better during the test than the teachers had expected. In some cases, the teachers said that the emotional potential of the child had been unleashed during the test. Thus, the teachers had already built certain expectations of the children before the test. The teachers formed their expectations mainly based on student files, family characteristics, students' motivation, and discipline.

The inability to provide methodological support to the teachers in the experimental group — to teach them how to use the report, monitor their work with the report, and provide advice — can be considered a limitation of the research conducted. Research shows that if interventions are not supported and not accepted by teachers, they may not produce an effect [De Boer, Timmermans, van der Werf, 2018].

It should also be noted that during the study, namely in the second half of the school year, schools switched to distance learning. It is not possible to assess statistically whether this transition had an impact on the results of the study.

The conducted study is the first experimental research on the effects of teachers' expectations on student academic achievement in Russian schools.

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Appendix Balance Test after the Randomisation of Schools

	Baseline assessment. Scores in mathematics (SD)	Baseline assessment. Scores in reading (SD)	Baseline assessment. Scores in behavior (SD)	Baseline assessment. Scores in communication (SD)	Female (yes/no)	Class size	Teaching experience (year)	The teacher completed higher education (yes/no)	The teacher believes that the information about the groups is helpful (yes/no)	The teacher focuses efforts on low-performing students (yes/no)
Experimental group	0.003	0.040	–0.043	0.021	0.014	0.539	0.813	0.007	–0.077	–0.087
	(0.006)	(0.042)	(0.046)	(0.063)	(0.011)	(1.074)	(1.486)	(0.050)	(0.056)	(0.062)
Constant	–1.590***	–1.269***	–0.530	–0.485	0.188	2.974	33.125***	0.662***	0.384	0.725**
	(0.079)	(0.339)	(0.427)	(0.380)	(0.123)	(5.097)	(7.052)	(0.237)	(0.264)	(0.292)
N	5.183	5.183	5.390	5.391	5.392	288	288	288	288	288
R^2	0.238	0.263	0.057	0.068	0.014	0.395	0.193	0.210	0.214	0.171

Note. Robust standard errors, clustered at the school level, are given in parentheses. Strata fixed effects are included.

***p < .01, **p < .05, *p < .10.

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Digital Transformation of Schools and Student's Information and Communication Literacy

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Abstract

Information and communication literacy is one of the main meta-subject competencies that graduates of the secondary school should possess. The full-fledged formation of this competence is considered as one of the tasks of preparing students for life in the information society and the digital economy. The article discusses the results of a monitoring study of the information and communication literacy of 9th grade students, which was conducted in 21 regions of the Russian Federation in 2020. About half (45.4%) demonstrated a level of competence that corresponds to the readiness for life in the digital economy. The influence of the equipment of schools and the peculiarities of the organization of educational activities on the students' level of information and communication literacy (ICL) was considered. The study results indicate a strong connection between the students' competence and their out-of-school environment and a weak — with their work in the school. Research findings allow to determine the reasons for the insufficient level of ICL in a significant part of graduates and used to propose recommendations for its increase.

Keywords

information and communication competence; mail school; digital transformation of education; scenario assessment methods; computer testing; assessment of competencies.

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Forty years ago, Academician A. Ershov had validated the notion of a second ('computer') literacy as an important meta-subject competency of an information society member [Ershov, 1981]. Nowadays this notion is universally accepted and underpins the concept of digital literacy as well as information and communication literacy (ICL). Ten years ago, the cultivation and development of students' ability to use information and communication technologies became part of the obligatory requirements for the results of the basic educational programme in secondary schools[1].

The Organisation for Economic Co-operation and Development recommends that all member countries regularly assess digital literacy in secondary school as a mandatory component of the development of digital learning environments [OECD, 2021]. Such an environment not only provides the prerequisite for the development of ICL in students, but also makes it possible to use previously inaccessible intellectual tools to assess the effectiveness of its development. Since 2013, the International Computing and Information Literacy Study (ICILS) for 8th grade students has been held, coordinated by the International Association for the Evaluation of Educational Achievement (IEA). Two cycles of the ICILS study have been conducted. The third cycle will take place in 2023.

The implementation of the Federal Project *Digital Learning Environment*, for its part,[2] also requires monitoring of the digital transformation of general education and regular assessment of the ICL level of students. Under this project, schools purchase computers and other digital equipment, increase digital bandwidth, develop digital courseware, and organise additional professional development programmes for teachers. In order to assess how these efforts affect students' ability to handle information in a digital environment, solve learning tasks and problems outside of school, and their commitment to lifelong learning, in February–October 2020 a study was commissioned by the Ministry of Education of the Russian Federation as part of the project *Monitoring the level of information and communication literacy of 9th grade students (graduates of basic schools)*. The monitoring also included an online survey of teachers and school administrators about the use of digital technology and the organisation of the educational process at school.

[1] Order of the Ministry of Science and Education of the Russian Federation No. 1897 of 17 December 2010 *On approval of the Federal State Educational Standard for Basic General Education*.

[2] The Federal Project Digital Learning Environment is part of the National Project Education. It aims to create and implement a digital learning environment in all educational institutions in the country, which would ensure a digital transformation of education. The project seeks to provide organisations with modern equipment and develop digital services and content for educational activities: https://edu.gov.ru/national-project/

The information and communication literacy of 9th grade students was assessed using the ICL test (Information and Communication Literacy Test). It is a state-of-the-art instrument whose validity has been confirmed in the ICL assessment of several thousand Russian and foreign schoolchildren, also within the framework of World Bank projects. It provides fast, real-time automatic processing of the measurement results, displays the test results to each student on the computer screen in an interactive mode and suggests personalised guidance for improvement of their ICL. The ICL test has gained international recognition: the University of Helsinki is localising it for use in Finland, while the Inter-American Development Bank is adapting it for Latin American countries.

The purpose of this study is:

- to document, using a reliable up-to-date tool, the level of pupils' ICL at the graduation from basic school in the context of the roll-out of the Federal Project *Digital Learning Environment*; to evaluate the extent to which the availability of digital equipment, digital services and digital learning content in an educational institution affects the level of ICL of basic school leavers;
- to identify the specific characteristics in the work of educational institutions that influence the formation of ICL in the basic school.

Current approaches to assessing ICL and related constructs

The concept of computer literacy (competency) has not yet been fully established[3]. The terms 'computer literacy', 'digital literacy', 'information and communication technology competency' ('ICT competency'), 'digital competence' etc. are often used as equivalent terms[4]. An academic dictionary has retained a late last century interpretation of computer literacy as 'the mastery of skills in the use of computer hardware; an understanding of the fundamentals of computer science and the importance of information technology in society'[5]. This interpretation has informed the course in computing, which became a compulsory part of the school curriculum in Russia more than 35 years ago. The framework curriculum for ba-

[3] For instance, the website of the Agency for Social Initiatives defines digital competences as an element of digital literacy: 'Digital literacy is the body of knowledge and skills that are necessary for the safe and efficient use of digital technology and Internet resources. It includes digital consumption, digital competences, and digital security'. https://old.asi.ru/future_skills/

[4] In the English-language sources, a number of terms with similar meanings are used: computer literacy, digital literacy, digital competence, ICT literacy, information literacy, internet literacy, digital culture.

[5] https://dic.academic.ru/dic.nsf/enc3p/161138

sic general education[6] defines ICT competency as 'the ability to use ICT for information management in learning tasks, individual cognitive activities, life and work in the present-day high-tech society'.

In the mid-1990s, the European Commission supported the development of a working standard and certification tool for assessing computer literacy in Europe[7]. The new framework and associated measurement tool came into use in August 1996 in Sweden under the name 'European Computer Driving License' (ECDL). By the end of the 1990s, the ECDL had become popular in Europe and expanded beyond its borders to become known as International Computer Driving License (ICDL). By the early 2010s, with the support from UNESCO, it had spread around the world. ICDL testing services were provided by more than 20,000 certification centres in 148 countries. Today, the updated ICDL tools[8] enable individuals to assess their computer skills and knowledge of the most common computer applications. While constantly evolving, the ICDL framework, just like other such tools, does not test the ability to work with information in a digital environment. It is limited to technological skills, and the associated training materials and testing tools are primarily aimed at bridging the digital divide in technology.

The key importance of computer literacy in a digital environment was pointed out as early as the 1980s by the American Library Association [Association of College and Research Libraries, 1989]. By the beginning of the 21st century, insights had emerged on how the spread of information technology affects the requirements for information literacy in the workforce [ITAA, 2000]. An international panel of experts convened by the Educational Testing Service (ETS) in 2002 pointed out that the digital divide is not only created by a lack of access to computers, software, and the Internet. Equally important in this respect is the lack of general literacy and the inability of users to work with information. Experts stated that mastering technology skills without developing general and information literacy would not help to bridge the growing digital divide [International ICT Literacy Panel, 2002. P. 6]. The international panel defined ICT literacy as 'using digital technology, communications tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society' [Ibid. P. 2].

The proposed ICL framework provided the basis for most of ICL assessment tools [Virkus, 2003; Webber, Johnston, 2017; Kim, Kil, Shin, 2014; Eisenberg, Lowe, Spitzer, 2004; Sparks, Katz, Beile, 2016]. It underpins The European Digital Competence Framework for Cit-

[6] Approved by the Federal Methodological Association for General Education (Record 1/15 of 8 April 2015) http://fgosreestr.ru/registry/primernaya-osnovnayaobrazovatelnaya-programma-osnovnogo-obshhego-obrazovaniya-3/

[7] http://icdlcenter.com/about/our-history.html

[8] http://www.ecdl.com

izens — DigComp[9]. The DigComp framework includes the ability to identify information needs, find and retrieve the right digital material (content), assess the relevance of the material and its source, organise, store and use the information [Carretero, Vuorikari, Punie, 2017]. The DigComp framework, in turn, was used as the basis for developing a framework for information and data literacy by UNESCO [UNESCO, 2018]. The latter included the identification of information needs, data search and retrieval, assessment of the credibility of source and content, storage, management and organisation of the information.

The ICT Competency Framework that has been developed by the international panel of experts assembled by ETS, was used to create the NAP ICTL tool in Australia. This tool is used to monitor ICL at the national level and to identify factors influencing its development [Ainley et al, 2005]. It represents a collection of multiple-choice questions. Based on the ICTL NAP, a tool has been developed and has been used since 2013 for assessing schoolchildren's computer and information literacy in International Computer and Information Literacy Study (ICILS). Russian schools were also involved in this study [Avdeeva, 2015; Gvozdev, Nikulin, Rodnevskaya, 2017]. The assessment framework of ICILS [Frailon et al., 2019] bundles technical (computer) literacy, information skills and digital communication used to achieve various educational and communication goals in problem solving.

Tool of the study

The ICL test, as well as the ICILS tools, relies on a definition and framework of information and communication literacy that have been developed by the panel of experts assembled by the ETS. During the ICL test, students are immersed in the digital environment of the tool.

The test uses 16 scenario-type tasks of varying difficulty and is based on evidence-centred design[10]. Recognising that ICL is not solely acquired at school, the test contains tasks that have academic, out-of-school and personal contexts, with the academic (school) context making up 40% of the set. All problem scenarios (tasks) presented to the respondents are as close as possible to everyday life. For further details on the ICL test, see [Avdeeva et al., 2017].

During test development, five achievement level descriptors (ALDs) were established for ICL as a measured construct and for its seven components, with their contribution to the overall con-

[9] See https://ec.europa.eu/jrc/en/digcomp

[10] Evidence-centred design involves a set of interrelated procedures that help to answer the two questions: what in the respondents' behaviour indicates that they do or do not possess the competencies of interest; how can we create a situation that allows us to determine this? [Mislevy, Almond, Lukas, 2003].

struct of ICL, as well as sets of observable activities whose accomplishment indicates the level of respondent's mastery of each of those components. These indicators facilitate the use of test results for students and their teachers as well as for school administrators and other decision-makers in education. The units of measurement of the ICL are testimonies (observable variables) and not the test tasks themselves. The chosen procedure for developing the test made it possible to relate the latent variables (ICL and its components) to the observed indicators (testimonies) in a transparent way. Moreover, the tasks themselves may contain varying numbers of such testimonies, and each element of the task serves to record the manifestation of one of the components of the ICL. This design makes it possible to create numerous versions of the test, to cover all components of the ICL and to compile the test from items of varying difficulty.

Table 1 presents descriptions of five levels of ICL reflecting the abilities of 9th grade students to work with information in a digital environment.

Table 1. **Abilities Corresponding to Different ICL Levels of 9th Grade Students**

ICL level	
Advanced	The student performs the tasks at a high level, related to abilities to: • formulate the problem correctly; • find information from different sources; • organise information according to certain criteria; • assess the quality of information and the reliability of its sources; • compare and synthesise information from different sources; • draw the right conclusions from existing information; • present information to other people.
Above basic	The student performs the tasks at a high level, related to abilities to: • formulate the problem correctly; • find information from different sources; • organise information according to certain criteria; • draw the right conclusions from existing information; • share information with other people. The student performs the tasks at a satisfactory level, related to abilities to: • assess the quality of information and the reliability of its sources; • compare and synthesise information from different sources.
Basic	The student performs the tasks at a satisfactory level, related to abilities to: formulate the problem correctly; • ??? • find information from different sources; • organise information according to certain criteria; • assess the quality of information and the reliability of its sources; • compare and synthesise information from different sources; • draw the right conclusions from existing information; • share information with other people.

ICL level	
Below basic	The student performs the tasks at a satisfactory level, related to abilities to: • formulate the problem correctly; • find information from different sources; • organise information according to certain criteria; • draw the right conclusions from existing information; • share information with other people. The student fails to perform the tasks related to abilities to: • assess the quality of information and the reliability of its sources; • compare and synthesise information from different sources.
Developing	The student fails to perform the tasks related to abilities to: • formulate the problem correctly; • find information from different sources; • organise information according to certain criteria; • draw the right conclusions from existing information; • share information with other people.

The ICL test has a number of features that make it unique. It assesses a basic school leaver's ability to use computers and digital technology in the acquisition of new knowledge, communication, research, lifelong learning, and self-realisation in professional life. The automatic processing of the test results makes it possible to inform the students of their ICL level immediately after the test is completed and to offer recommendations for its improvement. Thus, the ICL test can be used for both resulting (monitoring studies) and formative (in the learning process) assessment of ICL levels. The ICL test is the subject of a patent for an invention[11].

Design of the study

The Centre of Education Quality Monitoring at the National Research University Higher School of Economics, with active involvement of education authorities, school administrators and teachers, conducted a monitoring study of the ICL level among basic school leavers in 21 regions of the Russian Federation in 2020. The aim was to assess the ability of 9th grade students to operate with information, solve practical problems using ICL, think and work in a 'digital world'. The administrative regions for the study were selected on the following criteria:

- participation in the federal project to introduce a targeted model for a digital learning environment in general education institutions;
- experience of monitoring studies to assess the quality of education, including international comparative studies;
- long-term successful experience of introducing ICT into the educational process.

[11] Patent for an invention No. 2656699: ICL test — a tool for measuring information and communication literacy in the digital environment. Authors: Avdeeva S.M., Tarasova K.V. Et al. Date of state registration in the State Register of Inventions of the Russian Federation: 6 June 2018.

From the 21 regions that met these criteria, data were collected on their general education institutions, such as: type of school, location area, the number of 9th grade classes, the number of students enrolled, etc. Based on these data, a two-step stratified cluster sample was created, in which the strata corresponded to the location of schools (urban or rural), and the clusters corresponded to study groups (classes) of specific schools. All 9th grade students in the selected regions were treated as the general population. Classes were randomly added to the generated sample (classes smaller than 6 or larger than 30 students were discarded), until the total number of students in the sample exceeded 36,000. The selection of classes was made separately among urban and rural schools in proportion to the total sample size and their representation in the general population. A total of 30,011 ninth graders took part in the study. The criteria for selecting regions and a description of the sample are presented in more detail on the website of the study[12].

Alongside the ICL assessment, a questionnaire was completed by students, school administrators and teachers who taught in the classes being tested. Teachers and administrators obtained individual accounts and filled in the questionnaire electronically at ictlit.ru at their convenience. The students filled in their questionnaires during online testing in computer classrooms, where each 9th grade student was assigned an individual workstation with Internet access. Before the testing, school coordinators briefed the students. They then made sure that the test was carried out by the schoolchildren themselves, recording breaches of procedure in the protocol. At the end of the test, the results were automatically sent to the server and each student received a message about their ICL level and personalised advice on how to improve it.

Results of the study and discussion

The results of the ICL study of 9th grade students in 2020 are shown in Figure 1. Just under a third of the study participants (29.6%) have a basic ICL level. 12.4% of schoolchildren are above the basic level and 3.4% are at the advanced level, i.e., about half of 9th grade students (45.4%) are prepared for life in the digital economy.

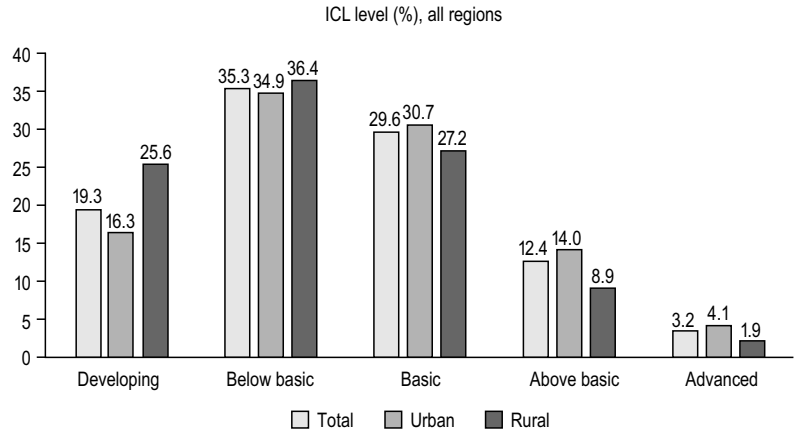
More than a third (35.3%) of the tested ninth graders are below the basic level. In order to reach the basic and higher levels, their ICL needs to be improved. For those at the 'developing' level (19.3%), additional training sessions are not enough: systematic work must be purposefully organised.

In rural schools, more than a quarter of students (25.6%) were at the developing level. At the same time, there are almost half as many rural ninth graders at the advanced level as in urban schools

[12] https://ioe.hse.ru/monitoring/monitoring_icl/materials

(1.9% versus 4.1%). In contrast to cities, in rural areas the secondary school is practically the only institution capable of providing all learners with the digital hardware, software and resources (individual training assignments, collaborative projects, online courses, etc.) required to develop their ICL.

Figure 1. **Results of ICL assessment in 2020 (all regions)**

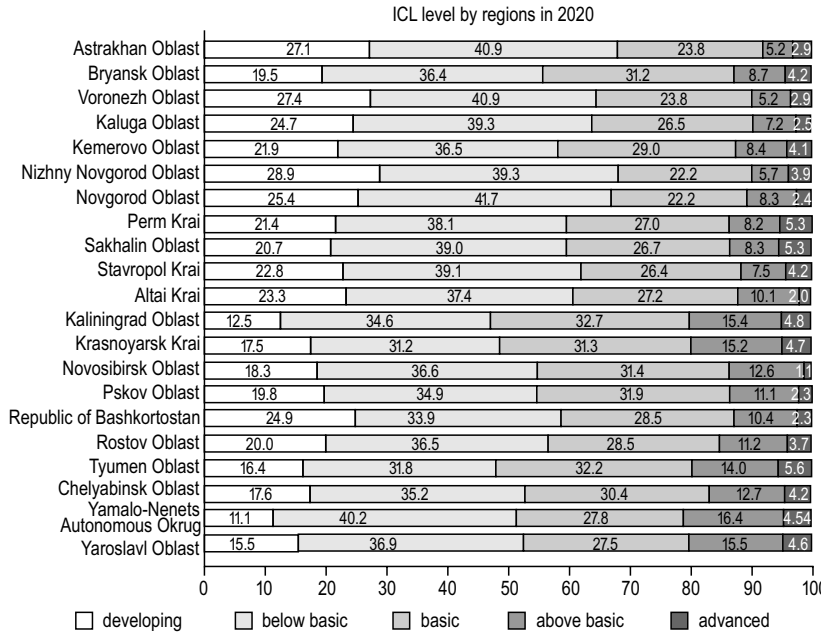


To sum up, a significant gap has been identified in the ICL level between urban and rural school leavers. They have the same type of distribution of their test results, that is left-skewed, but the number of those who showed a developing level of ICL among rural school leavers is half as large again as among urban school leavers (25.6 vs. 16.3%). At the 'above basic' level there are one and a half times fewer rural school leavers than urban ones (8.9 vs. 14%), and at the advanced level there are half as many (1.9 vs. 4.1%). However, the gap in the percentages of urban and rural school leavers at 'below basic' and 'basic' levels is not as large (1.5 and 3.5%). These data suggest that there is a systemic problem preventing the development of ICL in the mainstream school environment.

The percentages of students who showed the developing ICL level varied considerably across the regions of the Russian Federation (Figure 2). Thus, in Astrakhan, Voronezh and Nizhny Novgorod Oblasts this rate is more than twice as high as in Yamalo-Nenets Autonomous Okrug. Tyumen Oblast (5.6%) and Perm Krai (5.3%) lead at the advanced level, while the results of Altai Krai, Astrakhan, Kaluga and Novgorod Oblasts are almost half as high (< 3%). The leaders in the development of the ICL of basic school leavers are Tyumen, Kaliningrad and Chelyabinsk Oblasts, Krasnoyarsk and Perm Krais, and Yamalo-Nenets Autonomous Okrug.

Meanwhile, in the regions, as well as in the total sample, significant differences in ICL levels were found between urban and ru-

Figure 2. **Results of ICL assessment of 9th grade students in 21 regions of the Russian Federation**

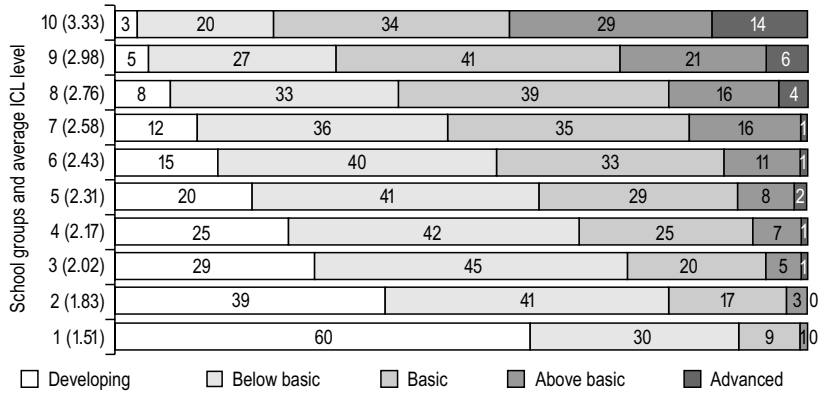


ral students. In Kaluga Oblast, more than a third of students in rural schools (36.8%) and only a fifth in urban schools (20.9%) were at the developing level. In Perm Krai, there were almost twice as many students in rural schools (28.6%) as in urban schools (14.6%) at the developing level. In Tyumen Oblast, urban schools had twice as many students at the 'above basic' and 'advanced' level as rural schools (23.9 vs. 11.6%). The same pattern can be observed in Yamalo-Nenets Autonomous Okrug (23.8 vs. 9.9%).

For further analysis, the five levels of ICL have been numbered from 1 (developing) to 5 (advanced), making it possible to calculate the average ICL level for a school or group of schools. All the educational institutions taking part in the study have been ranked according to the average ICL level of all respondents in the school and then divided into 10 groups with an equal number of schools in each group. Figure 3 shows the percentage of ninth graders at each ICL level in each of the ten groups of schools and the average ICL level per group (in parentheses next to the group number).

The first group consisted of the educational institutions whose 9th grade students had the lowest level of ICL. On average, 60% of their students are at the developing level, 30% are at the 'below basic' level and just under 10% are at the basic level. In the tenth group, which had the highest average ICL level, only 3% of ninth graders were at the developing level, 20% were at the 'below basic'

Figure 3. **Percentage of 9th grade students representing each ICL level in each of the ten school groups**



level, while the majority of students reached the basic level (34%), the 'above basic' level (29%) and the advanced level (14%). In the 1st group the predominance of rural schools was observed (70%), and in the 10th group urban schools were prevailing (74%).

The increase in the average score between lower groups of schools (1st to 3rd) is mainly due to an increase in the proportion of students at the 'below basic' and basic levels and a sharp decrease in the proportion of ninth graders at the developing level. Further on, the increase in the average score is due to both a decrease in the percentage of students at the developing level and an increase in the number of students at the basic and 'above basic' levels.

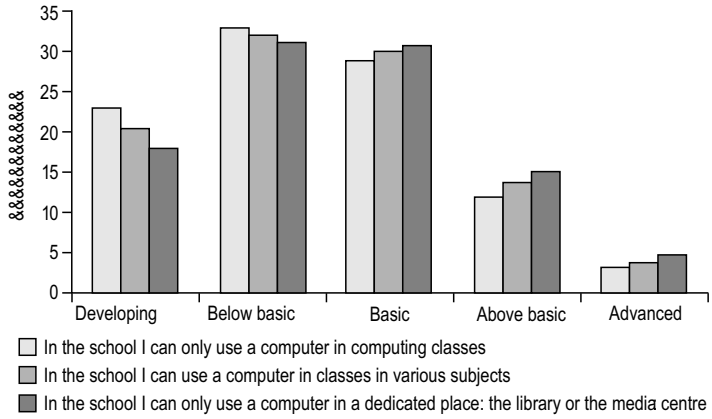
The impact of school and out-of-school environment on the information and communication literacy of 9th grade students

One of the aims of the study was to find out how ninth graders' ICL levels were related to the use of digital technology in educational institutions, that is, to what extent the formation of ICL is the result of school work (the use of digital technology in teaching, the pedagogical practices implemented in schools, etc.), and to what extent it depends on the out-of-school environment (cultural, educational and material resources of the family, the accessibility of digital technology at home, its use outside school, etc.).

A questionnaire survey of ninth graders showed that the majority (79%) use computers at school only in computing classes. Less than a tenth (9%) of students use computers in classes in various subjects, and 12% use them mostly in the library or in the media centre. However, these differences do not have a significant impact on the level of ICL (Figure 4).

This observation is broadly consistent with the conclusion drawn from PISA studies that there is little correlation between the ICT ac-

Figure 4. **The relationship between the ICL levels of students and the accessibility of digital technology in school**



cess in schools and the educational outcomes of students in traditional school systems [OECD, 2015; Schleicher, 2019].

As shown in Table 2, the regression coefficients between the level of ICL and the amount of time spent by students using digital technology for learning and entertainment do not differ across the sample as a whole. However, for rural school students, the regression coefficient between the level of ICL and the use of digital technology for learning is half as low as the respective regression coefficient for the use of digital technology for entertainment (ß = 0.06 vs. ß = 0.12). These data can be seen as evidence that in rural areas the influence of school work on the formation of ICL is noticeably weaker in comparison to the out-of-school environment.

Table 2. **The Relationship between the ICL of 9th Grade Students and the Use of Digital Technology for Learning and Entertainment**

Variable	Schools [ß, p, (SE)]		
	All	Rural	Urban
How much time do you use your computer, tablet, smartphone and other gadgets for:			
learning (doing schoolwork, etc.)	0.08***	0.06***	0.09***
	(0.01)	(0.02)	(0.02)
entertainment (playing games, watching videos, etc.)	0.08***	0.12***	0.07***
	(0.01)	(0.02)	(0.02)
communication (video and/or audio calls, chat messaging and social media)	–0.04***	–0.06***	–0.03
	(0.01)	(0.02)	(0.02)

Significance level: ***p < .01, **p < .05, *p < .10. Standard error (*SE*) is given in parentheses.

A number of questions in the questionnaire aim to clarify the nature of the relationship between 9th graders' ICL and the use of digital technology in school. This relationship was found to be positive with regard to two questions (Table 3): (a) 'How often do you and/or your classmates work with information in school lessons, alone or in a group: confront facts and/or concepts, compare, classify and analyse information (making tables, charts, etc.)?' and (b) 'How often are you assigned homework from a textbook or book of problems at school?'. All other indicators showed a negative relationship.

Table 3. **The Relationship between the ICL of 9th Grade Students and the Use of Digital Technology in School**

Variable	Schools [ß, p, (SE)]		
	All	Rural	Urban
How often do you use a computer, gadgets or an interactive whiteboard in class (except for computing classes) to:			
carry out experiments and/or laboratory work	–0.07***	–0.04	–0.08***
	(0.02)	(0.04)	(0.03)
take quizzes	–0.06***	–0.05	–0.07***
	(0.02)	(0.03)	(0.02)
How often in school lessons do you and/or your classmates:			
play educational games / business games, practise training, role-playing, etc.	–0.11***	–0.06	–0.14***
	(0.02)	(0.04)	(0.03)
draw diagrams, construct concept maps (e.g., mind maps)	–0.09***	–0.07*	–0.09***
	(0.02)	(0.04)	(0.03)
work with information on your own or in a group: confronting facts and/or concepts, comparing, classifying and analysing information (making tables, charts, etc.)	0.10*** (0.02)	0.06* (0.03)	0.12*** (0.02)
At school, how often are you assigned homework:			
from a textbook or a book of problems	0.21***	0.26***	0.18***
	(0.02)	(0.04)	(0.03)
requiring the preparation of slides and/or a text for a presentation on a computer	–0.07***	–0.06*	–0.07***
	(0.02)	(0.03)	(0.02)
requiring work in team with classmates	–0.10***	–0.10***	–0.10***
	(0.02)	(0.04)	(0.03)

Significance level: ***p < .01, **p < .05, *p < .10. Standard error (*SE*) is given in parentheses.

The connection between the ICL level and the frequency with which students practise information analysis is obvious: over 45% of students replied 'often' or 'every day' to question (a). It is also possible to explain the correlation between the ICL level and traditional

approach to homework based on a textbook or book of problems. Students are regularly required to do this work, which has a positive impact on their ability to read texts meaningfully and to work with information. However, the mechanisms of this connection need to be further explored.

The questionnaire survey of ninth graders did not show a connection between the ICL level of schoolchildren and the use of innovative, digitally supported learning methods (search for information on the Internet, carrying out experiments, laboratory work and quizzes, business games, simulations, role-playing, etc.). Moreover, the use of game methods, concept maps and group tasks is negatively related to the formation of ICL (Table 3). An explanation could be the rare use of such practices in the learning process: when asked 'How often do you or your classmates draw diagrams, create associative maps?' 80.7% of the respondents answered 'rarely' or 'never'.

These data suggest that the accessibility of digital technology at school and existing learning practices are weakly related to the ICL level of 9th graders.

Among the factors of the out-of-school environment, the ICL level of 9th grade students is related to their plans to continue their studies, the availability of books and smartphones at home, and their mothers' educational level (Table 4).

Students with high educational ambitions, that is those who plan to continue their education, have a higher level of ICL (ß = 0.23 for rural students and ß = 0.13 for urban students). A strong correlation has been revealed between the ICL of the ninth graders and their mothers' educational level: among pupils with developing ICL scores, those whose mothers have higher education are 2.3 times fewer than those whose mothers have only completed secondary school. At the 'above basic' and 'advanced' levels, there are 2.5 times more students whose mothers have higher education than those whose mothers have only completed secondary school. The correlation of the average ICL level of students in the ten groups of schools (see Figure 4) with their plans for further education and with their mothers' education is shown in Figure 5.

The availability of a smartphone was found to be a significant factor contributing to higher ICL levels of the ninth graders: this device is used most often to access the Internet (81%). For urban students, there is also a strong correlation between the ICL level and the availability of books at home, as well as with the amount of time spent by parents on computers: among students with developing ICL, there are 3.7 times more those whose parents do not use computers at all (7%) than students whose parents spend a lot of time on a computer (26%). According to the data collected, more than 90% of basic school leavers are active users of modern digital devices. 93% of students think they can freely use the Internet for

Table 4. **The Relationship between the ICL of 9th Grade Students and their Plans for Future Education as well as Home Setting**

Variable	Schools [ß, p, (SE)]		
	All	Rural	Urban
Plans for future education:			
to continue education at the comprehensive school	0.17***	0.23***	0.13***
	(0.03)	(0.05)	(0.04)
to go to a vocational school	–0.09***	0.03	–0.16***
	(0.03)	(0.05)	(0.04)
to go to work	–0.21***	–0.16	–0.25***
	(0.07)	(0.12)	(0.09)
Home setting:			
availability of a smartphone	0.22***	0.26***	0.19***
	(0.05)	(0.07)	(0.07)
mother's higher education	0.11***	0.10***	0.11***
	(0.02)	(0.03)	(0.02)
availability of more than 200 books at home	0.09***	0.02	0.11***
	(0.02)	(0.04)	(0.02)
the amount of time spent by parents on the computer	0.06***	0.03	0.06***
	(0.01)	(0.02)	(0.02)

Significance level: ***p < .01, **p < .05, *p < .10. Standard error (SE) is given in parentheses.

their own purposes, while no more than 15% of the time they spend on the Internet is devoted to educational purposes[13].

The technological digital divide is narrowing; it can be expected to become insignificant in the coming years. However, data on the patterns of ninth graders' use of digital technology (Table 5) show that the amount of time they spend watching videos, listening to music, or using various services is weakly related to their ICL levels. The use of digital technology for traditional routine operations (telephony, video, text exchange, etc.) does not lead to a reduction of the new digital divide, that is of the disparity between those who are able to use digital technology to handle information productively and those who use it as a substitution tool. This is also evidenced by the correlation found between the ICL levels of 9th grade students and their activity in office applications and reviewing content of specialised websites (Table 5).

[13] These data are consistent with the results of the 2019 HSE study. See *Indikatory informatsionnogo obshchestva*, 2019 [Indicators of the information society, 2019]: https://www.hse.ru/primarydata/ice2019

Figure 5. **The relationship between average ICL levels in the ten school groups and students' plans for further education as well as their mothers' educational level**

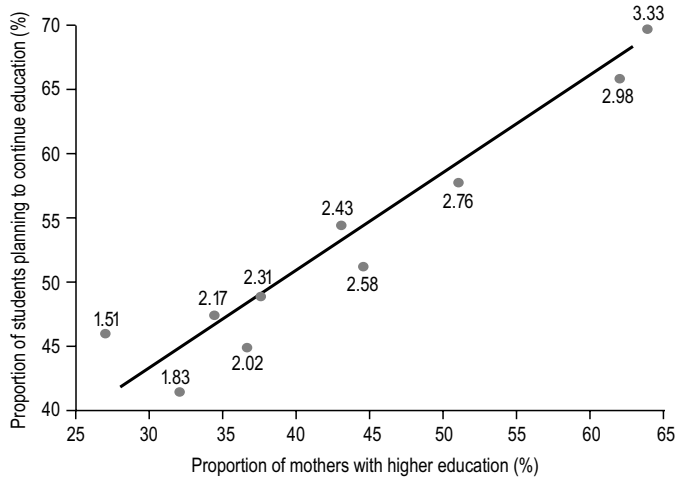


Table 5. **The Relationship Between the ICL of 9th Grade Students and the Patterns of their Use of Digital Technology**

Variable	Schools		
	All	Rural	Urban
How much time do you spend on each of the listed activities while using a computer and/or other gadgets:			
Reviewing content on specialised portals/sites or in social media feeds	0.09***	0.09***	0.09***
	(0.01)	(0.02)	(0.02)
Playing games	0.03**	0.03	0.03*
	(0.01)	(0.02)	(0.02)
Watching videos, listening to music	0.04**	0.07**	0.02
	(0.02)	(0.03)	(0.02)
Working in office applications (notepad, squibs, calendar, Word, Excel, Power Point, Notes, etc.)	0.10***	0.09***	0.11***
	(0.01)	(0.02)	(0.01)
How much time do you spend on each of the listed activities while using social media (VK, Facebook, Instagram, Twitter, etc.):			
Writing texts, uploading photos, making posts	–0.08***	–0.09***	–0.07***
	(0.01)	(0.02)	(0.02)
Reading feeds, blogs, posts	0.04***	0.08***	0.03
	(0.01)	(0.02)	(0.02)
Playing games, using social network apps	–0.07***	–0.10***	–0.06***
	(0.01)	(0.02)	(0.01)

Significance level: ***p < .01, **p < .05, *p < .10. Standard error (SE) is given in parentheses.

Thus, the results of the study show a strong connection of the ICL of 9th grade students with their out-of-school environment and a weak connection with their work in the school.

Conclusion

A monitoring study of the ICL level of 9th grade students, which involved about 30,000 schoolchildren from 21 regions of Russia, showed that more than half of them (54.6%) had insufficient ICL. School leavers whose ICL is 'below basic' (35.3% of those surveyed) may be able to overcome their deficit with appropriate correction and additional training in the next stages of education. Almost a fifth of the ninth graders (19.3%), who are at the 'developing' level, have not actually formed their ICL. They are unable to correctly formulate the problems they face, to search for and organise the necessary information, and to draw reasoned conclusions from it. They are not good at presenting information to other people. Most of those at the 'developing' level are students in rural schools (70%). All ninth graders with a 'developing' ICL need help in developing their ability to work with information in a digital environment. Politicians, education authorities, educators and parents should find ways to offer them additional training and opportunities to master the use of information, digital devices, and educational resources.

In regions where targeted work on ICT in education had been carried out in recent years and the ICL level of schoolchildren has been assessed, the proportion of ninth graders with ICL at the 'developing' level is almost twice as low as the average for the regions covered by the project (21.74%). In Kaliningrad Oblast, for example, it is 12.5% and in Yamalo-Nenets Autonomous Okrug it is 11.5%.

The regions selected for participation in the study were those that were implementing the target model of a digital learning environment in general education institutions, and many of them had been actively working on ICT-use in school for the previous 15 years. It is unlikely that in regions where such work was less intensive, the school impact on the formation of the ICL of 9th grade students would be stronger. Therefore, extrapolation of the study findings to all regions of the country can hardly be made without further research.

In recent years, an increasing variety of digital technologies have become available to schools. 59% of teachers surveyed said that they were incentivised to use digital technology in the classroom. More than 68% of teachers believed that their school had enough digital equipment, like computers and video projectors. However, there are regions where the situation is not so good, for example, in Bashkortostan 49% of teachers do not consider the availability of digital equipment in schools to be satisfactory. Across all regions of the project, a notable proportion of teachers report-

ed a weak digital infrastructure in schools. More than 40% said that they did not have the opportunity to use the computer classroom for their lessons at least once a week. 43% believed that the technical support available to them was not sufficient to maintain the available equipment and make full use of the digital learning environment.

About half of the teachers (52%) responded that their school had stable Internet access with a connection speed of at least 2 Mbps. In some regions, however, the majority of teachers disagreed with that: 66% in Pskov Oblast, 57% in Rostov Oblast, 56% in Krasnoyarsk Oblast, and 71% in the Republic of Bashkortostan. These were primarily teachers in rural schools. These results diverge from some sources[14], which report that more than 90% of schools in the country are connected to high-speed Internet.

The real demand from school administrators for the development of digital infrastructure is low. For example, increasing the speed of Internet access in schools has not been given the highest priority: 85% of administrators rate its priority as medium, 10% rate it as low, and 4% do not recognise it as a priority.

A weak connection was found between the level of ICL of students and the availability of digital technology in the school, i.e. the development of its digital learning environment. Thus, increasing the accessibility of digital devices and reducing the technological digital divide alone does not ensure bridging the second digital divide and creating a sound ICL in students. The reason seems to be that schools today focus mainly on reproductive forms of learning practices. Teachers use digital technology primarily as a substitute and/or enhancement for presentations in frontal teaching. Although more than 90% of school administrators declared the importance of the digital learning environment in forming the necessary educational outcomes for students and 78% of teachers noted that they have access to digital technology at school, more than a third of all respondents (39%) indicated that the use of digital technology was not among their priorities.

The results of the monitoring study showed that the ICL level of the ninth graders was strongly related to the characteristics of their out-of-school environment: their mother's educational level, their plans for further education, the availability of a smartphone, and the number of books at home. At the same time, the correlation between the ICL of 9th grade students and their ability to work in the school digital environment is weak.

[14] Coordinating Centre of the National Domain of the Internet, National Research University Higher School of Economics. Analytical report *Tendentsii razvitiya Interneta* [Trends in Internet Development]: https://issek.hse.ru/data/2018/04/19/1150466651/Tendencii_razvitiya_interneta_v_Rossii.pdf

The analysis of the study results makes it possible to set out a number of recommendations aimed at improving the ICL of basic school leavers.

1. The technological digital divide is narrowing, but even today it has not been fully bridged, especially in rural schools. The monitoring study took place in what the local education authorities consider to be reasonably well-equipped schools, but even here sometimes there is no reliable broadband Internet connection. It is necessary to simultaneously:

- fast-track the connection of schools, especially in rural areas, to broadband Internet and provide them with modern equipment, including peripherals;
- offer schools evidence-based, digitally supported, active learning methods that would be accepted by both pupils and their teachers.

2. Formative assessment of students' ICL should be made an integral part of the school' everyday activities. ICL was added to the list of meta-subject outcomes of the Federal State Educational Standards for general education more than a decade ago. Even today, however, there is no development or broad implementation of tools and procedures for assessing the ICL of students at different levels of the mainstream school. Monitoring studies involving low-stakes assessment procedures, which have no negative consequences for students, their teachers and schools, allow students to know their level of ICL and receive targeted advice on its development. Such surveys provide parents, teachers, and educational managers with objective information about students' readiness for further education. The findings can serve as a basis for the elaboration of targeted support measures for schools operating in difficult circumstances and for students from socially disadvantaged families.
3. To ensure that all basic school leavers successfully bridge the second digital divide, more work on digital upgrade of general education is required [Uvarov, Frumin, 2019]. It is necessary to introduce evidence-based organisational forms and methods of teaching and learning related to the use of digital technology in the learning process, which provide, among other things, the formation of students' ICL during individual and group work in class, homework, research and project work.
4. Today, a digital tool is available in our country that allows for a fairly simple and reliable automated assessment of the ICL level of students. The development of the digital learning environment and the connection of schools to the Internet provide

favourable conditions for the broad use of this tool and its derivatives in the mainstream school. Using methods of artificial intelligence and big data, further research and development is needed that will help to provide in real time detailed, individualised, targeted recommendations for each pupil, their parents and teachers on how to improve the ICL levels, prepare briefs for school administrators, education managers and methodologists on how to improve the work in schools, and introduce continuous formative assessment of students' ICL into everyday educational work.

Thus, considerable effort will be required to ensure that every basic school leaver possesses the ability to handle information in a digital environment as a prerequisite for successful personal and professional development throughout their life.

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Strategies of Reading Digital Texts for Performing Educational Reading Tasks: Study Based on the Think-Aloud Protocols

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Abstract

For success in education and life in our informationally saturated digital society, one must be able to select and interpret digital texts of different genres, choose optimal ways of interacting with these texts, and extract and assess information from them. Contemporary education specialists believe that skills of working with digital texts are an integral part of reading literacy; their publications model successful results of interacting with digital texts. Nevertheless, the means of attaining these results remains a very important and topical question for the education system. What strategies allow one to interact with digital texts effectively? How should one teach these strategies to contemporary schoolchildren?

The present article aims to identify and classify metacognitive strategies used by competent Russian-speaking lower secondary students for performing learning assignments based on digital texts. It is based on the analysis of think-aloud protocols and data from the online monitoring of readers' activities on the screen. The study describes and analyzes seven groups of digital reading strategies. The results contribute to basic knowledge about the processes at the root of effective digital reading and hence of the development of approaches to teaching and assessing reading literacy in the digital age.

Keywords

reading literacy, digital reading, metacognitive reading strategies, teaching digital reading, online monitoring, think-aloud method.

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Digital textbooks, interactive workbooks, and digital content ranging from educational to popular science — these tools have taken a strong position in the modern educational process. The sources from which today's schoolchildren draw information important for their education and development are mostly digital [Lebedeva et al., 2020. P. 262].

At the same time, there is a strong view held in the science of reading that interaction with digital text is fundamentally different from working with printed text or its digitized version. Digital reading is defined as working with texts characterized by distinctive properties that can only be found in the digital environment [Singer, Alexander, 2017]. This type of reading relies on specific cognitive and metacognitive processes. For the participants in today's education system, it is crucial to understand how digital educational reading, that is, extracting information from digital text and interpreting it to solve educational tasks, works. In particular, the "learning from the strongest" approach appears to be productive: understanding the strategies used by proficient digital readers can serve as a basis for teaching successful digital reading.

This article reports the results of a qualitative study of metacognitive strategies employed by proficient Russian-speaking digital readers at the end of lower secondary (or "basic", according to the terminology of the Russian education system) school when reading a digital text. The purpose of the study is to identify, describe, and classify these strategies.

The purpose of the study determines the structure of the present article. The article consists of an introduction, a review of the theoretical background, a description of the research methods and materials, a presentation and discussion of the results, and a conclusion.

1. Theoretical background of the research

1.1. Reading strategies for teaching and assessing reading literacy

The tools for measuring reading skills and competencies are based predominantly on the outcome-based approach to the assessment of reading activities. For instance, the sections on semantic reading in the international PIRLS [Mullis, Martin, 2019] and PISA [OECD, 2019; Zuckerman, 2010] surveys and the Russian monitoring and control tools for measuring reading literacy[1] [Ryabinina, Chaban, 2019] assess how participants solve the tasks of finding, selecting, interpreting, and evaluating information from text. The outcome-based approach is based on the assumption that in case of adequate ("correct") text comprehension the reader's projection of the text will be close to the author's projection [Zalevskaya et al., 1998. P. 35].

At the same time, in reading literacy instruction the outcome-based approach has a number of limitations. Focusing only on reading outcomes does not provide an opportunity to identify

[1] Description of the testing and assessment materials for the 2020 Russian language test, 4th grade // Federal Service for the Supervision of Education and Science. https://fioco.ru/Media/Default/Documents/%D0%92%D0%9F%D0%A02020/%D0%92%D0%9F%D0%A0_%D0%A0%D0%A3-4_%D0%9E%D0%BF%D0%B8%D1%81%D0%B0%D0%BD%D0%B8%D0%B5_2020.pdf

the underlying mechanisms that can help to improve reading skills [McNamara, Kendeou, 2011. P. 35]. When applying a strictly outcome-based approach, one does not measure semantic reading skills per se, but rather the reader's ability to answer text-based questions and complete text-based tasks.

The process-based approach, an alternative to that focused on the outcome, is used more often in basic research on reading and less often — in instruction and assessment. This approach focuses on the cognitive and metacognitive processes that take place during reading and text comprehension, from word decoding to making meaning from text. Of particular interest are the processes that readers consciously activate during and after reading, such as self-explanation and asking questions about the text.

There is a substantial body of evidence on how particular reading processes and strategies lead to effective or, conversely, poor comprehension [Magliano, Millis, 2003; Millis, Magliano, Todaro, 2006; Magliano, Millis, Ozuru, McNamara, 2007]. The information about the process of reading is usually complemented by an assessment of its results [McNamara, Kendeou, 2011]. This approach allows for a deeper understanding of how to teach semantic reading and helps students overcome difficulties in comprehending the text.

This research combines the process- and outcome-based approaches to the study of reading: we focus on the metacognitive strategies of digital reading, and we measure the effectiveness of these strategies by reading outcomes, i.e. accurate and complete responses to text-based questions.

1.2. Reading strategies as a special kind of process that occurs during reading

In the literature, strategies are defined as techniques that help readers to overcome difficulties and obstacles to successful text comprehension [McNamara et al., 2007] and as "voluntary actions of the reader aimed at the most effective and full comprehension of the text" [Oganov, Kornev, 2017. P. 118].

In didactic studies, reading strategies are defined as complex units — combinations of individual strategies representing behavioral or cognitive actions, for example, pausing while reading (Self Monitoring Approach to Reading and Thinking, or SMART), "Know — Want to know — Learned" [Smetannikova, 2018. P. 57–58], SQ3R and SQ4R [Prantsova, Romanicheva, 2015. P. 33].

In order to distinguish individual reading strategies from comprehensive instructional strategies, we will refer to the latter as technologies of strategy-based reading instruction. A technology is a particular sequence in which multiple strategies are applied for more effective comprehension and memorization of a text.

Reading strategies are defined in this article as deliberate, goal-directed actions that readers take to effectively accomplish

their reading goals. The goals can be self-determined by the reader or externally imposed, ranging from getting a "full comprehension of the text" [Oganov, Kornev, 2017. P. 118] to cursory reading or scanning the text for specific information.

Another category is metacognitive reading strategies. Using these strategies, readers consciously plan, control, evaluate, and correct their interaction with the text. The employment of such strategies involves "cognition about cognition" in the process of reading, i.e., being aware of the cognitive processing of the text and correcting the cognitive reading strategies being applied [Baker, Brown, 1984]. Three groups of metacognitive strategies are distinguished: Global Reading Strategies for reading planning, regulation, and assessment; Support Reading Strategies, such as taking notes or using reference materials; and Problem-Solving Strategies for solving problems while reading [Mokhtari, Reichard, 2002].

1.3. Digital reading strategies

This study focuses on strategies that readers use when reading a digital text, i.e., a text that is characterized by multimodality, nonlinearity, and interactivity [Lebedeva, Veselovskaya, Kupreshchenko, 2020].

Studies of reading distinguish between texts that are the result of digitization of print sources and texts that have specific properties that can only be found in the digital environment [Singer, Alexander 2017. P. 1035]. There is no doubt that to achieve learning objectives, schoolchildren also interact with digitized linear ("ordinary") texts. However, we are particularly interested in digital texts that require dealing with specific tasks: concentrating and overcoming distractors, choosing a reading trajectory, etc.

The differences in digital and print reading processes are often described in terms of strategies: strategies for text navigation, control of scrolling (flipping pages on the screen), and distribution of attention between the components of digital text, including components of different semiotic nature.

In particular, researchers have been studying strategies for navigating through digital text components that are specific to digital reading [Salmeron et al., 2005. P. 174], coping with the unexpected structure and interactivity of online texts [Afflerbach, Cho, 2010], and resisting the inclination to read in a cursory and fragmented manner typical of the digital environment [Zhang, 2012. P. 138].

It is important for our study that scholars conceptualize reading digital multimedia hypertexts as self-directed text construction [Coiro, Dobler, 2007]). The very nature of digital text encourages nonlinear, selective interaction with any text (or multiple texts) on the Internet, which contrasts with the conventional sequential reading of printed text. Every reader constructs his or her unique read-

ing path in the digital environment — or follows the path offered by that environment. According to N. N. Smetannikova, "readers of the virtual text do not follow the author, do not perceive the text according to the author's logical structure, but establish connections in the text independently, thus creating their own structure <…> Today a machine becomes an active 'reader', it offers its text to a human, thereby changing the relationship between reader and text" [Smetannikova, 2019. P. 8].

This conceptualization of digital reading as a construction process dictates the urgent need for a high level of reading awareness, which is essential to effectively and optimally construct the path and mode of interaction with digital text. We, therefore, assume that a proficient reader of digital text differs from a traditional reader in his or her ability to apply metacognitive reading strategies.

1.4. The strategy-based approach to digital reading instruction and reading skills assessment

The application of research on reading strategies in the classroom is based on the assumption that the strategies of proficient readers differ from those of readers who have difficulty comprehending what they read. This assumption is well supported empirically.

A whole range of studies have found significant differences between proficient and less proficient readers in the application of specific strategies (building coherence [Magliano, Millis, 2003; Millis, Magliano, Todaro, 2006], preliminary analysis of text structure [Block, 1986]), and in quantitative indicators [McNamara, McDaniel, 2004; Anderson, 1991; Yayli, 2010].

These data inform educational practices. Reading strategies are developed through both teacher-assisted instruction[2] and interaction with automated learning systems [McNamara et al., 2006]. This approach focuses not only on the outcome of reading (correct or incorrect comprehension) but also on the process of reading and making sense of the text. The effectiveness of this approach has been supported by research findings showing that didactic interventions significantly contribute to the development of reading competence.

Of particular interest is the use of the process-based approach to measuring reading skills. For example, evidence of significant differences in coherence-building strategies between proficient and less proficient readers has provided the basis for the Reading Strategy and Assessment Tool (RSAT) which enables automated assessment of reading competencies [Magliano et al., 2011]. In digital assessment systems, it also appears promising to consider reading

[2] See [Mulcahy-Ernt, Caverly 2009; Smetannikova, 2018; Prantsova, Romanicheva, 2015] for a description of approaches and techniques of strategy-based reading instruction.

behavior, i. e. user actions in the digital environment, which, as we assume, may reflect their reading strategies [Lebedeva et al., 2021].

In order to apply a strategy-based approach to digital reading instruction, we need to find out which strategies for interacting with digital texts, summarizing, and didactically making sense of the accumulated observations are used by competent readers. In particular, the international Online Reading Comprehension Assessments project (ORCA) has tested a model for teaching digital reading strategies based on teachers' demonstration (voicing) of strategies and techniques they use when working with online texts [Coiro, 2011].

This paper describes the results of a study on digital reading strategies employed by competent readers attending lower secondary school, conducted on the Russian-language materials and a sample of Russian-speaking readers.

2. Research methods and materials

2.1. Research participants

The study was conducted in two stages. At the first, screening, stage 12 students in grades 7–9 of schools in and near Moscow (six boys and six girls) took part in the study. This stage resulted in the selection of the two main participants — a boy and a girl in the ninth grade — who had been identified by the experts (language and literature teachers and reading researchers) as the most proficient readers. The second stage of the study involved individual sessions with the selected students.

Choosing senior students as participants was motivated by psychophysiological research on reading, according to which the ability to self-monitor comprehension develops in children after age 13, and the strategy-based approach to reading begins to develop closer to upper secondary school [Oganov, Kornev, 2017].

2.2. Research methods

The study uses a combination of think-aloud verbal protocols and structured online observation.

Think-aloud verbal protocols involve participants thinking about and explicitly commenting on what they are reading [Bereiter, Bird, 1985]. This method gives insight into the cognitive and metacognitive strategies employed by the reader as he or she is making sense of the text [Leslie, Caldwell, 2009. P. 416]. The effectiveness of the think-aloud method for studying reading processes has been confirmed in a significant body of research on traditional reading ([Magliano, Trabasso, and Graesser, 1999; Magliano and Millis, 2003; Millis, Magliano, and Todaro, 2006; Leslie and Caldwell, 2009; Bohn-Gettler and Kendeou, 2014; Wang, 2016; Bohn-Gettler, 2018], etc.) and in a smaller number of studies of digital reading [Coiro and Dobler, 2007; Salmeron et al., 2017; Latini, Bråten, 2021].

The structured online observation method implies recording the observed facts and events in the online environment [Polukhina, 2014]. For the purpose of this study, we were interested in observing the actions performed by the respondent while reading, such as scrolling up or down, slowing down or speeding up scrolling, engaging with interactive text elements, clicking hyperlinks, following text with the mouse pointer, highlighting text.

2.3. Research materials

The study simulated the conditions of educational reading, i.e., interaction with text to perform educational tasks. The participants were given the following reading prompt:

> At school, your class has been asked to prepare for a lesson on "The Differences between Human and Animal". You need to find materials on the topic and prepare answers to the questions. You found this online material: <link>.

The link led to a post in the community of the *Schrödinger's Cat* popular science magazine[3] containing an abstract of the text offered for reading. The text itself was published in the popular science section "Vsenauka" in the digital edition of the *Novaya Gazeta* newspaper[4]. Such an indirect path to the target text is intended to track participants' use of strategies for a preliminary evaluation of the text content and for making decisions on clicking hyperlinks in the digital text.

The reading material is a popular science text that possesses all the properties of digital texts. The structure of the text is unconventional, which leads to additional reading difficulties: the text opens with an interactive test to check the pre-reading knowledge on the topic of the text and to create reading expectations; the main part is written in the genres of expository text and interview; the conclusion contains the description of the books on the topic of the text.

The reading prompt consisted of three text-based questions. In the first question, the participants were asked to find specific, directly stated information in the text: "Find an example in the text of how animals use memes". According to the second question, the readers were expected to find information located in different parts of the text and interpret it: "How do different scientists answer the question of what makes humans different from animals?" The third question required thoughtful, analytical reading and summarization of information from throughout the text: "From what you

[3] The post can be accessed at: https://vk.com/kot_sch?w=wall-78004698_29921.
[4] The text can be accessed at: https://novayagazeta.ru/articles/2021/08/05/vopros-po-sushchestvu.

understood in the text, what makes humans significantly different from animals?"

2.4. Data collection

The data were collected online using the Zoom platform.

The introductory phase included the establishment of contact between the respondent and the instructor, the explanation of the research protocol, and the testing of the technical and organizational conditions of the study.

During the demonstration phase, the participants were given an example of how to comment on the reading process using the think-aloud method. While reading a sample digital text, the instructor was verbalizing his or her thoughts and explaining his or her actions to the study participants.

The main phase involved the participants performing the assigned reading tasks and commenting aloud on their thoughts and actions. At the beginning of the main phase, the respondents activated the screen sharing mode on their device, so that the instructor could observe visible actions that they were taking while reading. In most cases, the participants chose at which points to pause and verbalize their thoughts independently, but the instructor sometimes stopped the participants and asked them to comment on specific actions. The participants were not assisted in the reading process; the instructor's questions did not prompt a correct interpretation of the text, but only motivated the participants to think aloud, for instance, "What did you just think about?" and "Why did you flip through this fragment?" The success of the participant's completion of the reading tasks was assessed by the instructor based on the oral responses of the former.

As a result, two verbal protocols of 63 and 39 minutes were collected, transcribed, and marked.

2.5. Data analysis methods

The purpose of the study was to identify the specific digital reading strategies characteristic of competent readers and to classify them. The data analysis method most relevant for reaching this goal is content analysis [Weber, 1990. P. 9–10; Krippendorp, 2004. P. 48–53].

According to the verbal protocol analysis procedures [Bohn-Gettler, Olson, 2019], the records obtained from the research sessions were transcribed into a text format and segmented into single utterances, each of which was further encoded. Utterances containing multiple thoughts and ideas were split into smaller fragments. The coding was performed using the inductive approach [Bohn-Gettler, Olson, 2019. P. 5], which ensured that the observation was not distorted by studies done in other languages, populations, and settings.

Using the inductive analysis of verbal protocols, a coding scheme was developed. Table 1 presents a fragment of the scheme, showing the codes related to the preliminary evaluation of the text by the participants.

Table 1. **A Fragment of the Marked-up Verbal Protocol**

Code	Interpretation	Reader commentary
GENERAL_ PREVIEW	General preliminary evaluation of the text: the reader explicitly communicates his or her intention to evaluate the text before reading	*Here, I'll probably first look at what's on this page...*
SCROLL_FROM_ BEGINNING_TO_END	Scrolling through the text from beginning to end: the reader explicitly comments on this action	*...scroll through it completely...*
STRUCTURE_PREVIEW	Preliminary evaluation of text structure: the reader explicitly communicates his or her intention to evaluate the text structure before reading	*...look at the sections...*
LENGTH_PREVIEW	Preliminary evaluation of text length: the reader explicitly communicates his or her intention to evaluate the text length before reading	*...see how long it is...*

3. Results and discussion

By analyzing the verbal protocols, we have identified the strategies used by the study participants, classified them, and examined in detail some of the strategies specific to digital reading. A detailed description of the identified strategies can be found on the website of the study[5].

During the study, the participants demonstrated a high level of reading literacy and reading awareness, thus confirming that they were proficient readers: both participants gave correct and complete answers to the questions, and their commentary during the reading process displayed a high density, which is indicative of a competent reader [Anderson, 1991; Yayli, 2010].

In the general corpus of comments made in the course of reading, we identified comments that verbalize the following categories of strategies:

- text comprehension strategies;
- pre-reading strategies;
- strategies related to setting and pursuing a reading goal;
- strategies for choosing and changing the type, method, and trajectory of reading;

[5] https://digitalpushkin.tilda.ws/digitalreading#strategies

- strategies for monitoring the quality of reading and resolving difficulties that arise;
- strategies for using information from the non-verbal components of the text;
- support strategies.

3.1. Text comprehension strategies

Text comprehension strategies are fundamental, universal strategies for semantic reading. They include the following:

- paraphrasing;
- making inferences based on what has been read;
- activating background knowledge;
- summarizing what has been read.

The set of strategies identified in our verbal protocol analysis is similar to those described in other studies and does not depend on the reading format [Bohn-Gettler, Kendeou, 2014].

Other categories of strategies used in digital text reading have their specific features.

3.2. Pre-reading strategies

Pre-reading strategies include the following:

- preliminary evaluation of the text value and its relevance to the reading task;
- preliminary evaluation of the text volume, structure, and content;
- predicting the content of the text from the title, subtitle, and first lines.

Purposeful employment of these strategies indicates a well-developed level of skimming skills that is characteristic of a competent reader's repertoire of techniques, regardless of whether they are reading from paper or a screen. Yet, in the digital environment skimming has specific features. The most common action in skimming is scrolling, i.e., a special way of flipping that is not used in print reading. However, the difference is not only in mechanics.

A number of researchers have concluded that skimming is the predominant type of digital reading [Liu, 2005; Hillesund, 2010]. It can be assumed that to some extent the spreading of skimming is an evolutionary necessity: in the information explosion era, people face a prodigious amount of information and critically need the techniques for quickly determining the value and relevance of the incoming information. In the case of textual information, skimming is such a technique. A competent digital reader must be able

to quickly and consciously decide whether or not to read a text or text fragment, and such decisions are made based on a preliminary evaluation of various text parameters.

At the same time, as studies by other authors and our observations show, skimming is not always applied consciously and purposefully. For instance, according to the shallowing hypothesis [Annisette, Lafreniere, 2017], which is confirmed in recent experiments [Delgado, Salmerón, 2021], the daily mass experience of reading on digital media leads to a superficial perception of textual information, regardless of the reader's intentions [Alexander, the DRLRL, 2012; Delgado et al., 2018]. Consequently, a competent digital reader is characterized not so much by the high mastery level of their skimming skills as by the conscious employment of scanning techniques when beginning to work with the text in order to decide on the next steps to take.

Digital texts offer readers supports and cues that are not always present in a print text. In our study, for example, the participants paid attention to the slider on the right side of the text, and the structure of the digital text, when employing the strategies of preliminary text evaluation. When constructing a reading path, the participants relied on the following:

- their knowledge of the specific structure of texts in certain genres and formats:

  If this were a Wikipedia article where I needed to find specific information, I would pay special attention to the large print headings because they usually separate blocks of information;

- the visual arrangement of the text. In our study, for example, due to a typical visual arrangement the readers identified an advertisement fragment at the end of the text and did not take it into account when working with the text. Such selective attention mechanisms are known as banner blindness [Pagendarm, Schaumburg, 2001];
- other features of hypertexts and interactive texts. For instance, the readers separately evaluated the value of text fragments referenced by in-text and external links.

3.3. Strategies related to setting and pursuing a reading goal

Strategies related to setting and pursuing a reading goal include the following:

- focusing on the reading goal;
- tracking deviations from the reading goal and getting back to it;
- evaluating the accuracy and completeness of how the reading goal is accomplished.

Strategies related to the adjustment of reading behavior to the reading goal are especially important in digital reading. Researchers have suggested that when reading a print source, readers adapt to the reading goal better than in digital reading [Latini et al., 2019]. Purposeless and mindless wandering in the online environment has been documented as a recurring behavior pattern [Burbules, Callister, 1996. P. 41]. The so-called distracted reading is becoming a hallmark of today's multitasking world [Thain, 2018]. The prevalence of such behavior patterns is partly due to the high amount of distractors in the digital environment. Full of various stimuli claiming the reader's attention, the digital environment impedes concentrated, goal-oriented reading. The reader needs to make a special effort to stay focused on the reading goal.

In our case, there was a special distractor — an entertaining test at the beginning of the article, asking readers to check their ideas against the opinions of scholars. The two readers evaluated the value of this test differently as they performed the assignment, but, importantly, they did so in relation to the reading goal: one participant refused to take the test because they thought it was not conducive to reaching the goal; another participant answered several test questions to see if the answers contained information that was valuable for accomplishing the reading goal.

While avoiding the most distracting trap of the proposed text, participants nevertheless lost concentration:

> I think I got distracted from the question. I guess I was distracted by this text because it stood out, I got curious to see what was in it. There, that's it [back to goal-oriented reading].

Thus, a competent digital reader is characterized by the ability to define a goal, verbalize it explicitly, and check regularly against this goal while reading:

> I probably don't need to take this test. What is it for? Let's move on to the text. I have the assignment to work on.

3.4. Strategies for choosing and changing the type, method, and trajectory of reading

Strategies for choosing and changing the type, method, and trajectory of reading include the following:

- choosing the type, method, and trajectory of reading depending on the reading goal, type, content, and the visual arrangement of the text;
- controlling the reading speed, depending on the content of individual text fragments.

In the digital environment, the reader has to construct the optimal reading path independently, i.e. to make decisions about which parts of the text and in what order to read, whether to follow hyperlinks, get interactively involved with the text, and go beyond the text by using additional resources (for example, clarifying the meaning of unknown words in electronic dictionaries or checking the facts from the text in other sources), etc.

The study supported the findings of the non-linear nature of digital reading: observing reading behavior revealed the participants' frequently going back through the text, and their comments showed how decisions about these actions were made. That being said, non-linearity is not always a sign of aimless wandering through the text; non-linear interaction with the text is often a consequence of the conscious application of reading strategies:

> It looks like a conclusion, so it makes sense to read some of the preceding text. I'll take a look at the beginning of this paragraph here.

One of the key questions in this study was the reader's ability to switch between different types of reading to solve different reading tasks. Several of the tasks required search-reading techniques (reading for specific information), one of which was to find information located in a specific place in the text (an example of an animal meme), another was to collect and summarize the meaning of several text fragments (opinions of different scientists), while the third question required reading the whole text for detail (summarize the differences between animals and humans).

The question that required searching for multiple fragments proved to be more difficult for the participants than the question that required finding information located in one place. During search reading, the participants employed general strategies that could be applied regardless of the text format (e.g.,

> I am looking for some names. Usually they are capital letters <…> in the middle of a sentence. And then I will read the text to understand whose name it is and what it relates to),

as well as strategies specific to digital reading (e.g., a search reading strategy where the reader uses such technical capabilities as the Ctrl+F key combination to search a page). Both study participants said that they often used this method when they were looking for an answer to a specific question (Table 2).

Such an appeal to new technological tools to implement standard reading operations requires a separate commentary. The strategy of finding information in a text through automatic search in-

Table 2. **Search Reading Strategy with Automatic Text Search**

Question: "How do different scientists answer the question of what makes humans different from animals?"	
Action	Reader commentary example
Identifying the key (pivot) word	*The key word here is "scientists" <...>. But we want to find specifically the part with "different scientists". There won't necessarily be the word "different", so I'd put "scientists" in there*
Search by keyword in the text	*Better without the ending.* [Typing "учен" — the Russian equivalent for "scientists" without the ending — in the search field] *Seventeen results.*
Reading the search results with the keyword and evaluating their relevance to the question	*"Scientists managed to teach them the sign language" is hardly about different opinions.* *"Scientists from the University of California" — this is more interesting, but here we see the heading "It's not only humans who can empathize", so it's not really what I need, it's still not about different opinions.* *"Many respected scientists have also been convinced of this" — there may be something here about differing opinions.*

stead of using human eye only is an example of how humans are delegating some of their cognitive processes to emerging digital technologies. Word search entrusted to the computer ranks with such tasks as memorizing information, performing arithmetic operations, or translating text, which refers us to E. Clark and D. Chalmers' concept of extended cognition [Clark, Chalmers, 1998]. The assumption that the agent of the modern educational process can be seen as a "personality extended into digital media" [Semenov, 2020] requires thought and the revision of educational practices and methods of measuring educational outcomes.

While reading the text, the participants obtained two different results by using automatic search. For one, the strategy was successful and produced a quick result, while for the other it led to an incomplete solution to the reading task: the actions described in the table prevented the second participant to identify several scientists named hyponymically (anthropologist, biologist). This issue, however, was later solved with the use of the following group of strategies.

3.5. Strategies for monitoring the quality of reading and resolving difficulties that arise

The employment of the strategies for monitoring the quality of reading and resolving difficulties that arise is the most important indicator of a competent reader regardless of the reading medium. These strategies include the following:

- tracking text comprehension;
- going back through the text to resolve comprehension difficulties;
- reducing the reading speed when difficulties in comprehension arise;

- switching to whisper reading when difficulties in comprehension arise;
- consulting the context to resolve comprehension difficulties;
- consulting external sources to resolve comprehension difficulties.

The desire to solve comprehension difficulties often results in a non-linear reading trajectory. For example, the participants first paid attention to the text in larger font, then realized that they did not understand part of the text and, using linguistic cues (in this case, the anaphoric pronoun), returned to the preceding fragment:

> "One female came up with this for some reason"... Okay, "this", means there is some information before that. After all, I need to read what came before.

Furthermore, in the course of the study, we observed how the desire to solve comprehension difficulties competed with the desire to pursue the reading task: when confronted with an unclear fragment, the participants tended to skip it, considering it unimportant for answering the question:

> "...theological dogma. What complicated words! Okay, that's not important right now".

The reading time was unlimited; participants were asked to read as they would in a natural setting, so there were presumably other reasons for not resolving comprehension difficulties.

To increase understanding, the participants drew on the text, for example, inferring the meaning of words from the context:

> They have their own memes... stick a blade of grass in their ear. Apparently, they thought it was funny. Oh, no, I see: "non-biological objects, memes — ideas and technology". Okay, so a meme is some kind of joke that someone came up with and others picked up on.

The readers could also use external sources to increase understanding. For instance, the other participant used the search on the Internet to clarify the meaning of the word "meme".

3.6. Strategies for using information from the non-verbal components of the text

The text offered to the study participants did not contain many non-verbal components, such as graphs, diagrams, and tables, so we were able to observe only a limited repertoire of strategies from this group, including the following:

- using graphic text design and illustrations to choose a reading path;

- relying on illustrations and the arrangement of the text to choose a reading path.

The first strategy was used a lot by both participants. This strategy relies on the reader's prior knowledge that a highlighted fragment is very important for text comprehension:

> I saw the text in large print there. I'll read it because it is catchy. It must be something that contains the main ideas, most important ones in the article.

The illustrations also helped the readers to navigate the body of digital text and understand its structure:

> Here begins some new part <...> and the first thing that catches the eye is the photo.

3.7. Support strategies

Support reading strategies involve actions other than reading (such as writing, retelling, highlighting, etc.) that help readers interact more effectively with the text and understand and memorize what they read.

Our study identified the following support reading strategies:

- taking notes;
- highlighting a text fragment with the cursor.

Other studies have described a wide range of support strategies, in particular 9 types in [Mokhtari, Reichard, 2002; Anderson, 2003]. The limited repertoire employed by the study participants is presumably due to the limitation of the chosen data collection method: despite the instruction to behave as naturally as possible, as if they were performing a real-life learning assignment, the participants were aware of the artificial nature of what was happening. They even mentioned it in their speech:

> If I were now writing some text for myself, I would put it somewhere in Word, for example.

We expect to see a wider range of support strategies when the observations are carried out in more natural conditions.

4. Conclusion

In the study of the reading process of two competent readers at the age of 14 performing an educational task, we have identified and classified metacognitive strategies for digital reading. Seven

groups of strategies were described and analyzed. Some of them are universal and do not depend on the text format, others are specific to digital reading.

We chose a research design that allowed us to observe how competent ninth-graders were performing reading tasks. Participants did not always use optimal strategies, but they did track and address difficulties that occurred during the reading process. Thus, we modeled the behavior of a proficient reader, and this model can provide the basis for both teacher-assisted reading instruction and automated learning systems.

Below we briefly formulate the main conclusions of the study. This study confirmed the view of digital reading as text construction. The study participants avoided linear, sequential reading from first to last line, preferring nonlinear self-constructed reading trajectories. During the digital reading process, the participants made a lot of decisions about which text fragments to read, how attentively, and for what purpose. Through online observation, we found that the visual arrangement of digital text and the opportunity to scroll quickly supported nonlinear reading.

It was also found that the effectiveness of digital reading depends on the reader's self-control: on their ability to focus on the reading goal and overcome the distractors that hinder the reading process. An important group of digital reading strategies is strategies for the preliminary evaluation of text — of its relevance to the reading task, volume, structure, and general content. An observable indicator of the use of these strategies is quick scrolling through the text from beginning to end before reading.

In the context of digital reading, strategies that delegate some of the reading tasks to technology deserve special attention. Both study participants employed a search reading strategy with automatic page search, the successful application of which requires a range of skills from the reader. In particular, it is important to critically evaluate the results obtained with technology: while delegating, the reader should control how the search is performed.

The participants demonstrated how in the reading process they draw on their experience of reading digital texts and their idea of the typical arrangement of such texts and in-text visual cues. Since the arrangement of digital texts differs significantly from that of print texts, print reading instruction does not always result in a high level of digital reading proficiency [Ortlieb, Sargent, Moreland, 2014]. Consequently, digital reading practice guided by a teacher or other competent reader is important for developing a high level of digital reading proficiency.

The think-aloud method — the research method of this study — seems a promising instruction method. Using the explicit commenting technique, the teacher can model digital reading strategies explic-

itly for students. As evidenced in practice, by applying the think-aloud method in reading class, students are better at solving reading tasks independently, if they have the opportunity to observe an example from a competent adult [Dobler, 2015]. In addition, thinking aloud reinforces the practice of slow conscious reading and can thus prevent distracted reading characteristic of many contemporary readers.

The goal of digital reading instruction for today's students is to provide students with a repertoire of digital reading strategies and develop in them the ability to select from this repertoire those techniques that are useful for solving specific reading tasks.

The results of the present study can also be used to develop instruments for measuring reading literacy in upper secondary school. For example, the observable reader's actions described in the study can serve as the basis for automated reading assessment systems.

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How University Teachers View the Digital Transformation of Higher Education

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Abstract

The absolute majority of publications about changes in higher education resulting from the COVID-19 pandemic focus on the problems faced by students. They fail to articulate the position of university faculty members who are concerned about their dwindling role as a result of the digital transformation of education. Since 2020, the Institute of Social Analysis and Forecasting at the Russian Presidential Academy of National Economy and Public Administration with the support of the Russian Ministry of Science and Higher Education has conducted a monitoring study of the attitude of university faculty members to the changes taking place in higher education. The present article is based on the results of three research waves (non-random, administrative, river sample) conducted in April 2020 (N=33,987), June–July 2020 (N=27,484) and April–May 2021 (N=26,334). An overall positive trend is observed in teacher attitudes: the peak of discontent about the introduction of distance education has passed, and the attitude to online learning has become calmer and more level-headed. Most teachers continue to express unconditional support for traditional in-person learning, however. The article takes a close look at the attitude of teachers to the digital transformation of higher education and analyzes their narratives. Teachers believe that the most promising aspect of the digital transformation of universities is the use of blended learning technologies that combine the benefits of classical and innovative teaching methods. The article identifies risk factors and further opportunities for digital innovations in higher education.

Keywords

digital transformation, higher education, online survey, survey of university faculty members, administrative survey, hybrid learning model, blended learning model, distance education, distance learning.

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In the spring of 2020, due to the pandemic, the total lockdown, and the uncertainty about the further spread of COVID-19, the higher education system was faced with a choice: suspend classes, dismissing students and faculty for an indefinite period, or switch entirely to a distance learning mode. The education system immediately transitioned to distance learning, and the administrative coercion to it, which offered no alternatives, inevitably created resistance [Радина, Балакина, 2021; Рогозин, 2021b]. Most university teachers reacted negatively, considering this situation an attack on academic freedom, which would lead to the imminent destruction of the entire higher education.

At the same time, for several years already, the higher education system has been undergoing a planned digital transformation, with high-tech digital solutions being introduced and curricula being modernized. While before the pandemic these processes had run in parallel, the obligatory rapid transition to distance education inextricably linked them to each other in the perception of university teachers. Educators' prejudice against the distance learning mode has become a critical part of the context in which the digital transformation of higher education has taken place. University teachers can hardly be blamed for their resistance to change: the emergency in the country, the need for rapid adjustment, the dramatically increased workload, the burden of responsibility, and administrative pressure made them hostages to the situation since in most cases these circumstances were drivers of the change taking place.

It has been more than a year and a half. Do university teachers still have the initial prejudice against the distance learning mode and the digital transformation of higher education? What are faculty attitudes towards distance education in 2021? Have university teachers found the optimal balance between distance and classroom learning? Have the current events influenced faculty attitudes towards digital transformation? How do university teachers perceive digital transformation in general? How many of them are actually opposed to digital transformation? The present study examines the main elements of the digital transformation of higher education based on the current evaluations of faculty members, who are one of the main stakeholder groups of these changes.

The digital transformation of higher education and the university teacher's role in it

The digital transformation of higher education has been a topic of discussion for at least 30 years now. One of the initial impulses for this discussion was active learning technologies, seen as a way to increase students' learning motivation. In their classic work of 1991, C. Bonwell and colleagues state that active learning using the methods of the emerging IT industry will change the role of a university teacher from just a "transmitter of knowledge" to a "facilitator" who instead transmits the teaching method [Bonwell, Eison, 1991]. Thus, already at the outset of the debate, the university teacher's role in digital transformation was one of the central issues.

In recent years, various international organizations released statements and memoranda emphasizing the priority of active learning for successful future development. They included the decisions within the Bologna Process and the European Higher Education Area [Zahavi, Friedman 2019], *Partnership for 21st Century Learning* [Laar et al., 2017], and various editions of the book *Assessment and Teaching of 21st Century Skills* [Care, Wilson, Griffin, 2018].

Further development of the discourse followed technological advances, with the gamification of education becoming its frontier topic [Subhash, Cudney, 2018]. Despite many works on the benefits of gamification and incorporation of IT technologies into the educational process, university teachers remained skeptical about digitalization and gamification [Guerrero-Roldán, Noguera, 2018]. The most frequent areas of their concern were the anticipated changes of roles in the learning process, "time loss" for both teachers and students, a break with academic tradition, and the substitution of administering for teaching.

A compromise option combining the benefits of traditional academic education and innovative techniques was thought to be blended, or hybrid, learning [Борисова, 2019]. According to its generally accepted definition, "blended learning environments <...> combine synchronous and asynchronous activities and are situated on a continuum between face-to-face and online teaching and learning" [Graham, 2019]. In the second half of the 2010s, many studies were conducted to prove the effectiveness of blended learning in optimizing student engagement and organizing the entire learning process [Halverson, Graham, 2019; Manwaring et al., 2017; Boelens, de Wever, Voet, 2017; Boelens, Voet, de Wever, 2018]. However, the cornerstone of success remains the perception of blended learning technologies by faculty: if they are interested in using digital potential in the educational process, there is a positive change; if they are not motivated, no evidence for the effectiveness of blended learning is found.

In the autumn of 2019, just before the pandemic, Canadian researchers analyzed blended learning practices at four universities across the country, drawing on in-depth interviews with twenty fac-

ulty members from various disciplines who had experience with digital courses [Heilporn, Lakhal, Bélisle, 2021]. They found out that three basic scenarios can contribute to the success of blended programs in the educational process:

- creative revision of the existing structure and pace of educational courses (blended learning depends on the dynamics of instruction and requires alternating synchronous and asynchronous classes; any needless lengthening, pauses, and so forth make it less efficient);
- providing a choice in teaching and learning activities (blended learning is effective if it gives the author of the course more autonomy and freedom in finding the most appropriate tools, study guides and approaches to instruction, and reduces the amount of strictly regimented operations);
- paying attention to the role of the university teacher and his or her interaction with the course (it is emphasized that blended learning does not reduce the importance of a teacher, but, on the contrary, increases it, requiring him or her to establish a trust-based relationship with the students, stimulating direct contact between the members of the educational group).

The result of the studies carried out so far is the understanding that the digital transformation has three independent agents/stakeholders — society, academia (faculty) and students [Murillo-Zamorano et al., 2021] — and that their interests do not self-evidently coincide. Society can either artificially impose digitalization on universities or, on the contrary, inhibit it due to the lack of funding, necessary organizational decisions, and so forth. Students may have a very strong or, conversely, totally no demand for innovations in education. As for academia, they have personal ambitions and skepticism that affect the progress of the IT-based revolution. At the same time, the interests of these three agents should be considered in the aggregate, because their intersection is what creates an opportunity space for digital transformation at a particular point in time in a particular country.

Two common perspectives on the nature of the digital revolution, the technocratic and the humanistic, usually encourage the analysis of IT-based teaching methods in terms of public or student benefit, often ignoring the opinion of academia considered to be biased in advance and keen to preserve the status quo. It is no coincidence that the vast majority of authors examining the dramatic changes in the educational process caused by the COVID-19 pandemic focus on students' problems [Damşa et al., 2021]. Watching the current discourse, faculty members, who were worried since the early days of the digital age about the diminishment of their impor-

tance and the redefinition of roles in the educational process, might consider their concerns legitimate: their voice is often unheard and their position not articulated.

Several early works on faculty readiness for digital transformation aimed to identify the factors contributing to the educators' positive attitude towards IT-based innovations [Buchanan, Sainter, Saunders, 2013]. In particular, Finnish researchers outlined the "holistic concept of digital competence" required of today's teachers [Ilomäki et al., 2016]. Among the basic competences that were later referred to by other authors were the following:

- technical competence (the ability to use relevant technology and programs);
- the ability to use digital technologies in a meaningful way for working, studying, and in everyday life;
- the ability to evaluate digital technologies critically and motivation to participate in the digital culture.

While starting with the basic competence, that is, educators' ability to navigate modern technology, the authors finished with a much more interesting statement emphasizing the importance of academia's critical attitude to the IT-based revolution. In their opinion, an ambassador of any process should avoid formalism and a conciliatory stance: digital learning can only develop effectively if it receives constructive criticism from the professional community, which should be considered an integral component of the IT-based revolution in the educational environment. In addition, the authors emphasized the importance of a holistic approach to the role of the teacher, who is not merely a "function" of digital transformation but also has other academic interests and demands.

Norwegian researchers proposed a slightly different perspective on digital competence by identifying three specific levels of IT skills of faculty members [Gudmundsdottir, Hatlevik, 2018]:

- general digital competence, that is, the instrumental skills and knowledge university teachers require in order to use digital technology in their work, including mastery of relevant software;
- subject-specific digital competence, enabling faculty members to identify the specifics of teaching a particular discipline in an online format and address it creatively by developing unique online and blended courses;
- professional digital competence, ensuring the application of pedagogical skills in the unfamiliar digital environment: changing strategies and tactics of communication with students, developing a proper online assessment, and so forth.

The two models described above have much in common, as they take into account the multidimensionality of teaching, where the simple transfer of knowledge through a usual "analog" or digital channel is mediated by individual pedagogical excellence.

In 2020 the model of digital competences in higher education was very timely supplemented with a parameter formulated in the work of T. Aagaard and A. Lund [Aagaard, Lund, 2020]. The authors suggested that besides general, subject-specific and professional digital competences, transformative competence is also critical for the stability of higher education. Transformative competence refers to the ability of faculty and students to continuously reform and update their teaching and learning practices and is absolutely necessary to find ways out of extraordinary situations. Published in December 2019, the book of these authors could claim to be prophetic considering the COVID-19 challenge that followed, making transformative competence one of the most in-demand in the educational services market.

At the same time, it is evident that the adaptation of the educational process to the online delivery mode depends not only on the teacher's will and on students' willingness. The third stakeholder of digital transformation — the society represented by its regulatory institutions — also plays an important role. According to E. King and R. Boyatt, institutional culture is the key factor contributing to effective online learning [King, Boyatt, 2014], while F. Pettersson [Pettersson, 2018], based on the analysis of available sources, concluded that the positive effect of the teacher's personal digital competences is largely mediated by the organizational context of his or her activities. Both the absence of any institutional support and the excess of institutional regulation and control can be detrimental. If control over the teaching process becomes obtrusive, one of the key advantages of digital transformation — its flexibility and innovativeness — may be lost. In their work *Seamless Learning. Perspectives, Challenges and Opportunities,* researchers from Singapore clearly demonstrate the importance of informal, unwritten methods developed in the process of live teacher-student communication for successful online teaching [Looi et al., 2019].

Methodology

Since 2020 the Russian Presidential Academy of National Economy and Public Administration has been conducting a monitoring study of the faculty attitudes to the changes taking place in higher education. The study is based on non-random, administrative, river sample. The main administrative river sampling is organized with the support of the Russian Ministry of Science and Higher Education, invitations to participate in the survey are sent to all higher education institutions in Russia. The sampling process is controlled

locally by the universities' administrative staff. In order to control and evaluate the administratively approved responses, a second, alternative river sampling of respondents is organized through targeted advertising on social networks. For more details on the organization of the survey, see [Рогозин, 2021b]. This article is based on the results of the third wave of the study.

The first wave took place from April 10 to 15, 2020, inclusive. A total of 58,812 people participated in the survey over six consecutive days, of which 20,273 people met the eligibility criteria. Of the eligible respondents, only 6% refused to participate in the survey and 5% stopped completing the questionnaire before reaching the end. A total of 33,987 completed questionnaires were collected. The response rate, or the ratio of completed questionnaires meeting the eligibility requirements and quality criteria, to all click-throughs to the questionnaire form, was 89%.

The second research wave was conducted from June 25 to July 10, 2020. During 16 consecutive days, 42,382 people took part in the survey. 928 of them, or 2% of the sample, did not qualify for the survey; 11,680 respondents, or 28%, refused to participate right after answering the screening questions; 2,290 people, or 5%, stopped filling in the questionnaire before reaching the end. The final sample included 27,484 questionnaires. The response rate was 65%.

The third wave of the survey took place from April 23 to May 31, 2021. In 38 consecutive days, 42,272 click-throughs to the questionnaire were registered, and 32,086 people started to fill it out. A total of 26,334 questionnaires were collected that met the eligibility requirements (the respondents were teachers of higher education institutions). After controlling for errors and inaccuracies and editing the array, the final sample of 24,337 observation units was obtained. The response rate was 57%.

The consistent decrease in the response rate is, firstly, due to the large number of surveys conducted in higher education and, consequently, decreased faculty interest in participating in repetitious studies, and, secondly, due to the administrative organization of the survey, which without proper support lowers respondents' motivation to participate. Although the response rate is far from the extreme value (in opinion polls, it does not exceed 10–15%), this downward trend requires an in-depth methodological analysis.

Faculty attitudes towards the digital transformation of higher education

In 2021, the Russian Ministry of Science and Higher Education developed the Strategy for Digital Transformation of the Science and Higher Education Sector, aimed at achieving "digital maturity". One of the goals of the Strategy is to implement the target model of a digital university in all higher education institutions subordinated

to the Russian Ministry of Science and Higher Education[1], which, in particular, implies the active participation of the university faculty members in the planned changes. In order to assess faculty attitudes towards them, one of the questionnaire blocks in the third wave of our study was devoted to digital transformation.

Most respondents claim to be well aware of the digital transformation processes in higher education (Table 1).

Table 1. **Awareness of Digital Transformation Processes in Higher Education, % by column**

Do you know, have you heard or read, or are you currently reading for the first time about the digital transformation in higher education?	Wave 3, spring of 2021 (*N* = 24 337)
Know about it in detail	28.3
Have heard or/and read something	58.2
Reading about it now for the first time	7.4
Don't know	6.1

More than a quarter of respondents indicate that they know about the current changes in detail, and 58% have heard something about them. Even if we assume that the answer option "Have heard something" is a socially approved norm for a university employee, it can be argued that it is the pandemic and recent changes in the educational process that have made the knowledge about IT-based innovations in higher education background and common. At the same time, just over 15% of respondents take a negativistic stance; the majority take a neutral wait-and-see stance, and almost a third of respondents report a positive attitude (Table 2).

Table 2. **Attitudes Toward Digital Transformation, % by column**

What is your overall attitude toward the digital transformation: positive, negative, or neutral?	Wave 3, spring of 2021 (*N* = 24 337)
Positive	31.8
Negative	15.6
Neutral	40.9
Don't know	11.7

Only about 60% of respondents are aware that digital transformation is taking place at their university; 16% know nothing about it, and 22% cannot give a definite answer. Faculty members' evalu-

[1] The Strategy for Digital Transformation of the Science and Higher Education Sector was approved by the Ministry of Science and Higher Education of the Russian Federation in 2021. https://www.minobrnauki.gov.ru/documents/?ELEMENT_ID=36749

ations of the process and first results of the digital transformation in their university are somewhat more critical than their attitude toward digital transformation as such, but most tend to evaluate these results as "good" or "satisfactory" (Table 3).

Table 3. **Evaluation of the Implementation of Digital transformation at the University of the Respondent, % by column**

How do you evaluate the implementation of digital transformation at your higher education institution?	Wave 3, spring of 2021 (*N* = 24 337)
Excellent	11.2
Good	39.7
Satisfactory	34.3
Unsatisfactory	4.7
Don't know	10.2

University teachers who are concurrently employed in administrative positions assess the quality of the digital transformation in their university as "excellent" or "good" somewhat more often (Table 4). However, this bias is not decisive here.

Table 4. **Dependence of the Evaluation of Digital Transformation on the Respondent's Performance of Administrative Tasks, % by column**

How do you evaluate the implementation of digital transformation at your higher education institution?	Do you perform any administrative or managerial tasks in addition to teaching?			
	Yes, I do	No, I do not	Don't know	Total
Excellent	11.9	10.4	7.2	11.2
Good	40.5	38.7	35.7	39.7
Satisfactory	34.8	33.9	32.0	34.3
Unsatisfactory	4.5	4.8	4.0	4.7
Don't know	8.3	12.1	21.1	10.2

This block of the questionnaire included one multiple-choice question, namely: "What do you think the digital transformation of higher education is primarily aimed at?" Since the Strategy for Digital Transformation of the Science and Higher Education Sector was published on the website of the Ministry of Science and Higher Education on July 14, 2021, which is almost three months after the start date of the survey, the response options were not directly related to this document. Respondents were free to choose up to two answer options from the list, or they could articulate their own position by commenting on the option "Other" (Table 5).

Table 5. **Assumed Goals of the Digital Transformation (up to two response options)***

Response options	Absolute values	The proportion of all responses (%)	The proportion of all respondents (%)
Distance teaching of students, development of online education	14 507	33,9	59,6
Digital library resources, access to international databases	10 515	24,6	43,2
Automation of administrative and economic activities of the university	1876	4,4	7,7
Automation of university research activities, equipping laboratories and research centers	2139	5,0	8,8
Control over the university leadership by the Ministry	1419	3,3	5,8
Control over teaching activities	3049	7,1	12,5
A feedback system for faculty and students	3963	9,3	16,3
A digital archive, educational and regulatory university databases	2570	6,0	10,6
Other	886	2,1	3,6
Don't know	1831	4,3	7,5
Total	42 755	100,0	175,7

* Since it is a multiple-choice question, the sum of percentage proportions of the total number of respondents exceeds *100%.*

All the proposed response options can be roughly divided into those gravitating toward positive, neutral, and negative scenarios of digital education development in Russia. They are selected from among the possible ones based on the results from the first wave of the survey on faculty attitudes towards digital transformation in the COVID-19 era [Рогозин, 2021b]. The small percentage of teachers who chose the option "Other" confirms the validity of the list of answer options included in the questionnaire.

The body of relatively positive evaluations is represented by the statements about the following opportunities created by the digital transformation:

- digital library resources, access to international databases;
- automation of university research activities, equipping laboratories and research centers;
- a feedback system for faculty and students;
- a digital archive, educational and regulatory university databases.

The body of neutral statements includes the following options:

- distance teaching of students, development of online education;
- automation of administrative and economic activities of the university.

The selection of the following statements suggests that the respondent expects the digital transformation of the university to generate problems for the institution:

- control over the university leadership by the Ministry;
- control over teaching activities.

In the era of the digitalization of education, the negative connotation attached to the idea of supervision by higher authorities is persistent in both Russian and international discourse.

Positive evaluations of digital transformation prevail over negative and even neutral ones. Positive statements account for more than half of all responses, neutral ones for about 45%, and negative ones for 10%. Even if we assume that we have failed to take into account all the variety of possible negative statements, forcing critical respondents to choose the option “Other”, the negativist tone is still less significant than the others.

At the same time, the most promising aspects of digital education development — the development of a feedback system for faculty and students, and the technical re-equipment of laboratories and research centers — are not considered the most likely goals of the current IT-based transformation. The number of respondents who selected “a feedback system” only slightly outnumbers those who chose the negative scenario of “control over teaching activities”. Apparently, this distribution of answers reflects faculty members’ awareness of the ambivalence of IT-based transformation: digitalization, which enables a university teacher to better understand and feel a student in case of direct inquiry (and vice versa), similarly makes a teacher more vulnerable and transparent to bureaucratic control. Many of the respondents may not be sure which trend will shape the image of digital education in Russia to a greater extent.

Facilitating access to digital library resources and international databases, while being useful in itself, is rather an element of technical support of digital transformation than its driver. The large number of respondents who chose this as the ultimate goal of the IT-based reforms of the Russian educational environment may, therefore, be indicative of their low agency and conservative orientation towards using available resources instead of redefining practices.

Finally, the most popular statement about the goals of digital transformation associates the latter with the development of on-

line education and distance teaching of students. Since this statement can include a variety of implicit attitudes, its interpretation is problematic. In the perception of many Russians, as well as in the everyday and even academic discourse, digital, distance and online education are often considered synonymous. In reality, digital transformation, or digitalization, is much broader than simply moving the educational process to an online environment or replacing face-to-face interaction with students with distance education [Lund, Furberg, Gudmundsdottir, 2019; Петрунева и др., 2020]. Even before the pandemic, the most promising area of the digital transformation of universities was considered the use of blended learning technologies, which maximize the benefits of classical and innovative teaching methods. In those subject areas and with those students where / for whom gamification, internetization and other digital innovations ensure more effective learning, the use of innovations is appropriate; when the innovations do not seem to provide additional benefits or when they put at risk the established traditions of higher education, classical face-to-face methods should be used. The ultimate goal of blended learning is not to modernize all higher education at any cost, and especially not to leave teachers and students without face-to-face meetings, but to apply the technologies, methods, and pedagogical innovations that are most appropriate in each particular case. Whether our respondents meant such adaptation of the educational process or anticipated a decline of all face-to-face teaching modes, remains unclear. Given the observations from the first wave of the survey, the latter option is more likely.

A small proportion of respondents were not satisfied with the available response options and articulated the goal of the digital transformation in Russia in their own way. Due to the considerable size of the total sample, the number of alternative answers received allows us to analyze them in detail (N = 886 in the edited array). The option “Other” was most often chosen by the respondents who sought to highlight specific negative aspects of the IT-based modernization of education, as evidenced by the top-15 most frequently used words in the open-ended responses received (Table 6).

Some of the words above have a predominantly negative connotation, such as the words “reduction”, “decrease” and “destruction”. In this context, the otherwise neutral word “saving” is also semantically related to them. At the forefront, in addition to the neutral phrases about “digital transformation” suggested by the very structure of the question, are “reduction of quality”, “destruction of education” and “breakdown”.

The analysis of the most frequent answers shows that there are two answer types at the two extremes of the sample: one group is characterized by a pronounced formal approach to completing the

Table 6. **Fifteen Most Frequent Words in Open-Ended Responses About Digital Transformation Goals, % by column**

Position	Word	Absolute values	The proportion of the total sum of the most frequent words (%)
1	Education	404	24.8
2	University teacher	146	8.9
3	Digital	127	7.8
4	Reduction	111	6.8
5	High	93	5.7
6	Decrease	91	5.6
7	Student	88	5.4
8	Educational	86	5.3
9	System	83	5.1
10	Saving	77	4.7
11	Quality	75	4.6
12	Higher education institution	69	4.2
13	Process	62	3.8
14	Destruction	60	3.7
15	Transformation	60	3.7
	Total	1632	100.0

questionnaire, the other — by containing a highly emotional message. In the first case, the respondent often copied the formally correct answer to the question from official documents, articles, and guidance manuals, or gave a commonly used definition:

> The digital transformation of education is an update of the expected educational outcomes, the content of education, the methods and organizational forms of academic work, and the evaluation of the achieved results in a rapidly evolving digital environment, aimed at radically improving the educational outcomes of each student (male, 38 years old, Candidate of Sciences, St. Petersburg).

> The interaction of administration, faculty and students in organizing and managing the educational process, research, and economic activity of the university (male, 64, Doctor of Sciences, the Republic of Mordovia).

In the second case, the respondent sought not to answer the question, but to express his or her emotional attitude to the research topic in general:

> Who cares what I think, my opinion does not affect anything! What do the authors of this questionnaire want to find out by asking this question? The focus and goals of the digital transformation are defined not by an average faculty member!!! (male, 44, Candidate of Sciences, Kirov Oblast)

All other responses can be arranged on the usual continuum reflecting positive to negative attitudes to the IT-based innovation of the educational environment. This reveals the factors of possible success, as well as problem areas of the innovation process.

Respondents with a moderately positive attitude to digital transformation usually mentioned one of the following three assumed goals of the current changes (or a combination of them): personalization of educational trajectories, mastering of new digital products by students, and the technological advancement of the country and higher education.

> The idea behind the digital transformation of education is for everyone to achieve the required educational outcomes through the personalization of the educational process, including the use of artificial intelligence methods and virtual reality tools, the development of digital educational environments in educational institutions, providing public broadband Internet access, and working with big data (male, 39, no academic degree, Moscow).

> The goal of education changes to building and developing students' ability to learn and understand the logic of finding new solutions that move science forward (female, 36, no academic degree, Khabarovsk Krai).

> Equipping higher education institutions with modern digital technologies, intended to make education and educational materials more accessible to all (female, 50, Candidate of Sciences, Altai Krai).

> Ideally, digitalization should lead to the algorithmization of all the main processes in the university, that is, managerial, administrative, economic, research and educational ones, followed by the emergence of information systems to support activities and then decision-making (male, 38, Candidate of Sciences, Saratov Oblast).

Some respondents avoided generally accepted answers, sharing unconventional ideas about the innovation goals.

> Creation of virtual platforms where students from different regions and cities could receive a proper education. Creation of virtual on-

line universities akin to Yandex.Taxi (male, 45, Doctor of Sciences, Novosibirsk Oblast).

Certain responses suggest a likelihood of success in the digital transformation of Russian higher education. The most important factors contributing to the likelihood of success are the competence of many respondents in defining the proposed concepts, the ability to distinguish between "digitalization", "distance education" and other developments in higher education, the awareness of blended learning methods, and the willingness to adopt best practices, while critically evaluating digitalization in general.

An example of the respondents' competence:

> Improving the quality of education through the development of individual digital learning paths for students. Introduction of advanced AR- and VR-based learning systems and artificial intelligence systems, ensuring access to quantum computing. All the rest has nothing to do with digital transformation, being part of the usual IT systems development process (male, 67, Candidate of Sciences, Moscow).

Statements in favor of blended learning:

> No education system is self-sufficient; we should therefore strive for a balanced and high-quality organization of the learning process in higher education, combining primarily classroom learning with students' independent work and employing necessary online resources and the positive energy of a living person (female, 38, Candidate of Sciences, Volgograd Oblast).

> It is primarily a learning model for acquiring knowledge both face-to-face in the classroom and through online courses, the creation of a single digital space for the learner for different areas of activity (female, 50, Candidate of Sciences, Chelyabinsk Oblast).

The negative responses are represented by several common statements that describe digitalization as a process aimed at "optimizing" higher education institutions and saving public funds by reducing the faculty size, "dumbing down" students, dividing education into "high-quality intramural" and "low-quality extramural", embezzling the budget and goldbricking.

> The destruction of higher education in the country and the world, the stratification of society into a large group of fooled, easily manipulated people and a small elite group having access to

quality face-to-face education (female, 45, Candidate of Sciences, Irkutsk Oblast).

The stated goal is to ultimately reduce education to a service delivery system (male, 49, Candidate of Sciences, Omsk Oblast).

The holy grail of the proponents of digitalization is to finally eliminate the university teacher as an obstacle to the market-based interaction "administration — diploma — student"; record courses on Coursera and sell the rights to them. Nobody is concerned about what will happen to the professions and knowledge increment in one generation. Maximizing profits in the short-term is what they really care about (female, 47, Candidate of Sciences, Moscow).

To save university funds. The state hopes to replace traditional education with online education to spend less money on supporting higher education institutions. In my opinion, the transition to fully online learning is unacceptable: we thereby discredit the whole idea of getting a higher education (male, 24, no academic degree, Yaroslavl Oblast).

All the reforms of recent years are aimed at imitating a response to the challenges of our time, while what actually happens is a redistribution of funds, the creation of a hierarchy of universities consisting of elite institutions and those for the "plebs", increasing control and unification of education and teaching, the supremacy of indicators, the decay of academic freedom and ethical standards in relationships of faculty members with each other and with students, replaced by loyalty to the leadership and all the innovations initiated by them (female, 71, Doctor of Sciences, Moscow).

The opinions of Russian university teachers reveal both similarities and differences with their foreign colleagues' perceptions of the digital transformation of higher education. Given the Russian context, at the fore is the problem of social justice and the stratification of society into "elite" and "masses" who are allegedly forced into distance education. Besides, Russian university teachers are concerned about traditional learning being replaced with "optimizing" online learning and are less worried about the constraints on academic freedom and the teacher's changing role in society. They place economic concerns at the forefront [Ларионова и др., 2021]. After one year of the pandemic, critical respondents point primarily to institutional problems related to digital transformation and not so much to technical or organizational ones. The reason could be that most of the urgent infrastructural challenges have been

resolved during the first year, encouraging teachers to move from criticism of their own working conditions towards considering more global issues related to educational process management.

Thus, the analysis of narratives clearly identifies the problem areas in the digital transformation of higher education as perceived by Russian faculty members. Firstly, it is the narrowing down of digital transformation to the digitalization of the educational process and the introduction and/or wider spread of digital technologies, whereby digital transformation is understood as a full or partial transition to distance learning. Secondly, it is a dilution of institutional trust between all participants in the process, and a discrepancy between the stated and actual reform goals, articulated and recognized by university teachers. Respondents especially often pointed to the mismatch between the declared goals and the real-world situation:

> The question is incorrect. If it is about the declared goals in order to check the competence of the respondent, one group of answer options is appropriate. If it is about the actual situation, other options should be chosen (male, 70, Candidate of Sciences, Kamchatka Krai).

> According to what is declared, [digital transformation is aimed at] all of the above. In reality, it is aimed at saving money at the expense of higher education and reducing funding and staff (male, 50, Doctor of Sciences, Moscow).

> I can't know the real goals. For me personally, the advantage of digitalization in education comes down to positions 1 and 2 (woman, 60 years old, Doctor of Sciences, St. Petersburg).

Besides doubting the integrity of the digital transformation actors and pointing out the lack of transparency in their goals, the respondents also distrust their competence and ability to introduce innovations into higher education:

> The system is extremely flawed. We fill out the profile with indicators that do not correspond to our real-life activities. The developers have a poor understanding of the needs of faculty and offices. For reports, we have to fill out the forms all over again (male, Doctor of Sciences, Moscow).

> I believe that proponents of digital transformation do not know its exact goals, but simply follow the mainstream and the general motto of saving budget funds. All of the above goals can be achieved one way or another through the digitalization of the educational process (male, 56, Candidate of Sciences, Moscow).

> I think and observe in our university that distance education is considered a way to save money on faculty. The leadership does not understand that online education should be blended and hybrid and requires lots of time and advanced qualifications (female, 53, Candidate of Sciences, Primorsky Krai).

> I believe that digital transformation is inevitable in today's world. However, this process is usually implemented by people who do not understand anything about it — at least in those universities with which I cooperate (male, 39 years old, Candidate of Sciences, Moscow).

Faculty attitudes towards online learning

The attitudes of university faculty members to distance learning is one of the main subjects of this monitoring study, and the relevant questions in one form or another have been included in all three research waves. The peak of faculty discontent due to the introduction of distance learning has passed: their attitude to online learning has become more calm and level-headed. In a year, the proportion of negative evaluations decreased by 9.6 percentage points, the share of positive ones rose by 6 percentage points, while neutral assessments increased by 3.5 percentage points (Table 7).

Table 7. **Respondents' Attitudes Toward Distance Education, % by column***

What is your overall attitude toward distance education in higher education institutions: positive, negative, or neutral?	Wave 2, summer of 2020 (*N* = 25 386)	Wave 3, spring of 2021 (*N* = 24 337)	The difference, percentage points
Positive	20.0	26.0	6.0
Negative	47.0	37.3	–9.6
Neutral	29.2	32.7	3.5
Don't know	3.9	3.9	0.1

* The question was asked in the second and third research waves.

Although in 2021 the proportion of those dissatisfied with distance learning remains the highest (37.3%), more than a quarter of the respondents already have a positive attitude towards it, and about 33% take a neutral position. In the first wave of the study conducted on April 10–15, 2020, when asked about online delivery mode, 70% of those surveyed claimed that it had a negative impact on student learning; 15% believed that the quality of students' online learning did not differ from that of in-person learning, and only 2% admitted that distance learning had its advantages.

The change of sentiments among the faculty members confirms our hypothesis based on the first wave of the survey: the rejection of IT-based transformation was primarily due to the pandemic shock, the general uncertainty about the future characteristic of the spring of 2020, and the dramatically increased workload at the end of the academic year [Рогозин, 2021b]. Given the short-term effect of the above factors, their elimination could pave the way for a more conscious attitude toward the introduction of distance and blended learning, which is exactly what happened [Логинова, Бендрикова, Дегтярев, 2021; Магомедов, Абдусаламов, Магдилова, 2020]. The greatest willingness to change their evaluations was most likely shown by the so-called "neopessimists" of spring 2020, whose apprehension and defensive pessimism were an attempt to cope with current and future threats [Рогозин, 2021a]. Once the danger had passed or started to look less frightening, this group of respondents took a more neutral or even positive stance.

Faculty evaluations of the convenience of the distance teaching mode

If we look at more person-oriented questions, in particular, "How much do you agree with the following statement: *distance teaching mode is convenient and comfortable for me personally*", the overall positive trend in faculty attitudes becomes even more pronounced (Table 8). The proportion of university teachers who totally agree or rather agree that the distance teaching mode is comfortable for them grows with each measurement: while in the first wave, there were 27.9% of them, in the second wave, they were already 34.4%, and by the third wave their share reached 44.1%. Accordingly, the proportion of those who totally disagree or rather disagree that the distance teaching mode is convenient is decreasing: from 67.2% in the first wave to 62.5% in the second wave and 51.6% in the third wave.

Table 8. **Measuring the Convenience of the Distance Teaching Mode for University Teachers by the Degree of Agreement With the Proposed Statement, % by column**

Distance teaching mode is convenient and comfortable for me personally	Wave 1, spring of 2020 (*N* = 30 839)	Wave 2, summer of 2020 (*N* = 25 386)	Wave 3, spring of 2021 (*N* = 24 337)	Difference between waves 2 and 1, p. p.	Difference between waves 3 and 2, p. p.
Totally agree	5.1	7.3	10.9	2.2	3.6
Rather agree	22.8	27.1	33.2	4.3	6.1
Rather disagree	42.1	38.3	35.2	–3.8	–3.1
Totally disagree	25.1	24.2	16.4	–1.0	–7.8
Don't know	4.9	3.2	4.3	–1.8	1.2

In the third wave, the evaluations of the convenience of distance education for faculty and students were for the first time consistent: 41% of faculty members believed that the distance learning mode was convenient and comfortable for students, and about 53% thought that it was uncomfortable (Table 9). In the first and second waves in 2020, faculty members rated their levels of discomfort with the introduction of the distance teaching mode higher than those of students.

Table 9. **Measuring the Convenience of the Distance Learning Mode for Students by the Degree of Agreement With the Proposed Statement, % by column**

The distance learning mode is convenient and comfortable for students	Wave 1, spring of 2020 (*N* = 30 839)	Wave 2, summer of 2020 (*N* = 25 386)	Wave 3, spring of 2021 (*N* = 24 337)	Difference between waves 2 and 1, p. p.	Difference between waves 3 and 2, p. p.
Totally agree	3.6	3.8	7.0	0.2	3.2
Rather agree	23.3	21.6	34.1	–1.7	12.5
Rather disagree	42.0	43.3	37.0	1.3	–6.3
Totally disagree	18.0	26.2	15.9	8.3	–10.4
Don't know	13.2	5.1	6.1	–8.1	1.0

In the second wave of the study, the evaluations of the convenience of distance learning for students deviate from the general downward trend in dissatisfaction: the respondents who reported the convenience of distance learning for students in the second wave are 1.3% less than those in the first wave (26.9% versus 25.4% of those who *totally agree* or *rather agree*), and the teachers who indicated its inconvenience, conversely, are 9.5% more (60% versus 69.5% of those who *totally disagree* or *rather disagree*). The difference in values is almost completely offset by the decrease in the share of respondents who could not answer the question: by the second wave, their proportion has declined by 8.1%. Thus, between the first and second waves, there is no positive dynamics in the evaluations of the comfort of the distance learning mode for students, but in the third wave, it is evident. The distribution of answers to this question is then for the first time close to the distribution of answers to the question about the convenience of distance teaching for faculty.

The measurements in the first and second waves were carried out during the examination period and immediately afterward. It was the first semester of distance teaching, and credit tests and examinations could be administered online for the first time. It is likely that faculty members who had been unable to confidently evaluate

the convenience of distance learning for students in the first wave made up their minds by the second wave, which took place after the examination period, when 69.5% of respondents evaluated the distance learning mode as inconvenient for students.

Order of priority of the teaching modes

Along with a decrease in the rejection of distance teaching due to the possibility of choice, the proportion of those who reject the exclusivity of face-to-face teaching is increasing. While in the spring of 2020 more than half of the interviewed university teachers claimed that physical presence was absolutely necessary for their classes, a year later the share of such answers decreased to 38.7%, or by 13.7 percentage points (Table 10).

Table 10. **Priority Ranking of Face-to-Face Teaching Format According to Faculty Evaluations, % by column***

Classes in my courses are best delivered only face-to-face	Wave 1, spring of 2020 (*N* = 30 839)	Wave 3, spring of 2021 (*N* = 24 337)	Difference between waves 3 and 1, p. p.
Totally agree	52.4	38.7	–13.7
Rather agree	35.3	34.5	–0.9
Rather disagree	6.4	19.0	12.6
Totally disagree	1.5	4.6	3.1
Don't know	4.3	3.2	–1.1

* The question was asked in the first and third waves.

At the same time, there is still considerable untapped potential for developing faculty positive attitudes toward digital transformation and hybrid, adaptive modes of knowledge transfer. The majority of university teachers still unconditionally prefer traditional face-to-face teaching. Only a quarter of the respondents totally or rather disagree that in-person teaching is a priori better than distance teaching.

Teachers in the arts and culture, natural science, medical science, and agriculture most often insist on the priority of face-to-face instruction. Teachers in economics and management, computer science, social science, and law are more likely to be positive about the distance delivery of their classes. Thus, the respondents have a quite utilitarian approach to evaluating the advantages of distance teaching: when it is technically more feasible and does not involve practical classes and work in creative studios and laboratories, teachers support distance mode more eagerly [Захарова, Вилкова, Егоров, 2021].

The distribution of responses to the question "What proportion of the student's total learning time can be allocated to distance learning to ensure high-quality and effective education in your courses?" is quite stable. The only noticeable changes are a decrease in the proportion of those who could not answer (by 5.2 percentage points) and an increase in the proportion of those who would devote only a quarter of the total learning time to distance learning. This means that the prevalence of uncritical tolerant attitude toward the distance learning mode is decreasing, while there is an increase in the proportion of respondents who evaluate it realistically and aim to introduce distance teaching techniques so that they occupy from a quarter to half of the time allocated to a particular discipline (Table 11). Measurements for the third research wave were made in the spring of 2021. By then distance teaching in one form or another had been implemented for almost three semesters; therefore, some courses had already been adapted to the new format, and some were delivered online for the second time. Technical and information support for these disciplines had been expanded, and many pressing organizational issues had been resolved, allowing teachers to evaluate in practice and in a more thoughtful way the possibility of working within a blended learning model. The proportion of respondents who could not answer the question predictably decreased from 9.1% to 3.9%.

Table 11. **Preferred Proportion of Learning Time Allocated to Distance Learning to Ensure High-Quality Education, as Evaluated by University Teachers, % by column**

What proportion of the student's total learning time can be allocated to distance learning to ensure high-quality and effective education in your courses?	Wave 2, summer of 2020 (*N* = 25 386)	Wave 3, spring of 2021 (*N* = 24 337)	Difference between waves 3 and 2, p. p.
0%	7.8	10.3	2.5
not more than 25%	50.9	55.0	4.1
50%	22.0	23.4	1.4
more than 75%	6.9	5.5	–1.4
100%	3.3	1.9	–1.4
Don't know	9.1	3.9	–5.2

Thus, only 10.3% of faculty members (although the percentage has slightly increased compared to last year) consider distance learning in their courses unacceptable at all. The absolute majority believe that a quarter to half of the learning time can be spent online and it will not affect the effectiveness of learning.

Conclusion

The results of the third wave of a monitoring study into the faculty attitudes towards the changes in higher education indicate that almost 90% of university teachers are ready to adopt the blended learning model. Even before the pandemic, it was considered the most promising option given the forthcoming digital transformation. The survey results shed light on the reason behind a mildly critical attitude to online learning of more than half of the respondents: university teachers are against a full transition to distance learning, but admit its appropriateness in some cases.

There are two major problems in university teachers' perceptions of digital transformation, which can impede its implementation. The first problem is that, in the perception of many faculty members, digital transformation is reduced to the digitalization of the learning process. The second problem is the crisis of institutional trust between the participants. The narrow view of digital transformation is largely due to the abrupt and mandatory introduction of distance education during the pandemic, and the crisis of trust results from the lack of a targeted, thoughtful and reasoned public dialogue on most of the topics of concern to teachers, such as cutting staff and the number of universities, distinguishing between digitalization and distance learning, and social inequality in education. Thus, the risk factors are at the same time the opportunities to reduce institutional distrust and to develop public dialogue and joint decision-making on further digital innovations in higher education.

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