ISSN 1814-9545 (PRINT)
ISSN 2412-4354 (ONLINE)

ВОПРОСЫ ОБРАЗОВАНИЯ

Educational Studies Moscow

4 2021

National Research University Higher School of Economics

Voprosy obrazovaniya / Educational Studies Moscow
No 4, 2021

established in 2004, is an academic journal published quarterly by the Higher School of Economics (HSE)

ISSN 1814-9545 (Print)
ISSN 2412-4354 (Online)

The mission of the journal is to provide a medium for professional discussion on a wide range of educational issues. The journal publishes original research and perceptive essays from Russian and foreign experts on education, development and policy. "Voprosy obrazovaniya / Educational Studies Moscow" strives for a multidisciplinary approach, covering traditional pedagogy as well as the sociology, economics and philosophy of education.

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All papers submitted for publication in the "Voprosy obrazovaniya / Educational Studies Moscow" journal undergo peer review.
Distributed by subscription and direct order
Address
National Research University Higher School of Economics
20 Myasnitskaya Str., Moscow, Russia 101000
Tel: +7(495)772 95 90 *22037, *22038
E-mail: edu.journal@hse.ru
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National Research University Higher School of Economics

Voprosy obrazovaniya / Educational Studies Moscow

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What the New Measure of Thinking in School Students Has to Offer to Contemporary Education

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Received in June 2021

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Abstract

For the pedagogical principle of assigning comprehensible and adequate tasks to be implemented, allowance should be made for students' individual levels of logical reasoning, which requires diagnostic measures for objective and quick assessment. Today, the "clinical method" allows the most comprehensive assessment of logical thinking within the Piagetian framework. However, this diagnostic measure is extremely resource-consuming, hence unsuitable for large-scale testing. An overview of literature shows that the existing standardized diagnostic measures require a great number of highly-qualified experts to review the scores and prepare feedback for teachers, instructional designers, practicing psychologists and researchers.

The article describes design methodology of an instrument to evaluate levels of logical reasoning that will allow automated scoring without sacrificing score meaning, eventually facilitating and accelerating the diagnostic measurement procedure. Implementation of these principles is analyzed using the example of scenario-based tasks realized as computerized performance-based assessment in the form of stealth assessment of fifth- and seventh-grade pupils.

Keywords

automated scoring, critical thinking, diagnostic measurement, formal operations, logical reasoning, logical thinking, performance-based assessment, Piaget, psychometrics, scenario-based problems, stealth assessment.

For citing

Uglanova I. L., Pogozhina I. N. (2021) Chto mozhet predlozhit' novaya metodologiya otsenki myshleniya shkol'nikov sovremennomu obrazovaniyu [What the New Measure of Thinking in School Students Has to Offer to Contemporary Education]. *Voprosy obrazovaniya/Educational Studies Moscow*, no 4, pp. 8–34 https://doi.org/10.17323/1814-9545-2021-4-8-34

Assigning comprehensible and doable tasks is a fundamental pedagogical principle. "All the subjects that are to be learned should be arranged so as to suit the age of the students, that nothing which is beyond their comprehension be given them to learn." [Comenius

1939:151]. Overall, the design of modern school curricula makes allowance for stages of mental development, so an "average" student encounters little difficulty in learning. At the same time, underachievement in school education remains quite a pressing issue. One of its sources is that cognitive development rates of individual students are insufficient to enable them to learn what they are supposed to learn at a particular grade. There is empirical evidence of the relationship between academic gains in various disciplines and the level of intellectual development [Malhotra 2020; Watkins, Lei, Canivez 2007]. Comprehension of mathematical and physical concepts as well as of social norms and rules has been shown to require a certain level of logical reasoning [Inhelder, Piaget 1958; Piaget, Inhelder 2003].

Practices of the most successful education systems demonstrate that the problem of low academic achievement in school can be solved by personalizing the learning process, i. e. acknowledging that "every child is special" [Vainikainen et al. 2015; Hautamäki, Thuneberg 2019; Hienonen 2020]. Personalized learning requires, among other things, taking account of the individual levels of logical reasoning, indicated by students' performance on Piagetian tasks [DeVries 1974; Goldschmid 1967; Lawson, Renner 1975; Lovell, Shields 1967; Lawson, Blake, Nordland 1974]. Because conventional IQ test scores do not provide enough information on the composition and structure of logical operations to adapt curricula to individual levels of development, the modern school needs diagnostic measures that are suitable for mass application and objective, i. e. independent from subjective interpretations [Avila de, Pulos 1979; Hathaway, Hathaway-Theunissen 1975; Kaufman 1972]. A new diagnostic measure would help understand the cognitive sources of low achievement in individual children and adolescents so as to build personalized educational trajectories with due regard to individual psychological characteristics.

The present study seeks to identify and describe the stages in design of an automated-scoring instrument to measure school students' levels of logical reasoning.

1. The Construct of Logical Thinking: Composition and Structure

Before describing the instrument design methodology, it would be natural to define the construct that will be measured.

Logical thinking is not something we have by default; objectivity increases over the four stages of development between birth and maturity: (1) sensorimotor period; (2) pre-operational thought; (3) concrete operations; and (4) formal operations. From stage to stage, regular cognitive patterns that capture associations between various characteristics of reality are organized into increasingly generalized structures (logical operations). At the level of behavior, we observe changes in the individual's perceptions of the objects in the world around, their properties, space, time, motion, causality, etc. [Piaget 1994a; 1994b; 1994c].

A great contribution to success in middle and high school is made by logical structures that emerge at the stage of formal operations:

(1) (1) Propositional logic: ability to engage in hypothetical reasoning, i. e. identify (reflect) consistent patterns and associations not only between real-world objects and their visual representations but also between propositions of different language systems. Includes the following propositional operations: if … then (implication), or (disjunction (either or both)), and (conjunction), not (negation), if and only if (equivalence), etc.;
(2) (2) Combinatorial logic: conditional combination of various objects in all possible configurations, e. g. when any six (seven, ten, … *n*) objects are systematically combined into sets of two, three, … etc. in all possible ways without repetitions and with rigorous control of the outcome;
(3) (3) Synthesis of the two kinds of reversibility into a single cognitive structure of four transformations INRC (*I* is identity, or direct operation; *N* is negation of change, or inverse operation; *R* is reciprocity, or reciprocal operation, allowance for the impact of mutually related factors; and *C* is negation of reciprocity, the inverse of the reciprocal). The adolescent gains the ability to analyze problematic situations using all the four transformations at the same time.

At the latter level, the adolescent mind develops new operational schemata necessary for successful learning in school disciplines:

- Proportions (commensurability, equality of two or more ratios);
- Mechanical and homeostatic equilibrium (equality between action and reaction);
- Relative motion (motion in relation to a fixed system);
- Probabilities (odds of an event occurring in certain circumstances);
- Ability to go beyond the observed data, which involves hypothesizing (what if …?), constructing a system of probable regular patterns, etc. [Piaget 1994a; 1994b; 1994c; Piaget, Inhelder 2003; Piaget 2008].

As we can see, logical thinking represents a sophisticated system of interrelated structures.

2. Using the "Clinical Method" to Measure Logical Thinking

Logical thinking has been traditionally assessed using structured or semi-structured clinical interviews in which questions are asked by the interviewer (specifically trained expert) individually or in small groups. The purpose of a clinical interview is not restricted to scoring the product of problem solution as in standardized diagnostic measures; it also involves finding out how exactly the solution was reached, i. e. which cognitive processes were involved or not involved, and in what order.

Mistakes made while solving a problem indicate deficiencies in specific logical operations and thus are of high importance when interpreting the results. Using the clinical interview data, the expert makes inferences about the levels of specific logical operations and the overall level of logical thinking ability [Bringuier 2000; Piaget 1994a; 1994b; 1994c; Piaget, Inhelder 2003].

The disadvantage of the "clinical method" is its low level of resource efficiency, especially when using it on large samples or in large-scale assessments. First, there should be a sufficient number of highly-qualified experts capable of producing as unbiased diagnostic results as possible. Second, individually administered tasks make diagnosis essentially more time-consuming. In most contemporary educational situations, there are just not enough personnel and time for the administration of Piagetian tasks via the "clinical method" [Avila de, Pulos 1979; Meyer 1972].

Therefore, researchers face the need to develop a new measure of logical thinking that would be a decent alternative to clinical interview. It should be easy to use for teachers, instructional designers, practicing psychologists, and researchers doing large-scale data collection. It should also preserve construct specifics, i. e. allow observing how cognitive processes forming part of logical operations get involved in problem solving.

Scalability of the instrument can be achieved by standardized testing, where all behaviors observed in a test are interpreted using diagnostic criteria that are uniform, pre-determined, and objective (unaffected by expert bias).

3. Using Standardized Methods to Measure Logical Thinking

Since the 1960s, Piaget's followers have attempted to replace individual testing (clinical interviews) with group testing in order to check correspondence between mandatory school curricula and pupils' cognitive levels, e. g. in teaching life science disciplines [Lovell 1961; Shayer 1978; Shayer, Küchemann, Wylam 1976].

Researchers enquired whether group testing could yield results as good as those of clinical interviews. It was shown that clinical interview and frontal assessment (e. g. when stimulus material is displayed on a screen and respondents write down their answers) produce comparable outcomes [Faust 1983; Renner et al. 1978; Rowell, Hoffmann 1975; Shayer 1979]. Yet, frontal assessment is not equal to standardized testing as it allows variations in how stimuli are presented and how results are interpreted.

We analyzed a number of studies describing the use of standardized diagnostic measures of logical thinking in the period of transition between the Piagetian stages of concrete and formal operational thinking in large-scale group-administered quantitative assessments. The main objective of their authors was to ensure the same degree of interpretation as in clinical interviews, while reducing the time and re-

sources required for test administration. The standardized instruments analyzed differ by a few critical parameters:[1]

(1) Test content:
 a. Construct measured (logical operations);
 b. Scope of measurement: test outcomes (product) and/or reasoning (process);
(2) Response format:
 a. Selected response (multiple choice or yes/no (closed-ended) questions);
 b. Essay or short constructed response (open-ended questions);
(3) Scoring:
 a. Automated;
 b. Manual (expert);
(4) Stimuli: physical objects, pictures, text, video.

The tests differ both in the set of logical operations assessed and the scope of measurement. Despite some differences in the types of logical operations that they measure, all the tests diagnose both concrete and formal operational thinking. As for the scope of measurement, the tests can only measure participants' final scores (product) [Tisher 1971; Raven 1973; Milakofsky, Patterson 1979; Avila de, Pulos 1979; Roberge, Flexer, 1982; Bergling 1998; Bakken et al. 2001]. However, some authors developed diagnostic instruments that assess both the product and process [Longeot 1962; 1965; Staver, Gabel 1979; Lawson 1978; Tobin, Capie 1981; Roadrangka 1991]. The latter is diagnosed via open-ended questions, which require manual scoring by experts.

On the one hand, the obvious benefits of closed-ended questions are reduced testing time and lower student stress as writing skills are not involved. In addition, multiple-choice testing ensures score objectivity, whereas manual scoring of constructed responses by different experts may cause inconsistency of scores and reduce their reliability [Roadrangka 1991]. On the other hand, the closed-ended format does not allow to obtain justifications for choosing the specific answer, thereby curtailing the diagnostic potential of the instrument and leaving open the possibility of answering correctly by making a random choice.

Stimuli are presented not only as plain text but also as a combination of text and pictures [Longeot 1962; 1965; Tobin, Capie 1981; Bergling 1998], pictorial material alone [Milakofsky, Patterson 1979; Avila de, Pulos 1979; Bitner-Corvin 1988], a combination of text and video [Staver, Gabel 1979; Tobin, Capie 1981], a combination of textual de-

[1] The table at doi:10.17632/vxt3237yvt.1 presents a systematization of tests the psychometric characteristics of which are publicly accessible in peer-reviewed publications [Uglanova I. L., Pogozhina I. N. (2021) What the New Measure of Thinking in School Students Has to Offer to Contemporary Education. *Mendeley Data*, V1].

scriptions and physical objects [Roberge, Flexer, 1982], physical objects alone [Tisher 1971; Lawson 1978], etc.

Entirely verbal stimulus material is valid for assessing the development of formal operational thought; however, it implies a lot of reading, which can lead to semantic bias in the assessment of concrete operational structures. Furthermore, in the absence of physical objects as stimuli, students may stop perceiving the problem as significant [Lawson 1978]. Verbal stimulus materials and open-ended questions represent the greatest challenge for younger children [Lawson 1978; Roadrangka 1991].

On the whole, standardized tests as measures of the level of logical structures prove to be reliable and valid. As one of the ways of measuring their validity, results obtained in a standardized test are compared to results obtained in a clinical interview. Final reliability coefficients vary from insignificant on some scales [Staver, Gabel 1979] to significant at the level of 0.88 on others [Avila de, Pulos 1979; Bitner-Corvin 1988].

As we can see, the use of standardized measures allows to reduce testing time without sacrificing the scope of the logical reasoning construct to be measured. However, the problem of automated scoring has not been solved so far. In addition, there are no studies measuring logical operations in realistic situations, only in laboratory contexts.

Computerized performance-based assessment is a promising diagnostic measure of logical thinking (process and product) in technology-enhanced learning environments. This type of assessment allows to apply automated scoring, evaluate both the outcome and the reasoning process, and create real-life systems in every item [Wang, Shute, Moore 2015].

4. Requirements for the New Methodology

The new design methodology for diagnostic measures of logical thinking should, first of all, allow diagnosing the process of arriving at the solution and, second, provide feedback (which implies analysis of the results) for teachers, instructional designers, and practicing psychologists without the involvement of experts. Furthermore, the new measures should follow a principled assessment design framework [American Educational Research Association, American Psychological Association, National Council on Measurement in Education 2014; Messick 1992].

4.1. The process measurement requirement

Positively, "the nature of the construct guides the selection or construction of relevant tasks as well as the rational development of construct-based scoring criteria and rubrics" [Messick 1992:17]. Traditional multiple-choice items are not suitable for assessing the process as they only register the outcome (correct/incorrect) without making allowance for how it was achieved [Griffin, McGaw, Care 2012; Messick 1994; Razzouk 2011].

Prominent among the alternative modes of assessment are performance-based tasks [Messick 1994] which focus on both the product and process of solution. Today, computerized performance-based assessment is widely used to measure complex constructs in the form of games, simulations, and scenario-based tasks [Klerk de, Eggen, Veldkamp 2016; Graesser, Kuo, Liao 2017; Sun et al. 2020]. However, performance-based diagnostic measures of logical thinking within the framework of Piaget's theory have not been described in literature yet.

4.2. The automated scoring and feedback requirement

Transition from the "clinical method" to performance-based standardized testing provides a unique combination of benefits of both multiple-choice and constructed-response items: the analysis limitation is overcome by matching the examinee's product to the correct answer and assessing the solution process without involving experts.

Another advantage of performance-based testing is that it can be implemented in the format of stealth assessment, whereby test situations are embedded seamlessly into a computer-based learning or gaming environment such that the learner is unaware of being assessed [Wang, Shute, Moore 2015]. Stealth assessment helps to reduce test anxiety and maintain learners' engagement, while at the same time providing authentic contexts to make interpretation of assessment results as close as possible to everyday real-life problems.

Finally, the diagnostic framework should allow the use of test results to create psychological assistance programs for students whose levels of logical thinking are not enough to succeed in a discipline. The approach proposed in this article suggests decomposition of formal operational structures (activity-based diagnostic measurement, in some authors' terminology [Ilyasov 1986; Talyzina 2018]), which will allow assessment of not only the development of a logical operation as such but also the development of its constituent cognitive processes. Just as in clinical interviews, a lot of importance is assigned to analysis and interpretation of mistakes made during the solution process. Mistake is understood here as non-completion or incorrect completion of a cognitive task that is part of the logical operation measured and has to be completed to progress through the scenario. The developmental stage of the logical operation is determined based on the data collected.

In the future, the obtained diagnostic results can be used to elaborate an approximate action plan for promoting the development of the missing components of a "problematic" logical operation as well as to design and implement, within the activity-based approach to learning and socialization, a system of teaching practices required for such operation to be "internalized". The proposed methodology for diagnosing the composition and structure of logical operations will make it possible to accurately identify the "problem areas" in as many students as possible, so that each of them could be offered an appropriate personalized formative learning program.

5. The New Methodology and Instrument for Diagnosing Logical Thinking in School Students

The new methodology for diagnostic measurement of logical thinking proposed here involves the following:

- Identifying the logical operations as defined by Piaget [Piaget 1994a; 1994b; 1994c], their composition and structure as a diagnostic framework for activity-based diagnostic measurement and as the basis for design of formative learning programs in the future [Ilyasov 1986; Talyzina 2018];
- Analyzing the benefits and limitations of the currently applied measures of logical thinking;
- Applying modern psychometric techniques and digital technology.

To measure logical thinking in school students, we suggest using scenario-based tasks that put students into a technology-enhanced environment akin to learning and real-life contexts. In scenario-based tasks, examinees consecutively perform tasks that are interconnected within a context-enhanced story (scenario). The process and product of solution in such problems act as behavioral indicators allowing to assess the development of a specific cognitive process within a logical operation. Scenario-based tasks are similar in their format to computer games; unlike games, however, they involve less variation, which results in a more standardized assessment. Such an approach allows implementing the principles of stealth assessment for diagnostic measurement of logical thinking.

The diagnostic profiles constructed on the basis of test results describe levels of development of each logical structure (combinatorial logic, INRC group) measured. A teacher, psychologist, or parent can view information about the developmental stage for each logical operation separately to construct a comprehensive personal profile of logical thinking. As of now, scenario-based tests have been developed for fifth- and seventh-grade pupils.[2]

The new diagnostic methodology thus meets the design requirements for tasks measuring logical thinking and at the same time ensures that diagnostic measurement results can be scored without the involvement of experts.

6. Meeting the Process Measurement Requirement

6.1. Stimulus presentation

To measure concrete operational thinking, test items are supported with physical objects or their visual representations (videos, pictures), as pupils mostly think in images at this stage of development. Emergence of formal operations in the adolescent's mind enables them to

[2] The 4C's Project for assessment of 21st-century skills (critical thinking, creativity, communication, and collaboration) designed by the Centre for Psychometrics and Measurements in Education (Laboratory for New Construct Measurement and Test Design) of the HSE Institute of Education under an R&D contract with the Charitable Foundation "Investment to the Future".

build complex logical relations mentally without interacting with physical objects or their visual representations. That is why a verbal mode of stimulus presentation is more relevant than a pictorial one for diagnosing the developmental stage of formal operations [Avila de, Pulos 1979; Piaget 1994a; 1994b; 1994c].

The computerized scenario-based tasks that we propose allow to combine verbal and pictorial stimuli and simulate interactions with physical objects, which makes it possible to assess the examinee's ability to mentally manipulate various types of materials (physical, pictorial, symbolic) and ensure a more accurate measurement of the level of logical reasoning (concrete or formal operations stage).

6.2. Combinatorial problems

Combinatorial operations are a logical structure emerging within the stage of formal operations. An example of a combinatorial problem for fifth-grade pupils is presented in Figure 1. The problem offers an imaginary scenario, asking students to make fuel for a space ship. The instructions are partially verbal, while the stimulus material imitates interaction with real-life objects, allowing examinees to try out all possible combinations of ingredients one by one while avoiding repetitions and omissions.

In the course of the solution process, we systematically evaluate the development of cognitive processes within combinatorial operations: (1) identification of variables to be combined in the problem scenario; (2) combination of variables presented in the problem scenario with regard to instructions (into sets of two, three, etc.); (3) control of variable combinations (systematic combination of variables into all possible sets in accordance with the given conditions while avoiding repetitions).

As the first step, the examinee explores the planet and collects ingredients for the fuel (Figure 1a), i. e. identifies the variables. After that, the examinee is given illustrated instructions for research (testing of all possible combinations of the ingredients collected) to produce fuel. Particular focus is placed on making sure that students fully understand the instructions (Figure 1b), i. e. they realize that combination of variables should be part of the solution process. Next, the examinee solves the problem (Figure 1c) by combining the variables into groupings that satisfy the given conditions and exercising control over the combinations.

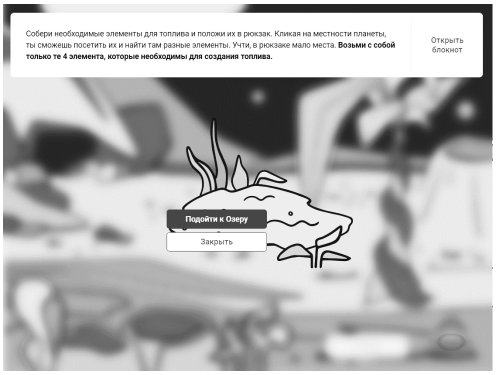
As students are asked to combine stimulus components systematically in search for candidate solutions and allowance can be made for mistakes that they make, not only the product but also the process of solution can be assessed.

The final assessment of the development of combinatorial operations is based on the scores assigned for the product (the number of correct variable combinations) and the process of solution (absence of repetitions). Three stages of combinatorial operations development are identified in the diagnostic profile:

Figure 1. **An example of a scenario-based problem measuring the development of combinatorial operations.**

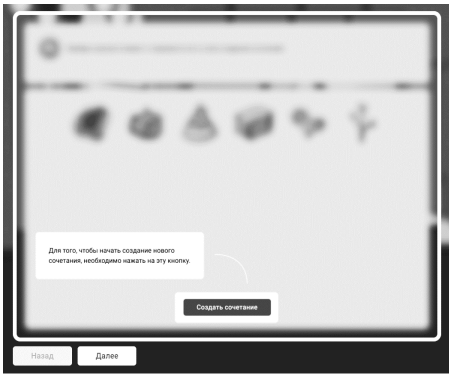
(a)

Collect the elements for making fuel and put them into the backpack. By clicking on planet locations, you can visit them and find various elements. Be mindful that there is little room in the backpack. Take only the four elements that are necessary to produce fuel.
Open notebook
Done

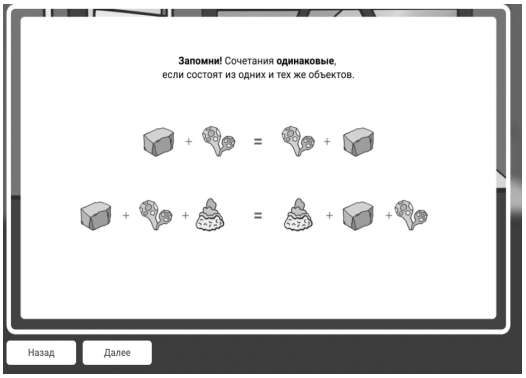


Collect the elements for making fuel and put them into the backpack. By clicking on planet locations, you can visit them and find various elements. Be mindful that there is little room in the backpack. Take only the four elements that are necessary to produce fuel.
Open notebook
Approach 'Lake'
Close

(b)

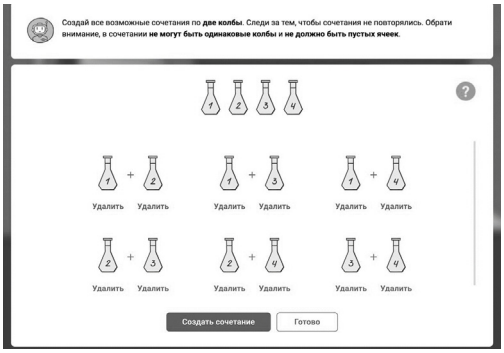


Click this button to start a new combination
Create a combination
Back
Next

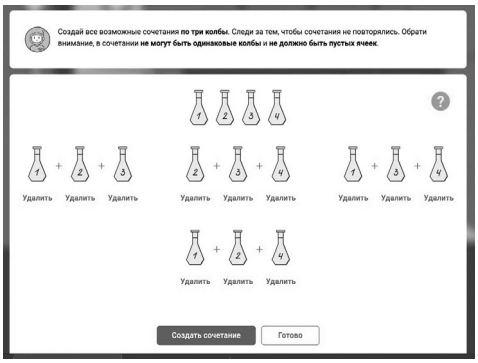


Remember! Combinations are duplicate if they consist of the same objects.
Back
Next

(c)



Create all possible combinations of two flasks. Make sure you have no duplicate combinations. Be mindful that there should be no identical flasks and no empty boxes in a combination.
Remove (×12)
Create a combination
Done



Create all possible combinations of three flasks. Make sure you have no duplicate combinations. Be mindful that there should be no identical flasks and no empty boxes in a combination.
Remove (×12)
Create a combination
Done

Stage 1: Combinatorial operations are not developed. The student is able to identify the variables to be combined in a problem scenario (1) but fails to produce combinations satisfying the given conditions (2) as well as to control the process of combination by avoiding repetitions (3);

Stage 2: Combinatorial operations are partially developed. The student is able to identify the variables to be combined in a problem scenario (1) but makes mistakes in the process or fails to combine all the variables (2) as well as to control the process of combination by avoiding repetitions (3);

Stage 3: All the cognitive processes within combinatorial operations are fully developed. The student systematically generates all the correct configurations satisfying the problem statement and avoids repetitions.

6.3. INRC problems

The emergence of the cognitive structure of four transformations INRC manifests itself in the ability to analyze the problem situation and examine the impact of all the given conditions one by one. By checking whether the situation is affected by a specific factor, the adolescent mentally performs two divergent operations, varying the factor characteristics (modifying the variables) and at the same time holding all the other factors constant (fixing the variables).

For instance, in a classic Piagetian task, the bending of rods with weights applied [Piaget, Inhelder 2003], to find out whether length, diameter, shape, and material have a difference in bending, the adolescent tests each variable one by one. To test for the effects of length, they select for comparison long and short rods that are alike in every other aspect: both are thick, round, and made of steel. Next, they bend the two rods and analyze the results. If the rods bend equally, a conclusion is drawn that length has no impact on bending, and vice versa. Effects of all the other variables in the scenario are tested in a similar way.

The same principle underlies the problem designed for seventh-graders (Figure 4). In a fantastic scenario, the examinee is asked to find out which residents of an old house have a chance of turning into a ghost.

Just as in combinatorial problems, this one allows to assess not only the outcome (correct/incorrect) but also the process of solution by measuring the development of processes within the logical operation of variable fixation as an indicator of INRC group [Ilyasov 1986; Baldina 1987; Pogozhina 2006]:

(1) Identify variables and their values in the problem scenario;
(2) Fix the variables: to determine the impact of variables on the outcome, the examinee has to compare situations in which all the variables except one are held constant;

Figure 2. **An example of a scenario-based problem measuring the development of INRC group.**

(a)

If you haven't sorted the evidence into three columns yet, it's just about time to do it. Classify all the pieces of evidence.

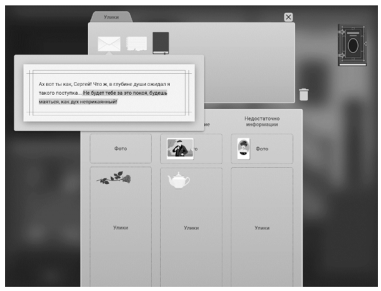
Got it

I'm sick and tired of this ghost! And, most importantly, why does it sneeze? Sneezing should be done quietly, into a tissue. I remember my late uncle Vladimir Alexeevich who coughed in a very cultured manner. He would wrap his scarf around his neck, brew some herbal tea, and sit there groaning. You know, he would always suffer some imaginary illnesses, but I never saw him actually sick in his whole life

At least this ghost doesn't do any damage. We have so many fragile things here, like this antique porcelain tea set... It belonged to Sergey Konstantinovich. He loved porcelain and was rarely seen without his favorite cup. Such a nice little thing

Evidence

(b)



Evidence

So that's what you're up to, Sergey! Well, deep down inside, I knew this would come... For what you've done, you will never find peace anymore and will be roaming forever like a restless ghost!

Insufficient evidence

Photo

(c)

Evidence

Not a ghost
Natalya Vasilyevna getting dressed up for the theater
Tea
Carries a tissue with a coat of arms
Visits a witch doctor

Not a ghost
Vanechka playing a ghost game
Tea
Carries a tissue with a coat of arms
Visits a witch doctor

Ghost
Sergey Konstantinovich
Tea
Carries a tissue with a coat of arms
Visits a witch doctor

Ghost
Arina Sergeevna
Tea
Carries a tissue with a coat of arms
Visits a witch doctor

Ghost
Vladimir Alexeevich at work
Tea
Carries a tissue with a coat of arms
Visits a witch doctor

No a ghost
Pavel Alexandrovich
Tea
Carries a tissue with a coat of arms
Visits a witch doctor

(3) Make a logical inference: if the effects of the variable are the same across the situations compared, it has no impact on the outcome; if the effects vary, the variable does have an impact.
(4) According to the scenario, the student first collects information on all the residents (those who have and have not turned into ghosts, Figures 2a and 2b), i. e. identifies variables and their values (1). Next, they fix the differing characteristics at constant levels (Figure 2c), i. e. perform variable fixation (2) in order to identify the factor affecting the probability of turning into a ghost—that is, to make a logical inference (3).

The results of systematic performance of all scenario-based tasks are used to construct diagnostic profiles, i. e. developmental levels of the logical operation of variable fixation as an indicator of INRC group:

Stage 1: The operation is not developed. The student is able to identify groups of variables described in the problem scenario (1) but cannot fix the differing factors (2) or make inferences about their effects (3);

Stage 2: The operation is partially developed. Having identified the right variables and their values (1), the student systematically fixes only some of them, making mistakes in variable fixation (2) and drawing invalid inferences (3);

Stage 3: All the cognitive processes within the logical operation of variable fixation are fully developed. The student identifies all the possible variables and their values in the problem scenario, systematically fixes all the variables except one, analyzes the effects of the non-fixed variable, and makes valid inferences.

7. Meeting the Automated Scoring and Feedback Requirement

The critical benefit of standardized testing is the easiness of scoring. Development of a scoring system that works without expert evaluation allows to maintain this benefit.

In the computerized scenario-based tasks that we designed, examinees have no opportunity to type their responses, but their actions can be interpreted based on the choices that they make, which allow to understand which cognitive processes are involved in solving the problem.

Feedback for examinees is prepared using quantitative data analysis and advanced psychometric techniques [Almond et al. 2015; Jeon et al. 2020]. The existing measures of logical thinking offer various interpretation frameworks, possible indicators of developmental gains including an increase in the total score on a test [Staver, Gabel 1979] or attainment of a cut-off score corresponding to the transition to formal operational thought [Lawson 1978; Roadrangka 1991]. The diagnostic system proposed here uses problem solution results to construct a personal profile of logical thinking, which reflects the development of cognitive processes within a specific logical operation.

The profile includes diagnostic measurement results for the logical operation of combinatorics (Stage 1, 2, or 3) and the logical operation of variable fixation as an indicator of INRC group (Stage 1, 2, or 3). Each stage reflects mastery of cognitive processes within a formal operational structure.

By contrast with the traditional approaches to diagnostic measurement that imply selecting cut-off values for total scores or specific scales, we suggest using modern psychometric techniques, i. e. treating the construct as a discrete variable and measuring the probability of being at a specific stage of development [Almond et al. 2015]. Such discrete arrangement and presentation of results allows automated feedback that can be easily used by teachers, parents, and psychologists. However, the staging procedure is yet to be validated in further research on the instrument's quality.

8. Conclusion

Comprehensibility and adequacy of school curricula can be provided by learning personalization, which requires performing large-scale objective assessments of logical reasoning and making allowance for the assessment results in teaching and in design of psychological assistance programs.

The Piagetian method of clinical interview allows the most comprehensive and accurate assessment of logical thinking at a specific stage of development. At the same time, the "clinical method" has a number of limitations when applied on a large scale, such as lack of highly-qualified experts, expert bias, and too much time per interview. One more essential limitation consists in that the examinee is always aware of being tested.

Standardized measures allow overcoming the limitations of clinical interviews. The existing group tests of logical thinking demonstrate sufficient reliability and validity, but they still involve expert evaluation. Correctness of answers to multi-choice questions can be assessed automatically, but experts are inevitably involved evaluate multiple choice justifications, i. e. the solution process. Besides, measures of logical operations in technology-enhanced learning environments have not been described in literature yet.

Overcoming of the existing limitations in diagnostic measurement of logical thinking development necessitates a new methodology that can be used in large-scale data collection and allows observing how logical operations get involved in problem solving.

The methodology proposed in this article makes allowance for the specific aspects of both logical thinking and large-scale testing with automated scoring. Furthermore, diagnostic results obtained with the proposed measure can be used for designing personalized psychological assistance programs for students within the framework of activity-based learning and socialization, as it meets the item design requirements imposed by complexity of the construct measured as well

as the interpretability requirement for large-scale standardized tests with automated scoring.

The item design requirements imposed by complexity of the construct measured—the composition and structure of logical thinking—are satisfied by the following:

- Computerized performance-based tasks, which allow selecting formats of stimuli (text, pictorial representations, object simulations) that contribute to validity of logical thinking assessment;
- Items requiring the use of combinatorial operations;
- Items requiring the cognitive structure of four transformations INRC, e. g. where examinees have to systematically fix all the variables except one to find the optimal solution under given conditions;
- Personal profiles of logical thinking for users of test results, providing scores on each logical operation.

The methodology proposed also satisfies the interpretability requirement imposed by the need to avoid expert evaluation in large-scale standardized testing. Feedback on test results is based on quantitative data analysis, allowing to avoid the costs associated with recruiting a number of highly-qualified experts, eliminate expert bias, and essentially reduce the overall testing time in case of large samples.

9. Recommendations on Using the Diagnostic Results in Educational Practice

Overall, the design of modern school curricula makes allowance for stages of cognitive development, so an "average" student encounters little difficulty in learning. However, findings show that the currently widespread perceptions of the age at which students develop formal operational thought appear to be overly simplified [Shayer, Küchemann, Wylam 1976]. Indeed, there is evidence that formal logical operations start to emerge in early adolescence, yet even college students sometimes reason at the concrete level [Lawson 1978; Tobin, Capie 1981; Tisher 1971]. Individually administered diagnostic measurement of logical thinking can help determine whether a particular adolescent is ready to learn the material adequate for their grade.

Diagnostic results will allow not only to establish whether or not specific logical structures are present but also to measure the stage of their development, thereby highlighting the cognitive processes that have not yet formed in a particular student. In the future, this diagnostic measure can be used for designing personalized psychological assistance programs to foster the development of the missing cognitive structures.

10. Limitations and Avenues of Further Research

An important characteristic of the methodology proposed in this article is that examinees are placed in a problematic situation that requires the use of the logical operations of interest. On the one hand,

such an approach allows interpreting the test results not in isolation, as in the "laboratory" conditions of classical Piagetian tasks, but within real-life contexts. On the other hand, diagnostic scenarios impose limitations on the extrapolation of test results. It cannot be guaranteed that the student will apply the same logical operations in a broad range of contexts.

There is empirical evidence that the same student deploys logical reasoning skills of different levels to solve problems presented in different contexts [Bart 1972; 1978; Cohen 1980; Twidle 2006]. This characteristic of logical thought development requires further examination of the phenomenon itself and the aspects of its measurement.

A promising avenue of further personalized learning research and practice is to examine more closely the relationships between levels of logical thinking and academic success in specific disciplines. Interpretation of the reasons for academic failure in school disciplines could be performed more thoroughly and associate learning outcomes not only with teaching quality or curriculum difficulty but also with the individual rates and characteristics of logical structure development.

The article was prepared in the framework of a research grant funded by the Ministry of Science and Higher Education of the Russian Federation (grant ID: 075–15–2020–928).

We are grateful to the team of the 4C's Project of the Laboratory for New Construct Measurement and Test Design at the Centre for Psychometrics and Measurements in Education (Institute of Education, National Research University Higher School of Economics), particularly to Anastasia Kamaeva, for their creative and professional approach to item design.

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Non-Cognitive Characteristics and Higher Education Choices

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Received in July 2021

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Abstract

Non-cognitive skills, shaped by genetics and early socialization experiences, are an important component of human capital that affects a number of social and economic outcomes throughout the life course, including individual educational choices. This study is focused on the contribution of non-cognitive skills to higher education trajectories: intention to study in college, probability of going to college, major choice, and college selectivity. The study uses data from the Russia Longitudinal Monitoring Survey of the Higher School of Economics (RLMS-HSE) for 2011 and 2016–2018. Non-cognitive skills are measured using the Big Five personality traits and locus of control, the two most prominent psychological concepts in the field. Educational intentions of adolescents aged 15–19 and past educational choices of young people aged 23–29 are analyzed using probit models and multinomial and ordinal logistic regressions. The psychological traits of openness to experience, neuroticism, conscientiousness, and internal locus of control are found to be the most powerful factors affecting educational intentions and choices, but results vary as a function of gender and socioeconomic characteristics.

Keywords

the Big Five personality traits, higher education, human capital theory, locus of control, non-cognitive skills.

For citing

Rozhkova K. V., Roshchin S. Y. (2021) Nekognitivnye kharakteristiki i vybor v sfere vysshego obrazovaniya [Non-Cognitive Characteristics and Higher Education Choices]. *Voprosy obrazovaniya / Educational Studies Moscow*, no 4, pp. 35–73. https://doi.org/10.17323/1814-9545-2021-4-35-73

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The Structure and Activities of Student Representative Bodies in Modern Russian Universities

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Received in June 2021

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Abstract

One of the key objectives in higher education governance today is to establish mechanisms for effective student representation. Based on a study of the practices of 50 leading Russian universities—federal universities, national research universities, Project 5–100 universities, and universities included in the QS World University Rankings as of summer–fall 2020—this paper reveals and summarizes the key practices of student representation (often referred to as student self-governance) existing in Russia at the turn of the 2020s. The following origins of institutional arrangements for student representation are identified: academic units, thematic clubs, student trade unions, dormitories, and personal teams of student leaders. The major types of student representation activities analyzed in the article include participation in shared governance, provision of information to other students and engagement in public interactions with them, and organization of mass cultural events for students. Most often, functions associated with shared university governance are restricted to formal membership in university boards and fulfillment of federal law requirements regarding local regulations and disciplinary action, rather than actual representation of students' interests in university decision-making on educational, social, and scholarship issues. Therefore, the governance agenda of student representatives is shaped much more by universities and their administrators than by students themselves.

Keywords

shared governance, student associations, student councils, student participation in university governance, student representation, student representative bodies, student unions.

For citing

Efimov D. B. (2021) Ustroystvo i deyatel'nost' universitetskogo studencheskogo predstavitel'stva v sovremennoy Rossii [The Structure and Activities of Student Representative Bodies in Modern Russian Universities]. *Voprosy obrazovaniya/Educational Studies Moscow*, no 4, pp. 74–96 https://doi.org/10.17323/1814-9545-2021-4-74-96

Debate over the role of students in higher education and the limits of its variation has been raging among academics and policymakers over a few decades [Brooks 2018]. Discussions concern the marketization of higher education, its orientation to satisfy the needs of students as customers, and the formation of inclusive university communities that bring students and faculty together on an equal or nearly equal footing. In recent years, a lot of attention has been paid to on-

line learning and the specifics of student status in a digital environment [Efimov 2020]. However, one of the key topics has always been the organizational structures and practices that students use to participate in shared university governance [Klemenčič 2014]: student representative bodies (SRB), which include student councils, student governments, student movements, etc.

There are two reasons why student representation practices in Russian universities are of particular interest. First, SRBs emerge and operate in a highly specific institutional and historical context characterized by the intertwining of Soviet experiences, modern values of the Russian society, and national youth policy goals. Second, unlike in other countries, there has been extremely little research attention to SRBs and no systematic reviews of available studies in the Russian literature [Efimov 2020].

The purpose of this article is to describe the mechanisms of origin and the common activities of SRB in Russian universities. The empirical basis of research includes open sources of information from the official websites of 50 leading Russian universities and transcripts of semi-structured interviews with student council representatives conducted in 25 leading Russian universities in February–March 2021.

The article is divided into five part. Part one provides a critical overview of Russian and global literature on student representation systems and a brief description of the specifics of the Russian case from the institutional and historical perspective. Part two describes the methodology and design of the empirical study. Parts three and four present findings on the formation and functioning of SRBs. Finally, the last part gives conclusions and outlines possible avenues for future research.

The Current State of Student Representation Research

Broadly speaking, student representation in higher education is part of the shared university governance system that allows key stakeholders including students to participate in the development, articulation, negotiation, approval, and/or implementation of managerial decisions at different levels [Rowlands 2017]. Inclusion of various communities—faculty members, administrators, students—is a central issue in the scientific debate on academic governance [Rosovsky 2015]. However, students have been paid comparatively little attention in this general discourse, student representation being studied comprehensively on its own: as a phenomenon of student socialization and value development and as a component of youth policy, not only as a governance practice [Boland 2005].

In Russia, the terminology applied in this field of research and practice has some specifics to it. The relationship between the most widespread term “student self-governance” and the term “student representation” can be described as the intersection of two different sets. Student representation includes all the opportunities for students

to be institutionally involved in university governance, while student self-governance—in the sense defined by national education policy—embraces various mechanisms of student self-organization around matters of student concern encouraged by the university as part of its youth policy: self-initiated student associations, clubs, squads, event management teams, etc. Naturally, formal SRBs can be at the intersection of the two concepts. However, there are also examples of student representation with no self-governance (direct participation in university governance without differences in status or "corporate" affiliation) as well as student self-governance without representation (various examples of student self-organized activities and related youth policymaking that have nothing to do with university governance decision-making or policy implementation). Below, we mostly zero in on the student representation systems that imply student self-governance, i. e. formal student representative bodies.

Different regions of the world have developed their own traditions of student representation research. A fairly long history of relevant research is observed in the Anglosphere [Raaper 2020], somewhat shorter ones—in some countries of Asia and Africa [Luescher-Mamashela, Mugume 2014] and in continental Europe [Klemenčič 2012]. While case studies are more typical of the Anglosphere countries, other regions produce quite a lot of literature reviews and studies conducted at the national level. Furthermore, student representation and its mechanisms have also been addressed in global (cross-country and supranational) studies [Klemenčič 2014; Brooks, Byford, Sela 2015b; Brooks 2018; Klemenčič 2020a].

The key finding to draw from the abovementioned literature is the fundamental role of two factors: national context (external circumstances in which the education system, universities, and students exist) and university context (objectives and goals of the educational organization and intentions of its community and administrators), which eventually determine how student representation systems function in their various manifestations.

One example of national specifics of education system functioning is the marketization of higher education in the UK in the 2010s, which predetermined many aspects of student representation and activism beyond institutionalized practices. National student representation policy can be manifested in varying degrees of institutionalization and official recognition that the state grants to student representative organizations, from strong centralized coordination and formalization of the entire system to complete non-recognition, with a number of intermediate approaches in-between [Klemenčič 2012]. Furthermore, drawing a clear line of demarcation between student representation and other types of student activism is impossible in a number of countries, where student activities either directly coexist with involvement in socio-political campaigns on other issues or become part of such campaigns over time [Klemenčič 2020b].

University context includes the university's institutional status, organizational culture, and policy as well as the status of the student community as such. In global practice, institutional status of the university is most often interpreted as, but not limited to, whether the educational institution is public or private [Lewis, Rice 2005]. The university's organizational culture and policy imply keeping to a preferred logic (or a combination of different logics) of interaction as well as a preferred style in communication and decision-making within the university. In practice, the choice of policy and logic of interaction is simply the relations between the university and students, who can be perceived as inherently unequal members of the community who have no agency and need to be supervised (traditional paternalistic approach), or as formally required consultants in decision-making (bureaucratic approach), or as useful participants in the development and implementation of particular types of decisions (corporate, or managerial approach), or as fully-fledged members of the community whose opinions deserve to be respected (political community approach) [Klemenčič 2014]. The status of the student community as such is characterized, on the one hand, by its role at the university (students as consumers and users, students as members of the academic community, etc. [Luescher-Mamashela 2013]), and on the other hand, by its involvement in university governance, its internal homo- or heterogeneity in various aspects, and prevalence of specific views and characteristics inside it [Brooks, Byford, Sela 2015a].

In the Soviet era, the functions of student representation were performed to a limited extent by student trade unions and the Komsomol—basically, the "driving belts" of Soviet power—giving rise to path dependence effects. The post-Soviet national education policy was characterized by a somewhat cyclical interest in student representation, with significant milestones in 2001–2002, in 2006–2007, when student representation was actively promoted by the Ministry of Education[1] in its subordinate universities, and in 2012–2014, when the status of student councils as SRBs was formalized by Federal Law No. 273-FZ "On Education in the Russian Federation" of December 29, 2012 (henceforth "the Education Act")[2] and extended beyond the Ministry's instructions and its subordinate universities. After the law was adopted, universities received more detailed recommendations on student organizing[3] from the Ministry, and the position of the ombudsman for

[1] *Translator's Note:* The Ministry's name changed twice over the period covered in this study: in 2004, it was renamed into the Ministry of Education and Science, and in 2018, it was split into the Ministry of Education (Enlightenment) and the Ministry of Science and Higher Education. For convenience, it is always referred to as the Ministry of Education; the Ministry of Science and Higher Education is implied when referring to periods after May 2018.

[2] http://www.consultant.ru/document/cons_doc_LAW_140174/

[3] Letter of the Ministry of Education and Science of the Russian Federation No. VK-262/09 "Methodological Recommendations on the Formation and Function-

students' rights was introduced.[4] However, a nationwide student representative body was never created. Another trend in national policy during that period was the introduction of support programs for the leading universities (e. g. Project 5–100). While it is not directly related to student representation, some scholars believe that one of the goals was to contain possible anti-regime student mobilization [Forrat 2016], while some other academics contest the hypothesis [Chirikov 2016]. The Soviet legacy and the radical reforms of the recent decades have shaped a highly specific context for the development of student representation in Russia.

In the scientific literature, student representation in Russian universities is still largely a frontier: few studies are available, most of them being limited to specific cases, statistical reports, or a formally legal perspective. The ones of particular interest include a paper analyzing a number of student representation practices in Russia as deeply rooted in the institutional structure of the Soviet higher education system by performing an in-depth qualitative analysis of the current state of student trade unions [Chirikov, Gruzdev 2014], and a few publications based on surveys of students or student representatives, including student council census and ranking data [Popov 2009; Stegniy 2016; Fatov, Kulikov, Sarukhanyan 2018]. Legal analysis is also important in assessing student representation practices [Shalamova, Fatov 2014; Fatov, Matvienko 2016]. Such works investigate quite extensively the adaptation of the existing guidelines and sample documents laid down by the Ministry of Education, analyze the relevant legal practice and case law, and propose some measures to incorporate best practices into law. Student representation research should also use data from rankings, censuses, and analytical reports produced by relevant public organizations.[5]

Using qualitative empirical data, this study analyzes the current structure of SRBs in Russian universities. Taking into account the available information about the national and university contexts, some inferences are made about the factors contributing to particular statuses of SRBs.

Methods and Data

Analysis of the situation with student representative structures is based on a sample of leading Russian universities with a special sta-

ing of Student Councils in Educational Institutions" of February 14, 2014: http://www.consultant.ru/document/cons_doc_LAW_159460/

[4] https://iz.ru/news/542048

[5] All-Russia Census of Student Councils: https://studorg.ru/assets/media/Materialy_po_itogam_perepisi.pdf; NUST MISIS Student Council Tops the First Student Council Ranking in Russia: https://misis.ru/university/news/life/2016–12/4348/; Consolidated Analytical Report on the State of Student Representative Bodies in Russian Universities (2018): https://studorg.ru/assets/media/image/SSU/Tvoyvibor/Analiticheskiy_otchet_o_sostoyanii_OSSU.pdf

tus: federal universities, national research universities, Project 5–100 universities, and universities included in the QS World University Rankings as of summer–fall 2020. Characteristics of the sample impose certain limitations on result interpretation. It is no use denying the possible effects of regional or industry-specific (in the case of specialized universities) contexts, not to mention that student representation practices can differ across universities with different educational levels of students [Kouba 2018]—only quite selective institutions are addressed in this article. Student representation research can thus be taken further by considering less selective colleges and going beyond higher education to focus on regional-level representation (municipal and regional student councils), secondary schools, etc.

The Education Act enables student councils to assume the functions of a representative structure. While the present study is focused on the former, findings show that such a division turns out to be artificial in many cases, both forms of student representation being closely intertwined.

The sample was comprised of 50 universities (Table 1). For each of them, open sources of information about student councils were analyzed: relevant pages on university websites, social media profiles of student councils and student trade unions (where applicable), formation procedures, and scope of activities.

At the next stage, the heads of the student representative bodies (presidents, ex-presidents, vice-presidents, and heads of other SRBs performing similar functions) of all the 50 universities were contacted (via social networking services) an invitation to participate in semi-structured interviews. With a response rate of 50%, 25 interviews were carried out. Personal characteristics of the respondents are shown in Table 2.

Every interview was conducted on the basis of a guide which covered the following aspects:—interviewee's overall background;—their personal journey in student representation;—characteristics of the university's institutional structure and practices;—interviewee's personal opinion on the university's organizational structure and the structural role of students;—the relationships between SRBs and university administrators as well as other external and internal actors;—perceived value of student representation;—personal and social reasons to participate in student self-governance. Additionally, the relationships between the SRB and the local student trade union (where applicable) were analyzed. Interviews were conducted in Zoom and recorded for transcription purposes. An average interview lasted one hour and 34 minutes, with the shortest of 55 minutes and the longest of two hours and 44 minutes.

As interview recordings were transcribed, thematic content analysis of the transcripts was performed, which involved identification and generalization of common themes and comparative assessment of frequencies of mention for different themes. Transcript content

Table 1. **Universities included in the sample.**

	Universities
Open data analysis only	Altai State University, Belgorod State National Research University, Bashkir State University, Immanuel Kant Baltic Federal University, ITMO University, Kazan Federal University, V. I. Vernadsky Crimean Federal University, Moscow Aviation Institute, Moscow State Institute of International Relations, Bauman Moscow State Technical University, Pirogov Russian National Research Medical University, National University of Science and Technology (MISiS), National Research Nuclear University MEPhI, Moscow Power Engineering Institute, Lobachevsky University, Peter the Great St. Petersburg Polytechnic University, Russian State University for the Humanities, Gubkin Russian State University of Oil and Gas, Plekhanov Russian University of Economics, Saratov State University, Ammosov North-Eastern Federal University, North-Caucasus Federal University, National Research Tomsk State University, Tomsk Polytechnic University, Ufa State Aviation Technical University
Open data analysis + in-depth interviews	Voronezh State Technical University, Voronezh State University, Far-Eastern Federal University, Kazan National Research Technological University, Lomonosov Moscow State University, Moscow Institute of Physics and Technology, Novosibirsk State Technical University, Novosibirsk State University, National Research University Higher School of Economics, Perm State University, Perm National Research Polytechnic University, Russian Presidential Academy of National Economy and Public Administration (RANEPA), MIREA—Russian Technological University, RUDN University, Samara University, Northern (Arctic) Federal University, Sechenov University, Siberian Federal University, Saint Petersburg Mining University, Saint Petersburg State University, Saint Petersburg Electrotechnical University "LETI", Tyumen State University, Ural Federal University, South Ural State University, Southern Federal University

Table 2. **Interviewee characteristics.**

	Interviewees
Gender composition	20 males, 5 females
Years of admission	2011–2014 (1 from each year) 2015–2016 (5 from each year) 2017 (4) 2018 (6) 2019 (1)
Fields of study	Social and Economic Sciences (13) Physical, Mathematical, and Computer Sciences (6) Life Sciences (6)

was divided into two major pre-determined categories:—the way respondents described the processes of SRB formation at their university;—and the way they described the structure and functioning of SRBs in their organization.

Below, we present the results of our qualitative study, summarizing the respondents' main ideas about the formation and functioning of student councils and other SRBs.

Formation of Student Representative Bodies in Russian Universities

It would be rather hard to present a universal model of SRB formation in Russian universities. Among the diverse university practices, there are five major origins of institutional arrangements for student representation, the structure of representative bodies being contingent on how the finite and limited power is distributed among the different types of origin, which are described in more detail below.

Faculties, departments, and other institutional units, including student groups, that bring students together on the academic grounds. One of the most widespread principles of SRB formation is based on the distribution of all students among communities as a function of their institutional unit and field of study: faculties, departments, majors, student groups, etc. Technically, the formation procedure of student representative bodies can take various forms: direct election, report-and-election conference, multistage voting with group presidents as delegates, etc. In any case, student representation works to serve the specific faculty, department, or student group, and every student is formally involved in such representation—no membership or any other additional proof of status is required.

Thematic student organizations. In Russian higher education, student representation is very often based around self-initiated membership in organizations established to promote or celebrate common interests within the university. Originally, such interest clubs are focused more on self-governance but assume the functions of student representation over time.

Student trade unions, in practice, may be either independent SRBs or constituent units of larger representative structures such as student councils or governments. Student trade unions are partly related with thematic student organizations—in term of self-initiated membership and, therefore, the lack of inclusion of all students in representation processes—and with academic communities—in terms of certain objectives and principles of operation, such as orientation toward both self-governance and representation, faculty-based "union bureaus", etc. Most often, university student trade unions descend directly from the respective system of the Soviet period. While not being available in all universities, they are represented quite widely in Russian higher education. Contrary to expectations based on current law and some previous research, student trade unions are not a separate "branch of government" in student representation that is roughly equal in its power, potential, and influence to student councils or governments, but rather an important part of the relevant councils—which is why they are classified in this study among the five "origins" of student representation. The range of possible relations between student trade unions and

other student representative structures is extremely wide: from equal partnerships with student organizations or faculty representatives, to antagonism and competition for students and resources.

Dormitories. A substantial proportion of students live in dormitories and need self-organization at their place of residence [Dremova, Shcheglova 2020]. Most often, dedicated dormitory councils are created for this purpose. This type of student representation is less common than the ones discussed above: some universities have no large non-resident student enrollments; in others, dorms are assigned to faculties, so no additional intermediation is required; and yet in others, the functions of dorm councils are assumed by thematic student organizations.

Personal teams of SRB leaders. In some universities, leaders of student representative structures have the right to invite a team of their own to join the SRB and even grant them decisive votes. While this formation procedure is not as widespread as the ones described above, it persists in a variety of forms, from mandatory approval of candidates nominated by the leader, to the leader's unlimited power.

The five origins of institutional arrangements for student representation are not necessarily present in all universities or share their spheres of influence. Coexistence of various types of student organizations is also possible, even if sometimes it involves antagonism and competition for resources and students; another possible alternative is when all the roles are performed by a single structure formed by one or two of the five ways. The structure, balance of power, and self-designation are determined by the university context. Faculties (or other academic units), thematic student organizations, and student trade unions are the most powerful origins of institutional arrangements for student representation.

Activities and Functions of Student Representative Bodies in Russian Universities

The method of formation of a student representative body determines the kind of people who participate in it and, consequently, whose interests they represent in the first place and what they do most of the time.

Table 3 presents the key categories of student representation agenda and activities in Russian universities, grouped by the frequency of mention in interviews: (1) mentioned by an overwhelming majority (16–17 or more mentions), (2) mentioned by nearly (or slightly fewer than) half of the interviewees (10–12 mentions), (3) mentioned by nearly one third of the respondents (7–9 mentions), (4) and mentioned less often but regularly (3–5 mentions).

The most widespread domains of activity. The three most prevalent functions performed by SRBs include participation in shared governance, provision of information to other students and engagement in public interactions with them, and organization of mass cultural events for students. The first function—the central one, stipulated by the Education Act—involves mandatory consideration of local regulations and

Table 3. **Domains of student representation activities in Russian universities.**

Category	Domains of activity
1	Bureaucracy and formalized participation in governance; provision of information to other students; organization of mass cultural events for students
2	Education quality; social and living infrastructure; scholarships and allowances; legal support; career guidance and counseling
3	Science and research; freshman and international student orientation; sports
4	Student group presidency; volunteerism; external partnerships; applicants; finance

decisions regarding student disciplinary action. In addition, shared university governance implies participation in university boards and commissions of various kinds as well as routine interactions with the university administration. In nearly all the universities, SRBs engage with structural units administering extracurricular activities and/or youth policy implementation. Less often, they also engage with a broader range of university administrators on relevant matters. Whether student representatives interact with the rectorate depends solely on the rector's preferences, each university being a special case in this regard.

Quite often, the student council becomes the main aggregator of information and events for students, especially if representatives of student organizations participate in the council on a regular basis.

> "First of all, it's cultural activities and arts: working with freshmen and other activists to engage them in socialization, socially significant events, organization activities, and to encourage them to develop and improve their soft skills. Second of all, it's communications and social media community management: getting information from the dean, administrators, or president of the student council to inform students about changes, whether it be a recent decree on the transition to distance learning, a decree on some scholarship issues, or information on all the current and upcoming events." (male, 4th year of Bachelor's studies, Mathematical and Computer Sciences)

Domains of activity mentioned in nearly half of the cases. Slightly less often, student representative structures address the issues of education, social and living infrastructure, legal help for students in case their rights are infringed within or outside the university, allocation of scholarships and other financial aids, career guidance and counseling, and other enriching events and experiences. Monitoring of education quality has lately become a priority issue in student representation activities and is likely to move up to the "most widespread" category, as this domain was mentioned most often among the areas of focus for future development.

> "Three domains: education, scholarships, and infrastructure. We took active participation in the transition to distance learning, collected complaints, and tried to help faculty members when necessary. We developed guidance on distance learning tools and practices, monitored the process across faculties, and tried to make adjustments in cooperation with the administrators. Regarding scholarships, we invested a lot of effort in student support, developing lists of students eligible for additional aid and negotiating emergency funding options with the university. As for the infrastructure, we had less work in this domain because the campus was virtually empty last year. Usually, it's routine work on building-specific issues. One of the big initiatives we accomplished was turning the library in one of the campus buildings into a co-working space. We often work on students' requests when they have problems. Faculty student councils also participate in disciplinary and scholarship committees on a mandatory basis." (male, 2nd year of Master's studies, Mathematical and Computer Sciences)

Domains of activity prevalent in one third of the cases. Among the SRB activities aimed at encouraging student research, providing orientation for freshmen and international students, and promoting sports and physical activity, the highest growth potential is observed for research promotion—a large proportion of the respondents refer to it as one of the most promising avenues of their representative structure's development. Quite probably, this domain of student representation activity will soon become more widespread.

> Everyone is deeply engaged in tutoring first-year students. It's very popular today, and everyone has those freshman tutoring programs, which vary a lot across faculties. The first term of the freshman year is the required minimum, everyone does this. Next, the research function: popularization of science is trending today, and we've launched a large-scale project recently. Then, international students: we accept any request or complaint from foreign students, consider it, and help them solve the problem. (male, 3rd year of Bachelor's studies, Social and Economic Sciences)

Domains of activity typical of specific university clusters. Among their SRB activities, some interviewees mentioned coordination of work with student group presidents, promotion of volunteerism, cooperation with external organizations and partners and university applicants, and elaboration of the financial base of student representative bodies and universities. The latter type of activities, namely the desire to participate in the audit of the university's funding allocation mechanisms and to ensure the possibility of attracting external funds (grants) for SRB operations, is a key point of growth in this category with the potential to move to a higher prevalence category: a significant num-

ber of respondents would like to develop student representation in this direction.

When describing the working conditions of SRBs, a number of respondents emphasized two problems. One of them is the high degree of bureaucratization: student representatives have to spend a lot of time on filling out huge amounts of paperwork in the prescribed ways instead of doing meaningful work and defending students' interests before the administration. The other problem is that university administrators ask SRBs to help them with event organization all the time. In a situation like this, SRBs basically become executors of technical functions, or, at the best, are "assigned" to administer events.

> "As an institutional unit of the university, the student council should formulate its opinion on paper prior to expressing it. Sometimes, we receive an executive document to provide feedback on, and it's such bafflegab that our specialized department just can't make sense of it. You can spend tons of time trying to figure out what those papers say just to realize down the road that you got it all wrong. Way too much time is wasted on translating from officialese into comprehensible Russian." (female, 4th year of Bachelor's studies, Social and Economic Sciences)

> "The university uses student activists to perform tasks that it needs, which may be of much less interest to students themselves and the student council. Moving tables, carrying speakers in and out, and so on. This is what often scared people away: instead of doing mental work, they had to do physical exercise. And it's hard to say no because everyone wants to maintain a good relationship. (male, graduate, Life Sciences)

Therefore, the functions of SRBs are largely contingent on the university's student representation policy, its legal framework, and real-life practice. Formation procedure also plays a significant role: if student clubs have a lot of weight in student representation, then provision of information and organization of mass cultural events are likely to be a priority, whereas SRBs based on institutional units and academic communities will pay attention to a wider range of issues. The main trend in the development of student representation functions, judging by our findings, is the strengthening of their academic and research capacity, which is reported as desirable by many interviewees.

Naturally, it should be kept in mind that this study was conducted on a sample of leading universities, and interviews were carried out with the leaders of those universities' SRBs, most of them being students or graduates in social and economic sciences. A broader and more diverse sample could produce a different distribution of opinions on the most and least common domains of student representation activities. Still, the four domains identified in the present article

most probably reflect nearly the entire range of student representatives' perceptions of what they do, which makes this finding a fairly good initial outcome of exploratory and descriptive research.

Specifics of Student Representation in Russian Universities and Avenues for Further Research

The system of student representation in Russian universities is a curious and distinctive example of thematic student communities being deeply and directly integrated into the overall representation hierarchy and often being substituted for the direct election mechanism which is more widespread in the global practice [Klemenčič 2020a]. Members of Russian SRBs are much less likely than their counterparts from other countries to be local "politicians" and opinion leaders but are more likely to be managers of self-initiated activities within student organizations. Even in cases where the leader is elected, it has almost zero effects on the system as a whole.

While university student representation in global practice is multivariate and involves socialization and youth policymaking (the experience of representation at this level can be later used by graduates to defend their rights in their career and civic life), in Russia it basically has the status of a managerial unit within the university. Furthermore, the central functions of SRBs in this managerial role are most often reduced to formal execution of legal requirements regarding local regulations and disciplinary action (including the related bureaucratic paperwork), participation in the work of university governing bodies, and maintenance of some university processes, mostly organization of mass cultural events for students and keeping them informed. Less often, SRBs actually represent students' interests in managerial decision-making on educational, social, infrastructural, scholarship, and other issues.

The governance agenda of SRBs in Russia is thus much more dependent on universities, university administrators, and higher-level policies and bureaucracy than on students themselves. A similar trend in the role of student representation (professionalization, bureaucratization, disengagement from regular students as voters) is being observed in a number of other countries, which researchers explain by the increasing marketization of higher education [Brooks, Byford, Sela 2015b].

Analysis of respondents' opinions in this study confirms the assumption drawn from a review of literature that national and university contexts are the main factors that shape the role of SRBs. The extremely strong influence that the state has on the entire system of higher education in Russia affects student representation practices among other things. Formalization of SRBs and their different types in federal law, development and progressive implementation of guidance on student organizing, and attempts to make some of the representative positions elective were part of a consistent policy that radically transformed the phenomenon of student representation during

the 2010s. According to the typology of national student representation systems [Klemenčič 2012], Russia belongs to the corporatist model with a bias for the statist model in some of the aspects.

Within the overall trend, the whole variety of student representation practices is explained by university specifics. The model of student representation adopted in a particular university is largely contingent on how strongly the university depends on the Ministry of Education, both on paper (whether the ministry is a founder) and in real life (financial relations, etc.). A significant number of universities use a distributed model of student representation which is *de facto* stipulated in the Ministry's guidelines and brings together multiple actors, predominantly thematic student organizations. Models that differ a lot from the distributed one and sometimes emphasize the election principle at different levels are more likely to be found in universities that are less dependent on the Ministry either because the latter is not their founder or due to some other reasons for a special status: Moscow State University, St. Petersburg State University, Moscow Institute of Physics and Technology, National Research University Higher School of Economics, and some others.

Along with university status, factors such as the intentions and views of administrators and students play a significant role, too. The structure of SRBs is an important factor that determines their functions: different origins of such student bodies naturally contribute to the prevalence of different types of activity (e. g. faculty-based SRBs prioritize educational and social issues, while those built around thematic clubs focus more on mass cultural events and keeping students informed). Whether a particular function survives or not depend on student-university interactions: the broader representation on both sides (not restricted to the vice-rector for youth policy and the head of the student council but involving a number of individuals who represent different opinions and deal with issues that they are specialized in) and the more regular and productive their interactions, the more likely the range of student representation functions will be to solidify. According to the taxonomy of forms of relations between university and student representative structures [Klemenčič 2014], managerial (or corporate) governance model and authoritarian-paternalistic approach prevail in Russian universities.

Associations between the functions of SRBs and their formation procedure as well as their relations with the university administrators are important in terms of education policy. Taking into account the high priority that universities assign to student feedback on the quality of educational processes, it appears a promising strategy to apply and promulgate the principle of student representation based on faculty or other academic affiliation (which may be combined with other principles, provided that they are equally important for the university's purposes) and to ensure that student representative structures engage on a regular basis not only with youth policymakers but also

with the administrators who are directly involved in coordination of educational processes. Every factor affecting the context of university development may and should be reflected in the structure of SRBs. In particular, the critical role of student dormitories necessitates representation of dormitory residents.

The purpose of the study performed was to summarize the existing practices and provide a basis for further discussion on student representation in Russian higher education. New qualitative studies will be needed, in particular, to ensure a more detailed analysis of national student representation policy—for the time being, we can only cautiously hypothesize about the driving forces behind certain initiatives. Furthermore, we definitely need quantitative studies as well to cover a much broader range of colleges (not only leading and selective universities) and describe models of student representation adopted in specific universities. Related areas such as student activism and student representation outside university deserve attention, too. Students are mobile, and student representation in Russia is constantly evolving, expanding the spectrum of research opportunities day by day.

I would like to express my sincere gratitude to all the interviewees for the huge volumes of information they provided, to the Center of Sociology of Higher Education (Higher School of Economics) for their invaluable help with data processing, and to the anonymous reviewer for their highly valuable comments on the article and further research avenues.

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Informal Student Groups in the Context of the COVID-19 Pandemic

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Received in August 2021

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Abstract

Informal student groups in Far Eastern Federal University exhibited significant activity and received essential support from the university administrators during the COVID-19 pandemic. Since the pandemic burst out, the number of informal student groups known to administrators has only increased, counterintuitively. Our findings show that the value of informal student groups for participants in the educational process is comparable to that of formal education programs, although participation in such groups is not part of any formal requirements or explicit societal demands. A series of interviews was conducted with members of informal student groups (a volunteer community, a group of medical volunteers, associations of engineering and information technology students), faculty members, and administrators. Analysis of interview transcripts shows that informal student groups can be considered valuable in the university corporation as a way of entering a profession, as a response to the implicit societal demand for "maturity" and agency development in students, and as a means of "internalizing" the learning environment and becoming a member of the university corporation. At the same time, a number of respondents perceive self-organization within student groups as generally and intrinsically valuable. Our findings show that informal student groups have an unspoken value in themselves, supported by an equally unspoken societal demand for "collectivist education", which is yet to be discussed.

Keywords

educational values, implicit curriculum, informal education, informal student groups, universities during the COVID-19 pandemic.

For citing

Zemtsov D. I., Yaskov I. O. (2021) Neformal'nye studencheskie obyedineniya v usloviyakh pandemii COVID-19 [Informal Student Groups in the Context of the COVID-19 Pandemic]. *Voprosy obrazovaniya/Educational Studies Moscow*, no 4, pp. 97–116 https://doi.org/10.17323/1814-9545-2021-4-97-116

By 2011, when Far Eastern Federal University (FEFU) was established as a result of the merger of Far Eastern State University, Far Eastern State Technical University, Pacific State Economic University, and Ussuriysk State Pedagogical Institute, the four universities cumulatively had about 50 active student organizations registered. Those were both organizations created on the basis of constitutional documents

and elective procedures, such as student councils and student organization boards, and informal self-organized associations, such as language clubs, Olympiad coding clubs, an e-sports team, a model UN, historical dance classes, etc. The number of informal student groups is constantly growing: it increased from about 25 in 2013, when the university moved to its new campus in Russky Island, to 42 by the outburst of the COVID-19 pandemic in 2020. Every year, informal student associations organize over 300 events of various kinds, including at the national and global scale (under the auspices of the Association of Pacific Rim Universities). FEFU provides support for informal student groups on an equal basis with student representative organizations: they can apply for competitive grants, use the university's coworking spaces, and get a space of their own for temporary use. Technology entrepreneurship teams have access to the Project Activity Center, Russky Technopark, and the Startup as Diploma program.

Informal student groups exist in a number of universities and are mostly perceived positively by educational stakeholders: students, their parents, faculty, administrators, and employers providing internship opportunities [Brint, Cantwell 2010:2460; Stuart et al. 2011:213]. At the same time, it is difficult, based on day-to-day operations, to compare such groups by value for the university, assess their role in the university's organizational culture, locate them in the hierarchy of values, and determine the presence or lack of societal and professional demand for their activities. Besides, as such practices are less controllable and measurable, they are also vulnerable to formal managerial decisions.

In March 2020, Russian universities had to interrupt face-to-face education and shift to emergency distance learning for a week. Organizational capacities of university teams were only enough to support the most vital components of the learning process. In FEFU, despite a smoothly running system of digital governance and the extensive use of online teaching, the transition to distance learning required a massive mobilization of managerial and faculty human resources. In a week, however, it turned out that informal student associations remained active as well, having adapted their activities to online formats, where possible. Counterintuitively, the number of informal student groups known to administrators did not decrease but increased by 12 to make 54. Over 100 online events were held in March–September 2020: conversation clubs, case clubs, hackathons, parliamentary debates using the Leader-ID.ru platform and the Boiling Point—Vladivostok facilities. ASAP Project was launched by university administrators in cooperation with student leaders to sustain self-organized practice-oriented teams and opportunities for student employment.

Faced with the emergency transition to distance learning, informal student groups did not suspend their activities, maintaining a high level of student engagement and receiving acknowledgement and support from university administrators at different levels. Mean-

while, activities of formal student organizations were essentially limited and largely sporadic during that period. The present study is aimed at answering the following research question: why is the value of informal student groups for educational stakeholders comparable to that of formal education programs even though participation in such groups is not part of any administrative requirements or explicit societal demands?

1. Research on Student Self-Organization during the COVID-19 Pandemic

Even in the pre-pandemic era, the reciprocal influence of online formats and informal student interactions was already widely discussed in literature. Rather than replicating face-to-face learning formats, the online learning environment should be regarded as a unique medium which, by its nature, necessitates unique communication, community-building, teaching, and learning strategies [Arasaratnam-Smith, Northcote 2017:188–198]. The COVID-19 pandemic made researchers from universities across the world enquire what has been lost and what has been acquired as a result of the transition to online education [Zakharova, Vilkova, Egorov 2021].

In medical education research, for instance, particular attention is devoted to risks and opportunities associated with professional identity formation [Stetson, Dhaliwal 2020:131–133] and subsequent integration into the profession, as well student self-organization practices that can mitigate those risks. During the COVID-19 pandemic, medical students were temporarily extricated from the clinical environment, and observers wondered if preserving or advancing students' professional identity and professionalism while away from patients and colleagues was possible. Researchers demonstrate how educators across the world succeeded in not only fostering professional identity formation while students were away from the clinical setting, but also in expanding notions of professionalism and what doctors do. Innovative examples of advancing professional identity in non-traditional ways are showcased: putting students in a public health role, promoting interprofessional work, and supervising social media engagement with society.

Canadian Engineering Education Association is concerned about socialization of undergraduate engineering students learning in online environments. Using data from a survey of such students, researchers identify the factors of online learning environments that affected students' socialization experiences: decreased frequency of interpersonal interactions, which hindered students from acquiring engineering knowledge and skills; lack of social interactions, which threatened students' mental wellbeing they would need to learn well; lack of synchronous interactions in learning, despite increased opportunities for asynchronous communication in the online environment; lack of opportunities for students to socialize and learn from others, etc. [Sweeney, Liu, Evans 2021:1–8].

In 2020, almost all campuses across the United States abruptly closed and shifted to remote instruction due to the COVID-19 pandemic. To examine how computing departments facilitated student participation in educationally engaging activities during the campus closures, American researchers administered a survey to over 900 students in 14 computing departments and interviews with 30 faculty members and university administrators [Thiry, Hug 2021:987–993]. Though students reported increased mental health struggles, they reflected on the myriad ways that faculty and peers supported their engagement in learning. In response to the pandemic, faculty and student leaders structured supports, such as peer-led team learning sessions and student clubs, and informal student organizations of various specializations intensified their activities.

FEFU's experience demonstrates that informal student groups become highly active during a crisis. Unlike authors of the studies mentioned above, we do not regard such intensification exclusively as a response to the COVID-19 pandemic. The crisis pushed universities into a "fire in a library" situation, where the most valuable books have to be carried out of the burning building. Under such circumstances, informal student associations were supported by all participants in the educational process, which indicates their unique value for the university corporation.

2. Methodological Frameworks of Student Self-Organization Research

One of the possible ways to answer the question about the unique value of informal self-organized associations for the university corporation can be found in Anton Makarenko's doctrine, which is still fundamental to Russian educational thought. Makarenko based his theory of personality development on the concept of *collective* (meaning "community"), which he interpreted as a free association of people united in their goals and actions, organized and equipped with organs of governance, discipline, and responsibility. However, he was also guided by the explicit societal and governmental demand for student self-organization practices: "The mission of our education is to raise a collectivist" [Makarenko 2014:138]. In the present-day Russian education system, the mission is defined somewhat differently: according to Federal Law "On Education in the Russian Federation", education serves the purpose of intellectual, spiritual, moral, creative, physical, and/or professional development of the individual, satisfying their educational needs and interests—therefore, the law leaves collectivist educational outcomes outside the formal education requirements.

Another angle for analyzing the value of informal associations, agency, and self-organization of students can be found in the works of the French sociologist Michel Foucault and his followers. Foucault distinguishes among four major types of technologies in the organization of human society: (1) technologies of production, (2) technologies of sign systems, (3) technologies of power, and (4) technologies

of the self. He further asserts that knowledge and education are inseparable from the technologies of power in a modern society. Knowledge acquisition is a transforming process for those involved in it. The "power-knowledge" structures are methods of objectivizing the subject by making them acquire knowledge, i. e. methods of power reproduction. They are opposed to technologies of the self, which "permit individuals to effect by their own means, or with the help of others, a certain number of operations on their own bodies and souls, thoughts, conduct, and way of being, so as to transform themselves in order to attain a certain state of happiness, purity, wisdom, perfection, or immortality" [Foucault 2008:99–100]. Foucault's positive education program consists in restoring the status of education in general, and university in particular, as an institution that promulgates "care for the self". Regulatory power of the teacher should give way to pastoral power of the mentor. The central questions for education should be: "How to govern oneself, how to be governed, by whom should we accept to be governed, how to be the best possible governor? How to be governed, by whom, to what extent, to what ends, and by what methods?" [Foucault 2004:122]. From this perspective, activities of informal student groups can be regarded as a "university in university", which puts Foucauldian "return of the subject" into practice.

Self-organization of students around a certain type of activity can also be viewed through the lens of Bourdieu's theory of cultural reproduction and professional recognition that he presented in *Homo Academicus*, while exploring the social structure of higher education in France [Bourdieu 2018]. As a result of his empirical study of structural changes in the French university community, Bourdieu suggested a theory of reproduction of social and professional bodies, based in particular on the concepts of *co-optation* and *recognition*. These processes allow the community to detect (and recognize) not only a specific competence in the candidate but also other properties required to become a member of the corps: specific ethical stances, manners, behavior, and faith in the institution's core values. The candidate is not supposed to demonstrate their properties explicitly and separately; rather, their behavior should manifest a certain way of thinking typical of a specific social or professional body. We find it productive to ask ourselves whether self-organization around a professional activity, e. g. software development, can be a form of achieving the "appropriate way of thinking" and a method of facilitating integration into the profession.

The practice of university education leaves no doubt about the high value of informal student associations, yet their role in the university corporation is not defined by formal documents or public consensus. In this situation, the concepts of *context*, introduced by Froumin in his monograph *The Secrets of School: Notes on the Contexts*, and *hidden curriculum*, which serves the basis for his speculations on complex educational outcomes, may be the adequate foundation for research on

informal student groups. According to Froumin, complex educational outcomes at school (we suggest applying this reasoning to higher education as well) do not emerge as a result of simple and technologizable teaching operations, but derive from *contexts*, a complex system of factors that defies exhaustive description. The culture of research, for example, cannot be "taught", but it can be absorbed in a laboratory, as a result of interactions within the research team. The obvious ambivalence of the status of informal student groups suggests that the answer to the question about their value for the university corporation should be searched for in the "hidden layers of the pedagogical reality" [Froumin 1999].

3. Research Design

3.1. Respondent Recruitment

The data source for this paper was semi-structured interviews with students participating in informal associations as well as with faculty members and university administrators directly involved in the activities of such associations. Interviewees were recruited from student groups that maintained or extended their activity during the COVID-19 pandemic, according to the university student association support system and the Leader-ID database.[1] Recruitment of respondents was performed as part of the study examining the impact of the COVID-19 pandemic on the quality of education in Russian universities [Anisimov et al. 2020].

3.2. Sample

For the purposes of this study, the informal student groups that remained active during the pandemic were classified into four categories: (A) participants of FEFU volunteer societies established in 2012 while preparing for the APEC summit and still operating as a network of informal organizations; (B) groups of medical volunteers that emerged during the COVID-19 pandemic; (C) engineering students who have worked as self-organized developer teams at FEFU Project Activity Center since 2017; and (D) self-organized teams of IT students existing since the movement to the campus in Russky Island in 2013 that received support from the university administration through the ASAP service of the Student Employment Assistance Program during the pandemic. Participants for interviews were selected by quota sampling, depending on the size of informal group category: five interviewees in A category, five in B, ten in C, and ten in D. The same principle was applied when selecting interviewees from among faculty members and university administrators that engage directly with informal student groups: two in A category, three in B, five in C, and five in D.

The final sample thus consists of 30 FEFU students (mean age = 21 years), ten faculty members, and five administrators. Of the 30 stu-

[1] Leader-ID: The 2020 Results. https://zen.yandex.ru/media/leader/leaderid-itogi-2020–5fed8115fe4e686f6a63da2f

dents, 20 are enrolled in IT and engineering majors, five in health and medical sciences, and five in the humanities. More detailed characteristics of the interview participants are given in the appendix.

3.3. Interview Procedure

The interviews were conducted online (using Telegram) and offline between May 2020 and June 2021. Names of the participants are not disclosed for confidentiality purposes. Every interview lasted between 20 and 60 minutes. The student interview guide included the following modules: biodata; participation in informal student associations before and during the pandemic; and perceived value of participation in informal student groups. The guide for faculty and administrators involved the following: biodata; engagement with informal student associations; and perceived value of informal student groups.

3.4. Data Analysis

Data was analyzed using the method of categorization [Kvale 2003]. In the course of analysis, units pertaining to the value of informal student groups were assigned codes, which were later divided into four categories. Categorization was performed by the two co-authors of the study independently, using the methodological frameworks specified in Part 2, with subsequent discussion of the results.

4. Results

4.1. A Method of Entering the Profession

In the interviews, a number of students expressed hope that participation in informal associations would play an essential role in their future career success. Responses of this type are given by members of coding teams and medical volunteers. Coders see a valuable outcome of their self-organization efforts in the lower barriers to entry into the coding profession and the opportunity to get easy credits for the projects implemented. They realize that their self-organized activities are pre-professional in nature, allowing them, in Bourdieu's terminology, to "capture the appropriate way of thinking" and at the same time "get a pass into the profession".

> "You might say this is kind of investment into the future. A simple example: all able students dream of finding a decent job one day. Employers, in their turn, assess not only knowledge but also professional competencies. Participation in extracurricular activities is sort of an indicator of my abilities. <...> This is a challenge that improves your endurance, unlocks your potential, and enhances your professional qualities. Of course, all of this will be useful in both my career and personal life." (1st-year student, member of an IT team)

Responses in the same category of perceived value of informal student groups are often given by administrators and faculty members. For example, a nearly identical substantiation of the value of self-organized activities is provided by the head of the expert council for IT majors who is deeply integrated in the university environment:

> "I would hire these students right now. They have proved themselves not only as good coders but also as being able to solve real-life problems and coordinate the work of their team members. Without these skills, you cannot work in the industry." (owner of a large digital company, head of the expert council of the FEFU Institute of Mathematics and Computer Science)

In addition to the role that informal student groups play in fostering the development of students' competencies, accomplished representatives of professional communities also emphasize that such groups help students internalize the professional culture and develop a relevant way of thinking. This is manifested most prominently in responses about medical volunteering.

> "At one of the meetings of the Coordination Council to Control the Incidence of the Novel Coronavirus Infection, the Minister of Health of Primorsky Krai asked if we could send volunteers to hospitals. I forwarded her call to our students, asking them to participate as much as they could, and I was astonished to see how civic-minded they were, because they came forward instantly. Despite all the risks, they volunteered to provide help where it was really needed. They do what their hearts tell them. I'm sure they will make decent doctors." (Vice President for Medical Affairs, clinician)

There is already some prominent evidence of the effects of participation in informal student associations during the pandemic on professional recognition. For example, students who launched the CODE Work project to help anyone interested prepare for Olympiads in coding received a job offer from a large local digital business, and students who launched the ASAP.Games game development training studio were invited to cooperate with a number of game development companies.

4.2. Maturing, Leadership, and Agency

Another category of responses about the value of informal student groups has to do with maturing and developing autonomy and agency in the process of participation. Responses of this type are especially typical of students admitted in 2020, who transitioned from school to university during the COVID-19 pandemic. For FEFU freshmen, it was also a period when the campus in Russky Island was cut off from the mainland during three weeks in the aftermath of an ice storm.

> "Not only did I enter the university in the midst of the pandemic, my friends and I also had problems communicating and reporting problems on time due to the ice rain. We solved those problems on our own, creating various digital products to make not only our own lives easier, but also those of other students and beyond." (1st-year IT student)

Responses of this category feature both sense of agency ("I can") and the internalized value of community and mutual help.

> "It's curious how people react: some are surprised to see me with an infrared thermometer at the entrance, while others get it instantly, thank me for keeping watch, and ask me questions sometimes. I volunteered most probably for the same reason I enrolled in medical studies: I've always wanted to help and be useful, it's a feature of mine. And since we're now in a situation where help is needed so badly, that's what I do." (2nd-year medical student)

The fact that perceived value of self-organization within informal student groups is associated in responses of this category with the increasing senses of agency and social responsibility and at the same time with the value of mutual help could be considered a specific feature of the pandemic that has little connection to what student groups normally do. However, respondents describing the activities of their groups before the pandemic also make associations between the values of agency and social responsibility.

> "It was only later that I realized that I had learned a lot and had developed professionally. At the moment, I just had that feeling of 'I can do it!' I can help hundreds and thousands of students solve a problem. And you just sit there and try to come up with a solution to make everyone happy. Not about the code lines or the praise you'll get. You live the emotions of people that they'll have when your project is complete." (4th-year IT student, developer of an IT app for students with over 7,000 users)

In some responses, the value of increased autonomy and agency is separated from that of social responsibility and derives solely from the "I can do it" feeling.

> "I came to FEFU from a small village and I was not aware of what the world needs. I just knew I wanted something related to electronics... In my first year, I already knew FEFU had submersibles, that my groupmate participated, went to a competition in America in the very first year, and even won the championship. So I thought: I should do something, if my groupmate can do it, I can too. I invited a few more guys. We didn't know what we would do, we just wanted to do something. They offered us to make peglegs... I chuckle when I look at my first prototype now, but I've learned how to use 3D-modelling software, and I now know what it means to work in a team." (1st-year Master's degree student, member of a FEFU Project Activity Center team)

Most responses in this category were given by students working at the university's open coworking facilities designed specifically for self-or-

ganization of students into teams: Project Activity Center with access to equipment and expendable supplies for technology projects, and the Boiling Point space that provides organizational and communication support for such informal associations.

4.3. A Means of "Internalizing" the University

In another category of responses, interviewees associate participation in informal student groups with the opportunity to "internalize" the university and become part of the university corporation by building their own educational trajectories with the use of self-organization elements that fit naturally into university life.

> "I founded Da Vinci Operative Surgery Club. The project started with only five people, and now we have 35 participants. Over 130 students have been members of the club throughout its existence, and we only admit medical students. I'm proud of contributing to the training of future doctors." (5th-year student of the FEFU School of Medicine)

There are examples of students essentially extending the scope of formal education programs with self-organization formats, while keeping with the same content logic. For instance, membership in cross-university contest communities for Olympiad coding or robotics adds value to informal associations and legitimates them in the eyes of faculty and administrators. In this case, the student assumes the role of an innovative educator and a member of the university corporation who accelerates its development.

> "CODE Work is a chance to level up yourself, your skills and knowledge, and your ability to work in a team. Competitive programming is now promoted by the top universities and IT companies in the world. Our goal is to create a community of motivated people at FEFU to keep this ball rolling." (3rd-year student, instructor at the CODE Work student organization)

For students in the volunteer corps, the sense of belonging at university is closely associated with the ideas of commitment and mutual help.

> "I was happy to help my instructors and my university in time of need. To tell the truth, though, I did it because I had nothing else to do at all back then. This is the only thing that kept me in Vladivostok, but now it's over and I can go home with a peaceful mind. I hope FEFU will not forget our commitment and will support us students just as we gave it our support." (2nd-year student from the FEFU Volunteer Corps, who assisted faculty members in effectively using distance learning software)

Of course, the COVID-19 pandemic brought some adjustments into the life of informal students groups. In the course of interviews, students

reported having become emotionally closer with faculty members and experienced understanding and empathy in interactions with them.

> "We all found ourselves in a difficult situation during the transition to distance learning. And I can understand teachers who struggle with technology. During that period, teachers became very much like family members to me, and I found pleasure in telling them how to use a program." (3rd-year student from the FEFU Volunteer Corps, who assisted faculty members in effectively using distance learning software)

We believe that "internalization" of the university's learning environment through participation in informal associations allows students to take a new look at their involvement in university life, encouraging them to proactively fill the gaps in education programs and enhance the curriculum. Moreover, for students who approach self-organization this way, it may also be a practice of entering the academic profession, in much the same way as it becomes a practice of integration into non-academic professions for respondents from the first category.

4.4. The Intrinsic Value of Self-Organization

Informal student associations are described quite often as intrinsically valuable not only by students but also by faculty and administrators. A number of respondents from among faculty members and university administrators even regarded the question about the value of informal student groups as trivial.

> "On a Saturday night, I called in to the Project Activity Center and found a few teams working on their projects there. It's extremely valuable that students get together voluntarily to do what they love and what will make a difference." (member of the FEFU Rectorate staff)

Students point out that administrators and faculty sympathize with informal student groups.

> "It matters a lot to us that the university encourages our desire to engage in team projects. We're used to such formats at Pacific Project Schools; they told us we would only attend lectures at the university, but at the FEFU Project Activity Center, we have the opportunity to choose what to do and how to do it, we have access to equipment, and we have mentors. I think that's what a modern university should be like." (2nd-year engineering student, graduate from a FEFU Pacific Project School)

Nine interviewees gave responses that can be classified under the "self-organization as an intrinsic value" category. Therefore, despite the lack of explicit consensus and regulatory framework for supporting informal student associations within the university, a significant

number of respondents agree that such associations have an intrinsic value that needs no additional substantiation. Probably, the value of self-organization is part of the "hidden curriculum" of university education, but this assumption is yet to be examined.

5. Conclusion

Analysis of interview transcripts and activities of informal student groups before and during the COVID-19 pandemic shows that such groups have a significant value for the university corporation. This value, however, is quite specific: it is not deduced from documents regulating the activities of educational institutions, articulated explicitly in discussions on the social or professional demand for education, or even manifested in routine managerial decisions of the university administration. In fact, informal student groups in Russian universities represent an unspoken value, and constitute part of the "hidden curriculum" which became visible during the pandemic exactly because it was threatened.

We identify a few grounds for considering informal student associations valuable for the university corporation: as a way of entering a profession, as a response to the implicit societal demand for student maturing, as a means of "internalizing" the university's learning environment, and as a value in itself.

Informal student groups as a way of entering a profession represent an obvious value since one of the university's key objectives is to prepare students for professional life. In a number of cases, self-organization practices are recognized by the university corporation as an effective tool for developing a profession-specific way of thinking, and thus as valuable for the educational institution.

The implicit demand that students "mature" and develop agency and ability to make and implement decisions on their own exists in society but is not formalized in education programs. Consequently, it has to be satisfied in informal ways, which is the case with self-organization practices, as it follows from interviews.

Informal associations become a means of "internalizing" the university's learning environment for students. By engaging in self-organization practices, students become co-designers and members of the university corporation, which improves their learning outcomes. By recognizing the role of students as current and future members of the university corporation, educational stakeholders also acknowledge the value of informal student groups.

In a number of interviews, students as well as faculty members and administrators seemed to be baffled by the need to substantiate the value of informal student groups. Such respondents observe the intrinsic value of students self-organizing into teams and being able to define their goals, team up, and achieve what they want. We believe that informal student associations are one of the unspoken self-contained values for Russian universities, underpinned by an equally un-

spoken demand for "collectivist education". This thesis deserves to be examined and discussed further.

Appendix

Table 1. **Characteristics of interview participants**

Students				
Interview #	Field of study	Year	Age (years)	Gender
1	Clinical Medicine	2	19	Female
2	Clinical Medicine	5	23	Male
3	Clinical Medicine	3	21	Male
4	Clinical Medicine	2	20	Male
5	Clinical Medicine	3	20	Male
6	Informatics and Computer Science	2	20	Male
7	Informatics and Computer Science	2	19	Male
8	Informatics and Computer Science	2	19	Male.
9	Informatics and Computer Science	2	20	Male
10	Informatics and Computer Science	2	19	Male
11	Informatics and Computer Science	1	18	Female
12	Informatics and Computer Science	1	18	Male
13	Informatics and Computer Science	3	21	Female
14	Informatics and Computer Science	3	21	Male
15	Informatics and Computer Science	4	22	Male
16	Photonics, Instrumentation, Optical and Biotechnology Systems and Technology	4	21	Male
17	Photonics, Instrumentation, Optical and Biotechnology Systems and Technology	4	22	Male
18	Photonics, Instrumentation, Optical and Biotechnology Systems and Technology	4	21	Male
19	Applied Geology, Mining, Oil and Gas Engineering, and Geodesy	1	23	Male
20	Photonics, Instrumentation, Optical and Biotechnology Systems and Technology	1	22	Male
21	Photonics, Instrumentation, Optical and Biotechnology Systems and Technology	2	19	Male
22	Photonics, Instrumentation, Optical and Biotechnology Systems and Technology	2	20	Male
23	Photonics, Instrumentation, Optical and Biotechnology Systems and Technology	1	22	Male
24	Photonics, Instrumentation, Optical and Biotechnology Systems and Technology	4	21	Female
25	Photonics, Instrumentation, Optical and Biotechnology Systems and Technology	4	22	Male

Students				
Interview #	Field of study	Year	Age (years)	Gender
26	Economics and Management	3	20	Male
27	Law	3	20	Female
28	Mass Media and Information-Library Science	4	22	Male
29	Linguistics and Literary Studies	3	21	Male
30	Linguistics and Literary Studies	3	21	Male

Staff		
Interview #	Position	Age (years)
31	Vice President for International Relations	43
32	Vice President for Medical Affairs	50
33	Head of the expert council of the Institute of Mathematics and Computer Science	46
34	Director of the Project Activity Center	28
35	Head of the Management Board for Development of the University Environment	28
36	Senior Lecturer	30
37	Associate Professor	32
38	Senior Lecturer	27
39	Professor	50
40	Associate Professor	46
41	Teaching Assistant	27
42	Teaching Assistant	25
43	Senior Lecturer	27
44	Teaching Assistant	27
45	Teaching Assistant	28

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Challenges to Internationalization in Russian Higher Education:

The Impact of the COVID-19 Pandemic on the International Student Experience

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Received in September 2021

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Abstract

The COVID-19 pandemic has essentially jeopardized the internationalization processes in higher education. International travel restrictions, financial insecurities, and the introduction of distance learning formats have been posing serious challenges for international students. The present study is based on data obtained in a countrywide survey of Russian university students conducted in June–July 2021 as part of the project Research and Instructional Design Support for the Development of a Quality Measurement System in Higher Education During the COVID-19 Pandemic and Beyond. International students' perceptions of distance learning, its quality and challenges are analyzed. Judging from international students' responses to the questionnaire, the process of their adaptation to the new study conditions has been routinized. Among the benefits of online learning, international students name the logistic ones such as mobility, relative cost-effectiveness, and optimization of time. Perceptions of the communication constraints related to learning from a distance are largely negative. In addition, international students perceive themselves as a more vulnerable category compared to Russian students and obviously gravitate toward in-person learning. For the most part, international students are ready for blended learning, but remote formats of communication and learning should be applied to them with more caution than with Russian students.

Keywords

COVID-19, distance learning, foreign students, international students, internationalization of education, online learning, pandemic, remote learning, student experiences.

For citing

Abramova M. O., Filkina A. V., Sukhushina E. V. (2021) Vyzovy internatsionalizatsii dlya rossiyskogo vysshego obrazovaniya: vliyanie pandemii COVID-19 na obrazovatel'ny opyt inostrannykh studentov [Challenges to Internationalization in Russian Higher Education: The Impact of the COVID-19 Pandemic on the International Student Experience]. *Voprosy obrazovaniya/Educational Studies Moscow*, no 4, pp. 117–146 https://doi.org/10.17323/1814-9545-2021-4-117-146

Internationalization of higher education is a key manifestation of globalization, which has swept over multiple spheres of life in modern society [Altbach 2019]. It implies purposeful integration of international and intercultural dimensions into national higher education systems, which involves international mobility of students and scholars, global university rankings, and internationalization of the curriculum, teaching, and learning [de Wit 2019].

International mobility provides an additional source of income for universities and promotes the development of domestic human capital by attracting talent from abroad. For Russian universities, internationalization is a mechanism for keeping up with the global educational and research agenda; in many rankings, the number of international students is a significant quantitative indicator of university performance [de Wit 2019]. From a broader perspective, internationalization in education is a "soft power" tool reflecting the global impact of host countries [Mellors-Bourne et al. 2013; Antonova, Sushchenko, Popova 2020].

This article zeroes in on a meaningful aspect of internationalization: foreign students who come from the "near abroad" (post-Soviet states) and "far abroad" (all other foreign countries) to study in Russian universities.

International enrollment in higher education had been constantly expanding up to spring 2020. Over the last fifty years, the number of mobile students enrolled in tertiary education programs worldwide doubled every decade, reaching 5.3 million in 2017 [OECD2019]. In the context of internationalization and massification of higher education, which are integral components of global economic and political processes, researchers projected further increase in international student enrollments and in the number of international educational and research collaborations [De Wit, Altbach 2021]. The COVID-19 pandemic triggered a crisis of academic mobility all over the world: following campus closures, a lot of students found themselves isolated in dormitories or had to go back to their home countries.

There is no consensus among researchers as to the long-term effects of the pandemic on academic mobility. Some predict a considerable and steady decrease in incoming international students and students willing to enroll in distance or blended learning programs in foreign universities. Such a conclusion is reached, for instance, by looking at the results of surveys conducted in spring 2020, at the beginning of the COVID-19 pandemic [Mok et al. 2021; Haugen, Lehmann 2020; Aristovnik et al. 2020].[1] Others, like Altbach and de Wit, contend

[1] Mercado S. (2020) International Student Mobility and the Impact of the Pandemic//BizEd: AACSB International. https://bized.aacsb.edu/articles/2020/june/covid-19-and-the-future-of-international-student-mobility (https://academ.escpeurope.eu/pub/IP%202020-73-EN.pdf); ICEF (2020) US: COVID-19 Impacts Include Campus Closures and Recruiting Challenges. https://monitor.icef.com/2020/03/us-covid-19-impacts-include-campus-closures-and-recruiting-challenges/

that the crisis-induced decline in international academic mobility is temporary, so one can only expect a restructuring of mobility patterns, probably changes in sending and destination countries or even learning formats, but the trend for internationalization of higher education will continue.[2] Survey findings show that the majority of students intend to return or have already returned to study abroad, whether online or in-person.[3]

One year into the pandemic, the situation remains quite ambiguous. While in-person learning has been resumed in some countries, distance learning continues to prevail in others. A number of questions regarding formats of international student mobility in the present-day context remain unanswered [Yıldırım et al. 2021; Li 2020].[4]

In Russia, naturally, increasing the number of international students is a priority for higher education policy. Russian universities engage in student mobility programs with the near-abroad (mostly) as well as far-abroad countries. International enrollments in Russian higher education has been constantly growing over the recent years, doubling between 2007 and 2017 to reach 260.000 [Gurko et al. 2019] and increasing by 17,000–20,000 each subsequent year to make 315,000 in 2020, which is almost 8% of total tertiary enrollment in Russia.[5]

Will the ongoing pandemic lead to an outflow of international students from Russian universities? To a large extent, it depends on their perceptions and feelings about the situation with the pandemic in general and the transition to distance learning in particular. The new circumstances faced by internationalization-oriented universities should be subjected to analysis. The key research question that the present study attempts to answer is, how did international students perceive distance learning in the academic year 2020/21? In particular, what advantages and challenges of distance learning matter for them? do Russian and international students differ in their perceptions of distance learning? and are there any fundamental differences within the category of international students? Answers to these questions will allow

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[2] Altbach P.G., de Wit H. (2020) COVID-19: The Internationalization Revolution that Isn't//University World News. March 14. https://www.universityworldnews.com/post.php?story=20200312143728370

[3] ICEF (2021) Survey Highlights Student Views on Returning to Study Abroad. https://monitor.icef.com/2021/07/survey-highlights-student-views-on-returning-to-study-abroad/

[4] Mitchell N. (2020) Students to Decide Which Institutions Survive COVID-19//University World News. May 07. https://www.universityworldnews.com/post.php?story=20200507135847614; Lane J. E., Borgos J., Schueller J., Dey S., Kinser K., Zipf S. (2021) What Is the Future for International Branch Campuses?//University World News. March 13. https://www.universityworldnews.com/post.php?story=20210310124052 85

[5] Form of Federal Statistical Monitoring VPO-1 "Information about a Higher Education Institution Offering Bachelor's, Specialist's, and Master's Degree Programs". https://minobrnauki.gov.ru/action/stat/highed/

assessing the risks and prospects of internationalization of higher education in Russia.

1. International Students During the Pandemic: Review of Literature

Researchers of higher education studying the status of international students during the COVID-19 pandemic mostly focus on how students cope with the transition to distance learning and how it has affected their mental health. Surveys were carried out to find out how students solved some practical problems (visas, financial issues, etc.) and how they reacted to decisions made by host governments and host universities; to a somewhat lesser extent, such studies address the sociocultural aspects of adjustment to distance learning. The majority of publications on international student experiences during the pandemic target local contexts, surveying particular groups of students in specific universities.

1.1. Specifics of transition to distance learning in different categories of international students

Emergency transition to distance learning became a major challenge for students. Studies performed during the first months of the pandemic show that online learning was perceived controversially by Russian [Zakharova, Vilkova, Egorov 2021] as well as international students, the latter expressing more negative views on the quality of distance learning than the former [Noskova et al. 2021]. In RUDN University, some positive effects of the transition to online learning for international students were revealed: students' attention concentration improved (especially in language lessons and project-oriented seminars) due to minimization of student-to-student distractions; teachers greatly improved their ability to use a variety of multimedia resources, which is a feature that had been unavailable in some classrooms lacking the necessary equipment; and some of the students studying from their home countries maintained high levels of motivation and participation. The challenges of transitioning to distance learning in RUDN University included the negative impact of technical issues on student attendance and involvement, the lower number of face-to-face social interactions, and the increased number of opportunities for cheating and other forms of malpractice [Novikov 2020].

Researchers report that distance learning formats exacerbate socioeconomic educational inequalities [Bekova, Terentev, Maloshonok 2021]. International students from developing countries are the most vulnerable category, in particular due to relatively high cost of internet access, poor internet connectivity, and lack of electricity in their home countries [Owusu-Fordjour, Koomson, Hanson 2020; Kapasia et al. 2020; Demuyakor 2020; Wang, Zhao 2020].

Students enrolled in majors requiring a lot of practice—mostly medical, but also some artistic and technical specializations—expressed their dissatisfaction with various "ersatz" hands-on learning practices [Li et al. 2021; Noskova et al. 2021; Tyumentseva, Kharlamova, Godenko 2021].

1.2. Mental health and accommodation issues

Studies conducted in February–May 2020 show, expectedly, a considerable increase in the incidence of anxiety, depressive states, and other mental health disorders among students [Cao et al. 2020; Aristovnik et al. 2020]. One of the key stressors was the outbreak itself, meaning a threat to physical health. Besides, there were various institutional problems associated with government policies: border closures, international travel restrictions, the economic recession that led to financial constraints, etc. College and university students have been traditionally more vulnerable to mental health disorders due to academic stressors, as compared to individuals in the same age bracket but not enrolled in tertiary education, so campus closures and isolation caused by the pandemic had a severe impact on their mental wellbeing [Fialho et al. 2021].

Students' perceptions of study conditions depend largely on the institutional environment and on how effectively visa, registration, insurance, accommodation, and tuition issues are solved. A special survey administered by Student Experience in the Research University (SERU) Consortium in July 2020 showed that, along with concerns about maintaining good health, the top three most stressful issues for international students during the pandemic also included managing their visa status and having adequate financial support [Chirikov, Soria 2020]. In a number of countries, international students became a marginal group because they were ineligible for economic securities and relief programs provided to residents by host governments [Coffey et al. 2020; Firang 2020]. Furthermore, preventive and supportive measures provided by the respective institution or authorities were positively related to students' satisfaction and trust gains [Sarker et al. 2021].

1.3. Cross-cultural barriers

Cross-cultural interactions and cross-cultural adjustment have always been in the focus of research on international student experiences [Li, Zizzi 2018; Straker 2016; Khanal, Gaulee 2019; Jones 2017]. When young people come to study in a foreign university, they have to learn to communicate with students from differing cultural backgrounds and to adapt to the new social norms relating to daily living such as recreation and food practices as well as to the academic culture such as the structure of student-teacher interactions, penalties for plagiarism, and the rules of in-class discussions [Rivas, Hale, Burke 2019]. At first, cross-cultural communication may be encumbered due to lack of meaningful interactions between international and domestic students, often negative stereotypes about international students, and their experiences of identity crises. Problems in intercultural communication are observed in English-speaking countries as well as in Asia (China, South Korea) [Lee, Bailey 2020]. Language barriers represent another source of problems, such a prominent one that the topic of linguistic racism has been brought up again lately [Dobinson, Mercieca 2020].

During the pandemic, foreign students undergoing cultural adaptation found themselves even more isolated than usual. Those who

studied from their home countries were more comfortable with distance learning than those who stayed in dormitories [Li et al. 2021]. Language barriers, which played a significant role pre-pandemic, may be even stronger in distance learning [Novikov 2020]. Complete lack of face-to-face interactions with peers and faculty may have a negative impact on both academic performance and cultural integration [Ibid.]. Researchers have been enquiring how students will develop sense of belonging and identity if they learn from a distance all or most of the time [Yıldırım et al. 2021; Rathakrishnan et al. 2021].

There is little data on international students' distance learning experiences in times of COVID-19. Available Russia-based analytical studies describe isolated cases (usually students of one university, sometimes two) or rely on very limited samples. This article presents findings that complement the results of a qualitative study performed in spring 2020 [Abramova, Sukhushina, Rykun 2020]. It has been over a year since the pandemic began, which means that a full academic year has passed in the new reality. Lectures, seminars, admissions, exams, and graduations were administered mostly or entirely from a distance, which provides an opportunity to evaluate more deliberately the early response of the higher education system to the crisis and examine the transformations it has undergone so far. Results of the present research can be useful for understanding the global agenda as well as for designing education policy in Russia, as they present a rather broad picture of experiences of international students studying in Russian universities during the pandemic.

2. Data Collection Method

The present study is based on data obtained in a countrywide survey of Russian university students conducted in June–July 2021 as part of the project Research and Instructional Design Support for the Development of a Quality Measurement System in Higher Education During the COVID-19 Pandemic and Beyond. The project was administered by a group of 13 universities on behalf of the Ministry of Education and Science of Russia. Data was collected via online questionnaires between June 1 and July 16, 2021. As soon as the universities were informed about the survey, they emailed the link to the questionnaire to their students or posted the relevant information in student accounts, on the university's official website, or its social media accounts. The final database included responses provided by 36,519 students from 473 Russian universities, including 3,909 international students (10.7% of the sample) from 289 universities. The survey covers all the regions of Russia, all the types of universities (leading, flagship, and all the other types), and three types of degrees: Bachelor's, Specialist's, and Master's. Respondents were allowed to choose between Russian and English as survey languages, which was followed by a filter question, whether they were a Russian or international student. Of international students, 24.8% (970 people) completed the questionnaire in Eng-

lish. Participants in the study include international students from 133 countries, of them 83% studying in Russian, 21% in English, and under 1% in another language (5% of the students specified two languages). Students from the near-abroad countries account for 52%; and those from the far abroad, for 48% of all international students. Other descriptive statistics for the sample are given in the Appendix.

3. Questions to Compare the Learning Formats

Analysis was performed for questions that allow comparing in-person, distance, and blended learning formats in terms of students' preferences ("If you could choose the format of learning, what would you choose?") and education quality improvement ("Which format of learning do you think provides the best quality of education?").

For the purpose of analyzing distance learning experiences, respondents were asked to what extent they agreed or disagreed with the following statements:

- I was able to study effectively in an online format.
- I was able to interact effectively with other students in my online classes.
- I was able to interact effectively with other students outside of class.
- I enjoyed studying in an online format.
- I felt comfortable participating in class discussions online.
- I received the support that I needed from teachers to successfully study online.
- I was able to interact effectively with teachers outside of class.
- I have more free time since we started to study online.
- I study less effectively in an online format.
- I became less tired of studying due to distance learning.
- With a distance learning format, I often postpone my assignments.
- I like to study online more than studying offline.
- During distance learning, it is easier for me to ask questions and participate in discussions.

For the purpose of determining the benefits of distance learning, respondents were asked: «What are the positive sides of online learning at the university? You can choose all relevant answers». The following statements were suggested:

- More time to sleep and recharge
- I can study anywhere
- I spend less money (on commute, rent)
- It is more comfortable for me to participate in discussions
- I can do multiple things at once
- It is easier to receive study materials (presentations, assignments)
- It is easier to balance work and studies
- Online classes are more interesting

- I communicate with other students easier, comfortably
- I communicate with lecturers easier, less formally
- If other, please spec ify: ……. .
- I see no positive sides of online learning

For the purpose of assessing the challenges that students faced in distance learning, respondents were asked: "What are the negative sides of online learning at the university? You can choose all relevant answers." The following statements were suggested:

- Lack of personal communication with lecturers
- Lack of personal communication with other students
- Bad conditions for online learning (bad internet connection, devices)
- It is hard to find a place where I will not get distracted
- It is hard to navigate programs and platforms for online learning
- Lessons are interrupted because of bad internet connection, pranks, etc.
- It is harder to concentrate during the lesson
- It is harder to concentrate when studying by myself
- It is harder to ask and answer a lecturer's questions online.
- I feel lonely, more isolated during online learning.
- Some courses can not be studied online
- If other, please specify: ……. .
- I see no negative sides of online learning

For the purpose of evaluating students' perceptions of education quality, respondents were asked whether they were satisfied with learning overall and whether they had thought about withdrawing from the university before graduation within the current academic year. In addition, international students' perceptions of workload in distance learning were measured by asking them whether they considered distance learning to be more challenging for international students than for Russian ones.

Respondents were also asked which format of learning they currently had (in-person, distance, or blended) (offline, blended, online), whether hybrid learning was in place (where some students attend physically and others study from a distance), and where they had spent the academic year 2020/21 (in Russia or in their homeland).

The following sociodemographic characteristics were considered in analysis: home country (the list of countries was recoded into "far abroad" and "near abroad"), year of studies, type of program, field of study subject area, and levels of proficiency in Russian and English.

4. Survey Results

While all Russian universities had to switch to distance learning in March 2020 due to the COVID-19 breakout, the transition became op-

tional in the academic year 2020/21: some classes were delivered online, and others in-person, largely at the discretion of university administrators. At the moment of survey in June 2021, over one third of international students (39%) continued studying entirely online (as compared to only 10% of Russian students). One third studied in the full-time in-person learning format (33%), and one in four was enrolled in blended learning programs, with courses taught partly in classroom settings and partly online.

Hybrid learning is another quite popular format where some students attend class in-person while others join the class virtually from home (39%). Foreign students, especially from far-abroad countries, were more likely to remain in distance learning, while their Russian peers returned to in-person education (online learning was reported by only 14% of Russian students). Commitment of international students to distance learning may be involuntary: less than half (43%) of them stayed in Russia throughout the academic year 2020/21, while nearly one third (30%) did not leave their home country, almost one in five (17%) came to Russia in the midst of the academic year, and one in ten (11%), vice versa, came back to their home country during that period.

4.1. Perceptions of learning formats: international students consider in-person learning to be of higher quality

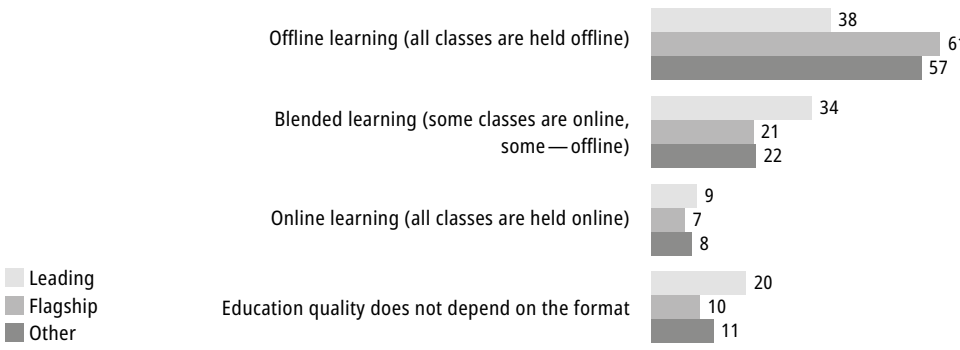
International enrollments in Russian universities do not appear to be reducing dramatically: overall, foreign students are satisfied with learning and are not showing symptoms of mass withdrawal. When answering the question about overall satisfaction, most of them agree (83%, as compared to 81% among Russian students), the "Fully satisfied" option being selected 10% more often by international students than by their Russian peers: 38 and 28%, respectively ($\chi 2 = 189$, $p = 0.000$). The overwhelming majority intends to continue education, while only 3% are planning to withdraw, and 8% are hesitant, which is only 1–2% higher than among Russian students ($\chi 2 = 42.9$, $p = 0.000$).

When evaluating their personal experiences of emergency distance learning, students expressed diametrically opposed opinions: nearly half of them (48%) liked learning online from a distance, and a slightly lower proportion (44%) did not. While 39% of international students prefer remote learning over in-person learning, exactly one half (50%) do not agree with this statement.

Neither international nor Russian students currently associate entirely online learning with quality education (Figure 1). However, foreign students are more likely to advocate for in-person learning, which is considered to be of higher quality by 47% of international students as compared to 38% of Russian students, whereas blended learning is recognized by a quarter of international (26%) and 33% of Russian students ($\chi 2 = 150$, $p = 0.000$).

However, it would be wrong to say that international students want in-person education or nothing. It is true that they are more likely to prefer classroom-based learning: 35% of international and 23% of Rus-

Figure 1. **The format of learning that provides the best quality of education, as perceived by international students, by type of university**, %.



sian students would prefer to study fully offline. However, a significant proportion of international students would choose blended learning if they had this opportunity (42%). Obviously, they highly appreciate the benefits of distance learning despite challenges of various kinds. Only 16% of international and 20% of Russian students are willing to study entirely online ($\chi 2 = 310$, $p = 0.000$).

The type of university attended plays a significant role in how international students perceive different learning formats. Students of leading universities are more likely to believe that education quality does not depend on the format and less likely to consider in-person learning to be of better quality. Education quality perceptions of international students enrolled in leading universities are similar to those of Russian students, probably because leading universities provide more adequate conditions for studying from a distance.

4.2. The upsides of distance learning: mobility and cost-effectiveness

Among the benefits of distance learning, international students appreciated quite highly the practical conveniences: mobility, relative cost-effectiveness, time optimization, and opportunity to combine work and study (Figure 2). For Russian students, these practical conveniences are even more important: describing the advantages of distance learning, they were more likely to check answers like "I have more time for sleep and rest"—52% as compared to 35% among international students ($\chi 2 = 279$, $p = 0.000$), "I can study from anywhere"—68% as compared to 53%, "It saves me money"—60% vs. 40% ($\chi 2 = 452$, $p = 0.000$), "I can multitask"—44% vs. 34% ($\chi 2 = 105$, $p = 0.000$), "Getting study materials is more convenient"—45 vs. 35% ($\chi 2 = 109$, $p = 0.000$), and "It is easier to combine study with work"— 58 vs. 36%, respectively ($\chi 2 = 495$, $p = 0.000$). That is, most Russian students have learned to make use of their extra time and financial resources, in particular combine study

Figure 2. **The upsides of distance learning as perceived by Russian and international students**, %.
What are the positive sides of online learning at the university? You can choose all relevant answers.

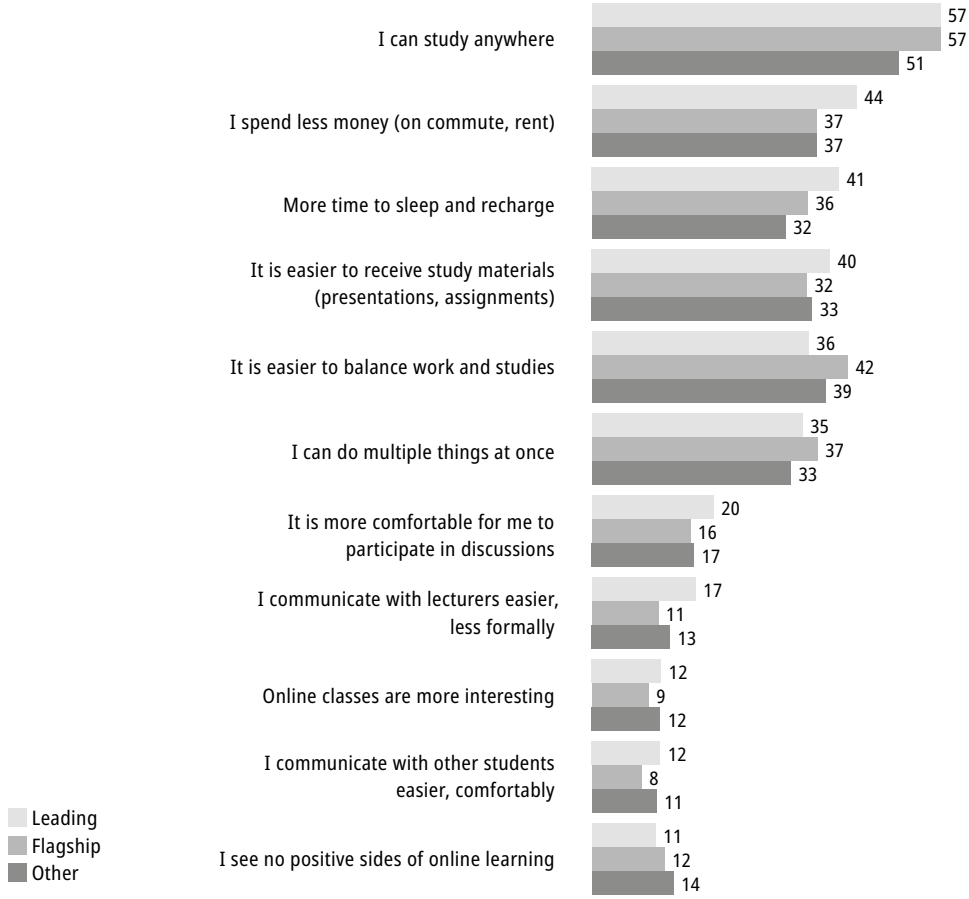
with work or other activities. For a lot of international students, apparently, those benefits are less obvious or less significant.

As for the communication aspects of distance learning, not many international students seem to like them: only 11% find it easier to interact with peers in distance learning, 15% feel more comfortable interacting with faculty from a distance, and 18% highly appreciate discussions in online classes.

Perceived benefits of distance learning differ essentially across the types of universities (Figure 3): international students enrolled in leading universities are more likely than others to check closer and more informal communication with faculty (17 vs. 11–13%, $\chi 2 = 14.4$, $p = 0.001$) and convenience of getting study materials (40% vs. 32–33%, $\chi 2 = 15.5$, $p = 0.000$). These patterns, along with the opinion that education quality does not depend on the learning format being more widespread among international students, allow suggesting that communication in distance learning was organized more effectively in leading universities.

Although from one third to one half of the surveyed international students rated distance learning as highly convenient, the overall per-

Figure 3. **The advantages of distance learning for students by type of university**, %.
What are the positive sides of online learning at the university? You can choose all relevant answers.

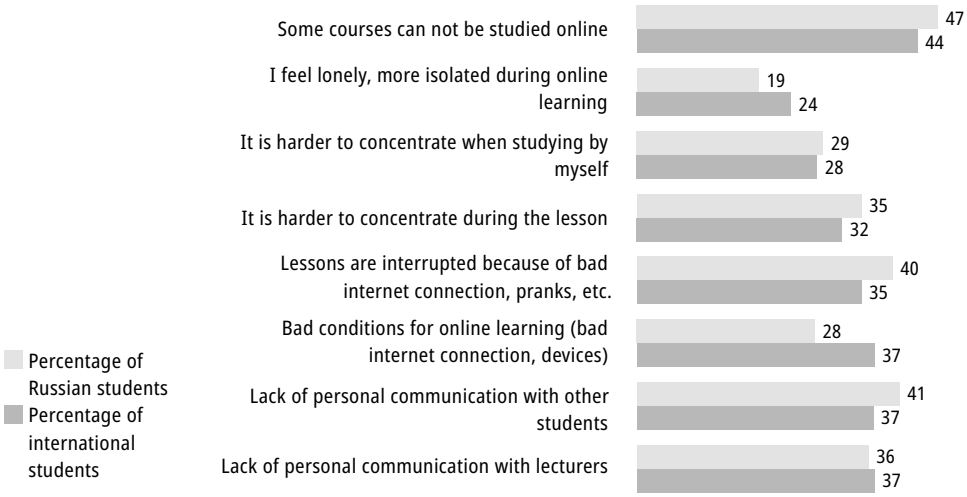


centage of those who perceive it as beneficial for themselves is much lower than among Russian students. The upsides observed by international students mostly have to do with "logistics" of distance learning—but not communication. International students of leading universities were more likely to check the benefits associated with learning organization: getting study materials, interacting with faculty, etc.

4.3. The downsides of distance learning: communication issues

Perceptions of distance learning disadvantages are quite similar between international and Russian students (Figure 4). About one third of the respondents reported socialization issues: lack of interactions with faculty (37%) and peers (36%); technical issues: poor infrastructure (36%) and internet connectivity (34%); psychological effects: difficulty

Figure 4. **The downsides of distance learning as perceived by Russian and international students**, %.
What are the negative sides of online learning at the university? You can choose all relevant answers

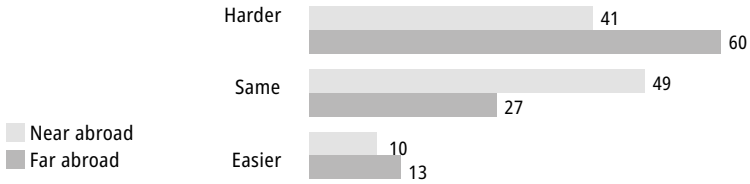


concentrating during self-study (27%) or in class (31%). Nearly half of the respondents (43%) are convinced that some disciplines cannot be studied from a distance. International students are more likely to feel lonely and isolated ($\chi2 = 19.7$, $p = 0.000$) and to report poor technical infrastructure ($\chi2 = 90.7$, $p = 0.000$) than their Russian peers. Thirteen percent of foreign students see no downsides in distance learning.

Half of the international respondents (53%) report studying less effectively in distance learning formats, as compared to 42% of the Russian students who agree with this statement ($\chi2 = 200$, $p = 0.000$). Nearly half (48%) of international students admit procrastinating more, as compared to only 34% of Russian students ($\chi2 = 518$, $p = 0.000$).

International students tend to perceive themselves as a more vulnerable category: 45% of them think that they experience more difficulty learning from a distance than their Russian peers, while one third (35%) see no difference, and only one in ten suggests that distance learning is less challenging for international students. The share of those convinced that foreign students have more problems with distance learning is higher among respondents from far-abroad countries than from the post-Soviet states (61 and 41%, respectively, $\chi2 = 183$, $p = 0.000$). Apparently, language barriers play a certain role here: the lower perceived proficiency in Russian, the more likely a student is to find it more difficult to study from a distance ($r = 0.14$, $p = 0.000$). Proficiency in Russian also correlates with some other perceived learning experiences: productivity of interactions with peers ($r = 0.18$, $p = 0.000$) and

Figure 5. **Difficulty of learning for international students in comparison to Russian students as perceived by students from far- and near-abroad countries**, %.



overall learning satisfaction (r = 0.22, p = 0.000). Naturally, students from far- and near-abroad countries differ in their Russian skills: only one in ten students from the far abroad rates their proficiency as nine or ten on a ten-point scale, compared to an overwhelming majority of students from the former Soviet Republics (79%).

Negative perceptions of distance learning are the most prevalent among international students who stayed in their home countries throughout the academic year. According to survey data, almost one third of students were unable to come to Russia; remarkably, about the same proportion of foreign students had chosen a Russian university mainly because they wanted to study in Russia. Even though international students in this category recognize, as all the others, the benefits of distance learning—possibility of studying from anywhere (nearly 60%), saving on commuting expenses (nearly 50%), etc.—they are more likely (over 40%) to check such downsides as lack of face-to-face interactions with faculty and peers as well as technical issues.

A lot of international students experienced difficulties in distance learning, mostly those associated with socialization (constraints in communication with faculty and peers), but also technical issues and mental health problems (difficulty focusing, feelings of loneliness and isolation). A considerable part of international students, especially from far-abroad countries, tend to believe that they encounter more challenges in distance learning than Russian students. Apparently, such perceptions stem from language barriers and probably also have to do with the fact that organizational issues are tougher to manage from a long distance.

5. Discussion

Emergency transition to distance learning in spring 2020 due to the COVID-19 pandemic caused some critical changes to higher education systems across the world, jeopardizing further internationalization of universities. Amidst the pandemic-induced crisis, a number of experts predicted a short-term decrease in the number of internation-

al students[6] all over the world and in Russian universities in particular for reasons associated both with the pandemic itself as well as with drops in income and, as a consequence, a decline in purchasing power. No significant reduction in international enrollments is observed in Russia, and our research finds no symptoms of mass withdrawals. This confirms the assumption of Altbach and de Wit that internationalization of higher education will continue in one form or another [Altbach, de Wit 2020].

Over the past year, international students of Russian universities have adapted to the new circumstances [Tyumentseva, Kharlamova, Godenko 2021]; in some aspects, their perceptions of learning experiences are even more loyal than among Russian students. The situation initially perceived as force-majeure had been largely routinized: international students, just as their Russian peers, adjust their learning strategies to the new formats, adapt to the downsides of the new study conditions, and recognize their benefits. It does not mean that emergency digitalization of education has been smooth and successful; rather, students tend to accept the lack of alternatives in the current educational context. Right after the first wave of COVID-19, students around the world were highly satisfied with support received from their universities, yet they were still worried about their future careers and education quality and experienced high levels of distress [Aristovnik et al. 2020]. In the long term, international students studying or planning to study in Russia may restructure their educational trajectories in the light of new alternatives, such as opportunity to study in the world's top universities from a distance at prices comparable to online tuition fees in Russian universities. Such a possibility should be accounted for in higher education management.

5.1. Reasons for preferring in-person learning

In the past academic year, international students had to study from a distance more often and were less prepared for distance learning than Russian students. With the exception of 10% of "fans" of online learning, international students are more comfortable with classroom-based education, considering it to be of higher quality and seeing less benefits and more downsides in distance learning than their Russian peers. One of the reasons why foreign students prefer in-person learning probably has to do with their motivations for studying in Russia. First, they have an opportunity to enroll in prestigious majors [Arefyev, Sheregi 2014] because for many of them, higher education programs in Russia are of better quality than in their home countries while at the same time not as expensive as in Europe. The top priority fields of study among international students are medicine and life sciences [Gromov 2017]. Professional ambitions of foreign students

[6] Mercado S. (2020) International Student Mobility and the Impact of the Pandemic//BizEd: AACSB International. https://bized.aacsb.edu/articles/2020/june/covid-19-and-the-future-of-international-student-mobility

make them gravitate toward in-person learning, which they perceive as more comprehensive and effective. Second, some students from the former Soviet Republics regard studying in Russia as a chance to emigrate. Third, there is a cohort of students from the far abroad who enroll in Russian universities specifically to study the Russian language and culture, so they want to be physically present in Russia, too [Koryagina, Korolev 2019].

Another complex reason for preferring in-person learning among international students apparently embraces socialization, technical, and mental health issues that such students encountered while learning from a distance during the past academic year.

5.2. Distance learning: how to mitigate the downsides

Above all else, international students complain about communication issues in distance learning: lack of interactions with faculty and peers or constraints in such interactions. Factors affecting communication in distance learning formats can be grouped into three main categories.

The first category is technical issues. With the emergency transition to distance learning, technical issues caused a lot of constraints, but some of them were tackled very quickly. Modern students possess advanced computer skills and learn to use new online tools easily, even though they prefer familiar programs over those recommended by universities, e. g. online communication platforms Moodle and BigBlueButton integrated with Zoom and WhatsApp [Aristovnik et al. 2020; Novikov 2020; Tyumentseva, Kharlamova, Godenko 2021]. Students also adjust quite well to the technical specifics of online communication, such as delayed responses or time differences if the student's country is in a different time zone. At the same time, the learning process can be greatly impeded by poor internet connectivity in some countries, mostly in Africa [Aristovnik et al. 2020] but in other countries as well, for instance in China, especially its remote and rural areas [Wang, Zhao 2020]. Nearly all the universities provided their students and faculty with equipment for temporary use [Abramova, Sukhushina, Rykun 2020], but obviously home infrastructure problems were not solved completely during the past academic year, since international students checked technical issues among the downsides of distance learning more often than Russian students.

The second category of factors affecting communication in distance learning is methodological issues, i. e. characteristics of online class organization and material presentation. Effectiveness of online learning depends on the designed and prepared learning material, the lecturer's engagement in the online environment, and lecturer–student or student–student interactions. "Teaching online is not simply putting learning materials online." [Aristovnik et al. 2020]. In a countrywide survey conducted in spring 2020, international students considered the main problem to be the absence of general logic in distance learning, which manifested itself in workload imbalances, lack of necessary online interactions, lack of feedback from faculty, and inad-

equate forms of practical training. The major reasons for that include faculty members' unpreparedness for online learning, their technological illiteracy, formalism, and lack of trust in e-learning [Abramova, Sukhushina, Rykun 2020]. Online delivery of material, especially when teaching international students, requires a well-defined class structure, simplified or adapted content, an opportunity for students to familiarize with lecture content and perform assignments at their own speed, and very clear instructions on using new online platforms, as instructions in a foreign language are extremely difficult to understand [Bao 2020; Novikov 2020].

The third category of factors inhibiting communication in online learning embraces language and cultural barriers, including cross-country differences in learning organization. In distance learning, international students experience even more challenges adapting to the new learning process than usual as they are isolated from the student community. Language barriers are perceived as a serious problem [Novikov 2020], first of all by students from the far abroad.

All the challenges associated with the transition to distance learning can be regarded as growth points. International students of leading universities already see more benefits in online education and give more positive ratings of its quality than in the early phase of the pandemic. Surveys show that Russian universities differ in the quality of online education [Koksharov et al. 2021], which means that there are groups of universities that were more effective in introducing distance learning practices. Such universities developed new methodological strategies that have shown good results and can be extrapolated to other types of universities. The high potential of distance learning formats is confirmed by the survey data showing that over 40% of international students would prefer blended learning.

The results of this research make it safe to suggest that remote forms of communication and learning can be applied to international students, but more caution should be exercised than with Russian students. Distance learning curricula should be adapted methodologically to meet the needs of international students. Ideally, course content and supplementary materials should be provided both in English and in the native language. It is not just language skill improvement practices that international students need; rather, they need new formats of participation in institutional academic processes. Even though some studies show that being at home during the period of distance learning contributes to more comfortable study conditions [Li et al. 2021], we suggest that on-campus experiences are critically important for increasing international students' learning satisfaction as well as for their cross-cultural adjustment [Tyumentseva, Kharlamova, Godenko 2021]. Foreign students could come to campus to take in-person exams, participate in summer and winter schools, and work on specific instructional modules. Such practices will allow them to spend some time at the university and immerse themselves into the university en-

vironment, thereby, among other things, increasing the motivation for learning in a large proportion of international students who want to actually study and work in Russia.

A number of limitations should be considered when interpreting the findings obtained. First, the survey was administered online by sending the link to the questionnaire to students via university administrators. Unequal representation of university categories in the sample, differential methods of informing students about the survey, and voluntary participation result in a number of biases that make it impossible to extrapolate the data unambiguously to all Russian universities, yet it can still be used to compare groups of students by various indicators. Another limitation on the interpretation of results is imposed by composition of the sample: international students of Russian universities come from a variety of countries in Europe, Asia, and Africa. Although the questionnaire for them was prepared in Russian and English, it is highly likely that there were students with insufficient proficiency in either language who refused to participate or gave invalid responses. Furthermore, grouping students into two large categories depending on whether they come from far- or near-abroad countries makes it impossible to account for cross-country differences, which very probably exist. In addition, the sample size does not allow making reliable inferences about differences between students form different countries or regions.

Finally, the present article covers only a small proportion of issues related to online education of international students as well as of the data obtained in the survey. In particular, it does not address specific psychological problems or learning and motivation strategies of international students in distance learning, which appear to be of high research interest.

This article was published with the support of the University Partnership Project run by National Research University Higher School of Economics.

Appendix

Table 1. **Key characteristics of the international student sample.**

Variable	Percentage of the sample,%
Gender	
Male	53
Female	47
Degree pursued	
Bachelor	69
Specialist	18

Variable	Percentage of the sample,%
Master	13
Field of study subject area	
Life sciences (chemistry, biology, physics, etc.)	10
Mathematics	2
Economics and management	15
Computer sciences	5
Engineering and technology	24
Social sciences (sociology, psychology, etc.)	6
Education and pedagogical sciences	4
Humanities (philosophy, philology, etc.)	6
Arts and culture	3
Health and medical sciences	20
Agriculture and agricultural sciences	5
National defense and security, military sciences	0,3
Physical education and sports	0,4
Type of university	
Leading	47
Flagship	10
Other	43
Survey language	
Russian	75
English	25
Region of home country	
Near abroad	56
Far abroad	44
Learning format at the moment of survey	
In-person learning (all classes are delivered on campus) offline	28
Blended learning (some of the classes are delivered in person (on campus), and others from a distance; physical attendance is not required)	22
Distance learning (all classes are delivered online; physical attendance is not possible) online	33
No classes	17
Whereabouts during the academic year 2020/21	

Variable	Percentage of the sample,%
Stayed in home country for the entire period	30
Spent some time in Russia, then returned to home country	11
Spent some time in home country, then came back to Russia	17
Stayed in Russia for the entire period	43

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Local Content Policies in the Russian Higher Education Sector:

Harming or Aiding Internationalization?

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Abstract Tensions between modernization and stability in Russia have been widely analyzed in the economic and political spheres; yet in the higher education sector, studies have mainly focused on the dominant internationalization discourse and left the demand for support and stability in universities understudied. This paper analyzes the friction between modernization and stability in educational policies, identifying the difficulties experienced when internationalizing universities and the opportunities for national governments to support academics. Through a case study devoted to the Russian higher education sector, the authors establish that the rules adopted by the government to ensure that internationalization processes are beneficial to Russian universities and to the country as a whole bear a striking similarity with Local Content policies in other spheres. The survey of Russian academics conducted by the authors reveals that the large acceptance among them of internationalization of higher education is accompanied by expectations that the state will help with capacity building and protect them from the negative aspects of a rapid integration into the international educational space. An analysis of the findings points out the benefits and risks of helping universities and their staff in the transition to international competition. Adequately calibrated LC policies are shown to aid the internationalization of higher education as they help "rub the edges off" an intensive catch-up internationalization program and support what is a "fledgling industry" in its transition to international competition.

Keywords identity, higher education, Russia, internationalization, local content policy

For citing Crowley-Vigneau A., Baykov A. A., Kalyuzhnova Ye., Gnevasheva V. A. (2021) Politika prioritizatsii mestnykh praktik v rossiyskom vysshem obrazovanii: prepyatstvie ili pomoshch' internatsionalizatsii? [Local Content Policies in the Russian Higher Education Sector: Harming or Aiding Internationalization?] Voprosy obrazovaniya/Educational Studies Moscow, no 4, pp. 147–165 https://doi.org/10.17323/1814-9545-2021-4-147-165

The global trend of internationalization of higher education sector, while it continues to spread across the globe supported by regional and international organizations, businesses and governments, is also increasingly criticized for the impact of neo-liberal values on the quality of education [Crow, Dabars 2020]. Within universities concern is voiced in different ways, from researchers struggling to meet publication requirements, to lecturers lamenting the standardization of higher education [Gill 2016]. Outside universities, civil society through different vectors objects to the amounts spent by governments on projects to make universities globally competitive and emphasizes the human consequences of accelerated university reform [Gao, Li 2020].

These trends in the higher education sector share many common features with internationalization in other sectors, the liberalization of which can lead to foreign companies overtaking national ones in production and revenue earning on the domestic market. In order to support the national economy, in high-value industries, specific measures are sometimes developed and implemented by the government: local content policies (LC policies) [Kalyuzhnova et al. 2016]. These localization measures vary in their design, wording and lifespan but usually require foreign players while operating on the national market to use domestically manufactured goods or services, employ local people and share their expertise with them [Kalyuzhnova, Belitski 2019]. LC policies have for goal to help a country develop its own industries and assist them in becoming internationally competitive over time, rather than protecting them forever from foreign competition [Tordo et al. 2013].

This paper applies the concept of LC policy to the higher education sector in an attempt to understand how governments deal both with the negative consequences of their internationalization programs and the demand for stability emanating from a large number of universities. National universities in some cases appear as "fledgling industries" unprepared for international competition, and excessive liberalization may lead to the closure of universities, depriving lecturers of their livelihoods and entire regions of motors of economic development. The authors argue that measures adopted by national governments to avoid some of the excesses of intensive internationalization programs, including measures to control the quality of higher education, measures to ensure there are no security breaches, measures to address brain-drain problems and measures to social unrest can be assimilated to LC policies. This in turn helps to understand why these measures are adopted and the way to make them more efficient.

Russia was selected as a case study to determine how LC policies affect the internationalization of higher education for several reasons: the relatively rapid transition from the Soviet higher educational system to the implementation of active government-led internationalization programs means resistance is more visible in Russia than in

countries that have made the transition to internationalization more progressively. Likewise, the need for LC policies is more acute in countries with "accelerated" internationalization programs. While the Russian case provides a concentrated view of the phenomena studied, the findings are generalizable to all countries with recent and ambitious excellence in higher education programs.

Tensions between modernization and stability in Russia have been widely analyzed in the economic and political spheres [Zweynert, Boldyrev 2017]; yet in the higher education sector, studies have focused on the dominant internationalization discourse and left popular discontent with the rapid integration of universities in the global market largely understudied. Through the case study of internationalization of Russian universities, the authors examine how LC policies temper the intense internationalization programs adopted by the government. The paper attempts to determine whether these LC policies negatively impact internationalization processes or whether they support them by helping adapt them to the local context. An original survey of 100 Russian academics from 81 Russian universities reveals that while internationalization is widely accepted along with the assessment of universities' performance based on international rankings; the demand for protection from the state and for the development of Russian content measures remains strong. An analysis of the findings points out the benefits of helping universities and their staff in the transition to international competition.

Theoretical background on LC policies and their relevance to Higher Education

LC policies in the academic literature

The concept of LC policy has primarily been explored in the field of management, with a focus on studying their use in high value-added industries.

The definition of LC policies as "multidimensional and a vehicle for enabling the start up of economic activity, technological catch up, human capital accumulation, and sustaining demand for local goods, work and services. It is also concerned with ownership structure and a transfer of property rights to domestic industrial actors or champions." [Kalyuzhnova et al. 2016. P. 3] guides the authors' general understanding of LC policies as measures created by a government to ensure that the local population benefits more from economic activities than foreign entities. This perspective reveals that LC policies are long-term policies that have for objective to increase over time the part played by local people and resources in the process. LC policy thus appears as a plan to impose and then remove LC regulations depending on the evolution of a specific industry. The need for LC policies depends on the level of development of countries and their ability to compete on the international market, with developed countries being less likely to develop LC policies than less developed economies. A variety of different instruments have been used by governments implementing LC policies, including giving the priority to local employees, home sourcing of goods and services and preferential treatment of local firms.

LC policies are commonly associated with the oil and gas sector and the automobile sector but the concept could be used beyond the spheres it is traditionally applied to. Research on specific aspects of LC policies has led to discussions regarding the utility of developing local requirements for foreign aid procurement [Warner 2017], for renewable forms of energy [Kuntze, Moerenhout 2013], in the healthcare industry [Hufbauer et al. 2013]. Many authors focus on the economic and financial aspects of LC policies, however LC may be guided more by political imperatives than financial reasons. Indeed it would seem most countries did not consider the "costs and benefits of alternative policy options" before implementing LC policies [Tordo et al. 2013. P. xiii]. This consideration opens the door to a wider understanding of LC policies, which may be designed for political, security or other reasons.

LC in Higher Education sector

While any sector could have elements of LC policy, history provides the most examples in the mineral sectors, the automotive and the pharmaceutical industries. One can draw a parallel between LC requirements in the energy and resources industry, and policies designed to enhance the local contribution to projects realized in the educational, environmental or any other spheres. While the huge financial impact of projects in high value-added industries can explain a country's decision to implement LC policies; it may be that LC regulations, under another name, are also being implemented in other spheres. While the financial incentive to promote LC policies in the realization of educational, cultural or other projects may be less decisive, governments may have political or other reasons to encourage firms, universities and other players to choose local rather than international players when carrying out projects.

LC policies are currently emerging in a variety of different fields such as the higher education sector as revealed by this study. While LC policies in all sectors share common characteristics, the circumstances of their emergence and the main actors involved in their realization may vary. The researchers developed a targeted definition of LC policy for the higher education sector to address the specificities of this sector. LC policies in the sphere of higher education can be defined as measures developed by the government to ensure that the internationalization process serves the interests of the national education system and the country as a whole. LC policies in higher education resemble those in other spheres in that they provide privileges to domestic players [Ovadia 2014], aim to increase the value of their products [Kalyuzhnova et al. 2016], promote local inputs at different stages of the value-chain [Sturgeon, van Biesebroeck 2009] and are considered a means of enhancing socio-economic development [Kalyuzhnova, Belitski 2019]. LC policies in higher education differ from those in other spheres in that they focus more on security and social issues and comparatively less on economic ones. Universities, regardless of higher education becoming a market, still differ from firms as their mission

goes beyond profit-making to educating a population and being both a consolidator and generator of a country's knowledge. While higher education has been affected across the globe by a wave of liberalization and privatization, it remains in most countries a public good due to the impact it has on the social capital of a society and on the socio-economic development of a country [Locatelli 2019]. Additionally, while LC measures are often explicitly named in other industries; in the sphere of higher education, the idea of promoting national content is not explicitly formulated, at least among the documents relating to current LC policy in the Russian Federation. The reason for this is multifold: the concept of LC policy has not yet been applied to the sphere of higher education nor has its benefits been analyzed, the dominant international discourse focuses on the limitless internationalization of higher education [De Wit 2017] and the idea of promoting national/local content in any sphere, which is not economic, may attract criticism.

Context of internationalization of the Russian higher education sector and LC measures adopted by the government

Context of internationalization of Russian higher education sector

The internationalization of the Russian education system began with the dissolution of the Soviet Union. Russia, as it transitioned to a market economy, experienced an economic crisis in the 1990s, which had a significant impact on the higher education system. Universities lacked funding to function properly and lost many qualified lecturers and researchers to other spheres and other countries. The 1992 Federal Law "On Education" offered a new legal framework for the changes, which had been taking place in the educational system and overturned the previous system in several significant ways: It allowed for the creation of private higher education establishments, paid educational services and partnerships with foreign universities in education and research. While the 1990s were focused on restructuring and overcoming the economic crisis, the liberalization of the Russian economy during that period led to a demand for economists and lawyers capable of meeting the needs of the market economy. Innovation became a priority in the higher educational system starting in the 2000s and Russia was assisted in its post-crisis reform by international organizations (OECD, World Bank). Russia's involvement in the Bologna Process from 2003 led to a harmonization of its educational standards with EU universities with the implementation of a two then a three-cycle degree system and the adoption of ECTS credits. Russia also created roadmaps on the other key Bologna objectives including the mobility of students, teaching staff and university administrators, developing quality assurance, and encouraging student-centered learning. The Russian government launched in the 2000s a series of projects aimed at improving the quality of higher education and supporting the emerging economy. The Federal Universities project launched in 2006 merged several universities in the Russian regions and had for goal to improve the standards of education and develop the links between universities, businesses and federal authorities. Promoting partnerships and joint research

projects between universities and businesses allowed for an inflow of private funding and for more dynamic technological innovation. The 2009 National Research Universities project had a more international orientation with participating universities selected on a competitive basis receiving funding to increase their research activities in order to be able to compete with universities on the global arena.

Alongside these projects, more specific initiatives were developed such as the Mega-grants project (project 220), launched in 2010 with substantial funding (400 million $ over three years). Project 220 aims at improving the quality of research in Russia by instituting monetary grants made available on a competitive basis to support scientific research projects implemented with the world's leading experts in the field. In order to achieve world-class research results and with the help of world-renowned scientists, Russian universities should set up research laboratories of a global importance, create links with leading universities worldwide and commercialize the research results and new technologies which have been developed.

The initiatives of the 1990s and the 2000s to reform Russian Higher Education lay the foundations for the more ambitious reforms, which flourished in later decades. The Russian government launched in the 2000s a series of projects aimed at improving the quality of higher education and supporting the emerging economy (including the Federal Universities and the National Research Universities projects) which laid the foundations for the more ambitious reforms, which flourished in the 2010s and led to the transition of a number of universities to a Western 'managerial' model [Yatluk 2020]. 2012 stands out as a rupture date in Russian higher education, with the launch of Project 5–100, an initiative which not only has internationalization as an aim but which reflects a new set of values including a focus on research, global competition for students and faculty members, a strive for excellence and the adoption of a new stakeholder-oriented business model in universities. While the projects before 2010 share common characteristics such as promoting structural reforms, supporting the national or regional economy, solving internal migration and employment issues, Project 5–100 openly states the ambition of building highly competitive world-class universities capable of excelling on the world stage. Launched by the Presidential Decree of the Russian Federation No. 599, Project 5–100 uses international expertise at each stage of its development, from its design with the participation of World Bank Experts J. Salmi and P. Altbach and the creation of roadmaps for universities with international consultants to the assessment of university performance by the international expert committee based on international rankings and criteria such as the proportion of foreign students and faculty. Project 5–100 reinforced the competition between Russian universities from the outset, by selecting out of a wide pool of candidates the universities with the best potential for international growth. While the majority of participants improved their positions both in nation-

al and international rankings; non-participants either followed closely the new trends and benefited from spill-over effects of the project or became marginalized, with a number being closed down by the government.

LC measures adopted by the government

The tension between governmental ambitions of modernization and globalization on the one hand and stability on the other has been described in studies of Russian economics and politics [Zweynert, Boldyrev 2017]. Although the Russian government is perceived as having aggressively promoted the internationalization of higher education; it has also developed a number of measures aimed at dealing with contestation and at managing the risks associated with the internationalization of the higher education sector. An extensive reading of primary and secondary sources, including Russian legal acts and the media reports, covering the period 2000–2020, enabled the authors to identify a wide range of measures by which the government attempted to address resistance to the internationalization of universities and solve the problems linked to the implementation of excellence in higher education programs. The information collected was manually coded in three stages with the last stage allowing for the emergence of four main themes, which became the original categories presented in the study. The four main categories each target a specific challenge: measures to control the quality of higher education, measures to ensure there are no security breaches, measures to address the brain-drain problem and measures to uphold traditional Russian values and avoid social unrest. There is no existing literature on LC policies in higher education as it is a novel application of the concept, however a number of scholars have explored some of the key issues making up these categories, as illustrated in Table 1.

While the structure and the content of what is taught at Russian universities have undergone significant changes in order to be compatible with the international higher education system, the Russian government has preserved a high degree of centralization and control over the organization of higher education. While neo-liberalism and international best practices point to the advantages of allowing universities to be regulated by market mechanisms, the Russian experience of decentralization was originally largely unsuccessful. In the 1990s, the state lost its credibility and the power to finance and control social structures including higher education: regional authorities acquired the right to authorize and regulate higher education activities and the expanding demand for higher education led to a sudden increase in the number of universities. The period was also characterized by a lack of funding, a growth of private universities, a diversification of programs on offer, a mismatch between the demands of the market and the training programs and a decline in the quality of higher education [Androushchak, Kuzminov, Yudkevich 2013]. In the 2000s, the government proceeded to recentralize higher education,

Table 1. **LC Policies in Higher Education and existing literature**

Types of LC measures in Higher Education	Existing literature
Measures to control the quality of higher education	Androushchak Kuzminov, Yudkevich, 2013; Yudkevich Altbach, Rumbley, 2015; Sterligov, Savina, 2016; Agasisti et al., 2018; Chirikov, 2021
Measures to ensure there are no security breaches	Persson 2021; Denisova-Schmidt 2016.
Measures to address the brain-drain problem	Kniazev, 2002; Torkunov 2017; Subbotin & Aref 2021
Measures to uphold traditional values and avoid social unrest	Abramov et al. 2016; Oleksiyenko 2021

Source: Authors' compilation

establishing state standards in order to improve the quality of education. Most universities are currently directly attached to the Ministry of Education and Science, the Ministry of Agriculture and the Ministry of Health and Social Development and have to report to them. A dedicated department was created inside the federal ministry, the Federal Service of Inspection and Control in Education and Science which is in charge of opening, merging and closing universities, accrediting and monitoring the quality of educational programs, financing higher education and allowing universities to create fee-paying programs, establishing quality standards (Law 29.12.12 273-FZ. 2012). Every year, all universities have to report on around 150 performance indicators related to their educational and research activities, financial management, human resources and international activities; following which the figures are compiled to determine their efficiency. From 2012, the state proceeded based on this data to close, reorganize or merge a significant number of universities. This trend of recentralisation and state control over higher education is a LC policy, which brings back a Soviet practice of unification, considered to be the only reliable way in the current context to maintain the credibility of the Russian educational system as a whole.

The second category of LC measures elaborated by the Russian government aims at ensuring that there are no security breaches linked to the internationalization of the higher education sector. Indeed, education at all levels is a tool in the hands of states, which they use to maintain and expand their political power. Education appears in this light as a security issue and external influence on the higher education system

affects states in different ways. Globalization has limited the autonomy of the state in many issues, including education and has led to «shifts in solidarities within and outside the national state». When encouraging the intervention of foreign players in Russian universities, the government remained conscious of the fact that internationalizing a country's educational system carries some risks because when a country opens up to an external influence it is hard to assess what it consists of, who the actors behind the scene are and what the long-term impact will be [Crowley-Vigneau, Baykov, Kalyuzhnova 2020]. Internationalization programs funded by the government are generally designed in such a way as to ensure that control of the project remains on the Russian side. The government seeks to protect higher education projects from unsanctioned foreign influence. In Project 5–100, foreigners contribute their know-how at all levels and inform strategic decision-making, but the final word always belongs to the Russian Ministry of Higher Education and Research and to members of the 5–100 Project Office with both structures being entirely controlled and populated by Russian citizens. This national control remains controversial as inefficient universities that are strategically important in their region continue to receive funding in Project 5–100 in spite of their worsening performance in international rankings. The government's decision to shield inefficient universities from the reputational risks of being excluded from the project is a LC decision, which takes into account the ripple economic and social effects of stripping a university of its reputation.

For security reasons, the government has also created a number of LC measures in order to ensure it maintains control on research related to strategic or confidential topics and on their funding. The void experienced by Russia during the 1990s led to foreign actors playing a decisive role in internal issues and acquiring confidential information. The Yeltsin government during its first years in power made developing relations with the West its absolute priority. The first Soviet-American private Foundation "Cultural Initiative" appeared in 1988, «opening an opportunity of direct application for Russian scholars to the Western funding source of academic activities, bypassing government structures». International organizations (World Bank, OCDE) and non-governmental organizations (the "Open Society Institute", the Aga Khan Foundation) also had a significant influence on national higher education systems in the Post-Soviet space, and the funding offered to Russia "came with strings attached in the form of certain conditions". By the end of the 1990s a large number of US organizations (McArthur, Ford, Carnegie etc.) were operating in Russia, providing funding to Russian researchers to carry out specific research which in some cases revealed Russia's inside state information or data related to the state of its natural resources or defense system. Disillusionment with Western-style reform and the 1993 upheaval of the political system led to a progressive change in Russia's foreign policy, which became more assertive, and the desire to protect its national interests.

In order to ensure that the new wave of internationalization did not result in the disclosure of confidential information, the Russian government has taken a number of LC policy measures to ensure that research is funded by approved sources. The controversial law "On Making Amendments to Certain Legislative Acts of the Russian Federation Regarding the Regulation of Activities of Noncommercial Organizations Performing the Functions of Foreign Agents" implemented in 2012 requires organizations "to inform the federal agency for state registration about the amount of funding and other property received from foreign sources <…> as well as about the intended and actual uses" and states that the information provided will be analysed by the anti-terrorist government institutions. Non-commercial organizations receiving funding from foreign states or citizens and which attempt to influence political or strategic decision-making or to shape public opinion are considered to be foreign agents and as such are submitted to more rigorous checks of their activities. A number of organizations funding independent scientific research shut down their activities in Russia after being labeled foreign agents, among them the Mc Arthur foundation. Universities do however benefit from some exemptions from the legislation on foreign-agents when engaging in educational and scientific activities. Federal Law № 121-FZ of 2012 is an LC policy, which allows the government to control the information about Russia, which is provided to other countries and to prevent foreign governments or individuals from gaining control over political and social processes in Russia. Other measures aimed at reducing espionage, such as a February 2019 directive, which encouraged scientists to inform their superiors about and take colleagues to meetings with foreign scientists proved too restrictive and were cancelled[1]. Striking the right balance between protective LC measures and internationalization measures requires constant trials and adjustments.

The Russian government has also developed LC measures in order to counter one of the side effects of the internationalization of the higher education sector: the outflow of qualified students and experts. Russian official statistics reveal that around 35 thousand scientists left Russia in the 1990s, which had a serious impact on the development of science and higher education in the country. This problem remains vivid today with Russian President Vladimir Putin declaring in April 2020 his intention to draw up additional measures to stop the outflow of scientists and university professors from Russia. Existing measures for funding research aim at preserving Russian and attracting foreign human capital. While encouraging Russian students to study abroad, the government strives to ensure that they return and contribute their know-how to the development of their home country.

[1] *'Russia scraps criticized restrictions on scientists foreign contacts'//The Moscow Times, 10 February 2020.* https://www.themoscowtimes.com/2020/02/10/russia-scraps-criticized-restrictions-on-scientists-foreign-contacts-a69220

An example is the Global Education Program, funded by the Russian government, which offers Russian citizens the opportunity to enroll in full-time graduate or post-graduate studies in the areas of science, engineering, medicine, education and management in the social sphere and has for target to develop Russian human resource potential. In order for the program to serve its final purpose, the program comprises a clause, which requires students to return to Russia upon completion of their studies to work for a period of three years in an approved list of companies and thus aims to avoid a brain drain. Russia's National Technology Initiative launched in 2014 aims to make the country a technological leader by bringing back emigrated scientists among other measures. Projects like Megagrants give priority de facto if not de jure to Russian emigrated scientists for the role of leader of the laboratory, promoting their return home.

The fourth category of LC policy measures was designed to uphold traditional Russian values and avoid social unrest. The need to defend Russia's history, culture, language and values remains a priority in Russia as demonstrated in studies of Russian presidential addresses. Russian values are linked to the country's Soviet history. The belief in equal opportunities and a paternalistic state leads to expectations that the government will fund higher education and not only provide free tuition but also stipends to talented students. Soviet education was free for anyone who had the ability to enroll and higher education was an effective social elevator. The introduction of tuition fees in Russian universities in the 1990s led to the creation of a dual tuition track system in which students can apply for highly competitive state-funded places or for less competitive fee-paying places. While students with the means to pay for their education have better chances of being admitted to the program and university of their choice, "budget" places are more prestigious and wealthy students may strive to enroll in them for this reason. The impact of neo-liberalism on Russian higher education is highly controversial and the demand for more equal chances appears in public debates and academic articles. While internationalizing universities, the Russian government decided to maintain subsidized places with around 40% of all students studying for free in 2019.

The federal government also develops and protects the main universities in the Russian regions for economic and social reasons. The Federal Universities project seeks to ensure that each Federal District can train the experts required by the local economy. In Project 5–100, universities were selected not only based on their objective performance during the competition, but also on the government's strategic goals and the need to develop different Russian regions. Some universities may not have had a huge international development potential, but were included because they provide experts for a specific industry, which needs to be developed (such as Samara University for the aerospace industry and Sechenovsky University for healthcare development). The development of some regional universities was also

supported in order to stop huge immigration flows towards universities in Moscow and Saint Petersburg. Rather than allow market mechanisms to take their course and possibly lead to a fundamental redistribution of people on the Russian territory, the government seeks to control these processes with LC policies aimed at slowing the liberal transition of the higher education system.

The Russian state also faces some resistance to internationalization by academics nostalgic of the Soviet system or those averse to change because they cannot be competitive on the international stage. A study of post-soviet countries showed that 'resistance identities' are common among those who have the most to lose from globalization processes, and this applies to university faculty members. While the Russian government aims to bring research into universities and seeks alignment with the international model of research universities, rather than risk direct confrontation, it has elaborated a step by step approach taking into account the interests of all parties. This type of LC policy is motivated by a tactical choice to preserve some traditional practices and ensure a smooth transition to international best practices. While in 2004, by creating a joint Ministry of Education and Science, the Russian government showed the intention to unite these two fields (which in 2018 was split into a Ministry of Education and a Ministry of Higher Education and Science), a significant portion of research is still performed in stand-alone think tanks and institutions. The first efforts to reform the Russian Academy of Science and its affiliate institutions were undertaken in the 2000s and led to a confrontation between a group of academics resisting reform and the government. While the Minister of Education and Science D. Livanov noted in 2013 that in the XXI century organizing academic research separately from universities was pointless and the Academy was reproached with a lack of transparency, prioritizing fundamental research over innovations output and an age distribution problem, the government recognized the need to pace out the reform over several decades. The prestige and reputation of the Russian Academy of Sciences, which is 296 years old, the high level of trust of the Russian population towards it and its values (that fundamental science should be funded by the state and performed per se and not to reap economic benefits) make it difficult for the government to engage in a radical reform. The LC policy in this case takes the form of a moratorium on change.

Survey of Russian academics: methodology and findings

Survey methodology

In 2020 in order to determine whether there is, under the conditions of successful internationalization, a demand for LC policy measures in Russian Higher Education we carried out a Survey. The goal was to clarify academics' attitude to LC policy as an instrument to help promote and protect Russian content in the sphere of higher education, which is currently undergoing a rapid internationalization process. The survey sample included representatives of Moscow universities as well as

of regional universities. The sample size was 100 experts, who are part of an informal all-Russia network of scholars, which works on jointly developing research projects in different fields. The list of surveyed academics, even though it was created based on a pre-existing database, was designed to be representative of the country as a whole and includes lecturers, associate professors and professors from 81 different universities in 35 different federal subjects. Even though a deliberate attempt was made to represent various types of scholars and lecturers, specialised in a myriad of subjects and at different stages of their career, their participation in this academic network testifies to high levels of motivation and activity. While this limitation may have a moderate impact on the results of the study, it makes the surveyed scholars less likely on average to support LC policies than scholars outside the network. Rolled out during the first half of 2020, it reflects current trends in academics' perception of internationalization processes and LC policy. The survey results were processed through Google forms and R-Studio.

The research instrument was a questionnaire that included 5 closed questions (See Appendix 1) designed to reflect current trends in Russian academics' perception of internationalization and understanding of LC policy. The Survey examines three key issues: whether respondents believe that the participation of Russian universities in the international educational space is necessary, whether the success of this participation should be assessed through a system of international ratings and whether the Russian higher education system should be supported and protected by the state. Indeed the purpose of the survey is to establish whether, in conditions of successful internationalization, academics are ready to by-pass LC policies or whether the demand for them remains strong. This helps to further clarify whether internationalization and LC policies are indeed compatible.

The first question focuses on the respondents' perception of the level of internationalization of the Russian higher education sector. It considers to what extent Russian universities form a part of the international higher education system. The opening question does not aim to reflect an objective reality but the subjective perception of each respondent. The second and third questions focus on international ratings, the former considering whether an external and foreign evaluation is needed to assess the work of Russian universities and the later reflects the respondent's opinion on whether these ratings should formally be used by the government to assess their performance. The third question, while in appearance similar to the second, contains a key distinction linked to the involvement of the state. Indeed while the second question deliberately remains vague when invoking "educational status" and determines whether respondents think international rankings could be used as a general reference point; the third question asks respondents whether the Russian state should use international rankings to determine whether universities are efficient,

Figure 1 **Degree of Integration of Russian universities in the global system**

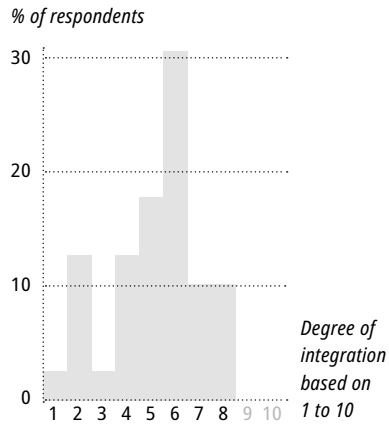
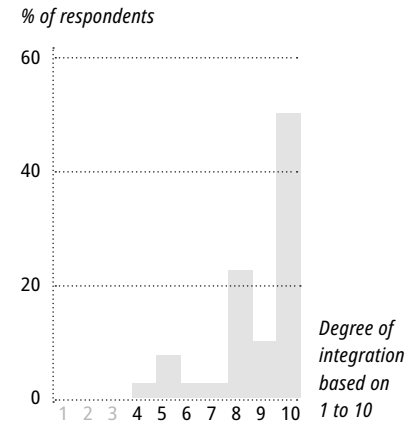


Figure 2. **On whether Russian Universities should participate in international ratings to confirm their educational status**



Source: Authors illustration

which would have a direct impact of the funding universities receive. The first three questions reflect the respondent's perception of how internationally oriented Russian universities should be, revealing their attitude to internationalization and the ways it has affected their profession. Questions four and five concentrate on two aspects of LC policy, the first looking at whether the state should create rules to ensure that the findings of Russian scholars and the specificities of Russian education are represented to a certain level in educational programs to avoid a complete westernisation of the content of Russian higher education. The last question considers whether Russian higher education should be protected by the state against external influences, such as foreign funding and control.

Depending on the question, respondents were required to choose on a scale from 1 to 10 to assess the degree of a phenomenon or to choose one of five different options. The answers to the questions were first processed separately and then the linkages between them were explored.

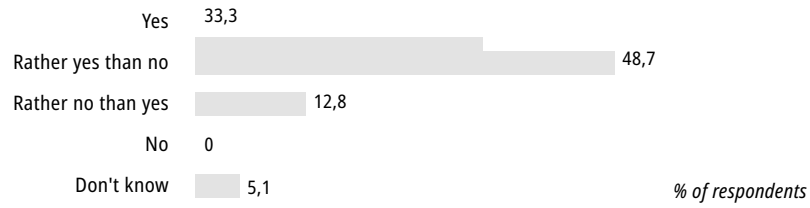
Survey findings

The survey reveals that while there is a shared belief that Russian universities should strive towards international integration, that Russian content should nevertheless be protected by state policies.

Answers to question 1 (Figure 1) reflect the fact that the level of integration is perceived as average by the majority and as low by a small proportion of respondents. No one defined the Russian Higher Educational sector as fully integrated in the global system.

Answers to the second question (Figure 2) indicate that the ma-

Figure 3. **On whether the State should use international ratings to evaluate the work of Russian universities**



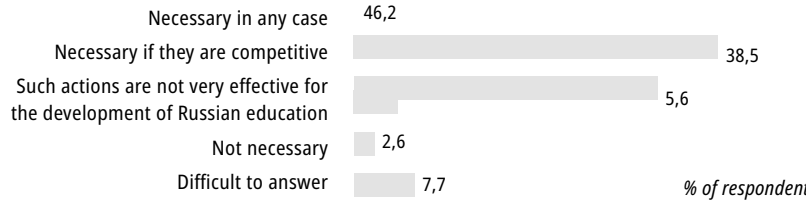
Source: Authors illustration

jority of respondents believe that Russian universities need to use international rankings to assess their performance, with the majority of answers falling into the 8–10 range. The lowest grades corresponding to a rejection of the use of international rankings were not selected. A minority of respondents selected middle range answers, reflecting the need to use occasionally, but not systematically, international rankings to confirm the educational status of universities. This dominant acceptance of international rankings among academics could be linked to an absence of authoritative Russian rankings or to a real desire to see Russian universities develop in an international competitive environment and meet those criteria set forward by international rankings.

Answers to the third question (Figure 3) reveal that over 80% of respondents agreed completely or to some extent with the fact that the Russian state should use international ratings to assess the performance of Russian universities (with 0% of respondents being in complete disagreement with this fact). Taken together, responses to questions two and three reflect a high level of acceptance of the fact that Russian higher education should be integrated in the international arena, revealing an agreement with the state policy to make Russian universities competitive in the international arena. Answers to these two questions also reveal a consistency in academics' responses: international rankings are important reference points for Russian universities and as such should be used by the state to determine their efficiency and track their progress.

Reponses to question four (Figure 40 reflect a strong support among academics of the fact that the state should legislatively and normatively ensure that the findings of Russian scholars and the specificities of Russian education are represented in Russian educational programs. These findings reflect the strongly anchored belief that Russian content should be protected by the state, with almost half considering that this support should be given regardless of whether Russian scholars and their ideas are competitive and 38.5% considering that support should be given only if they are competitive. These answers can be explained by a need to see Russian content (ideas, authors) in Russian educational programs and possibly the desire to give

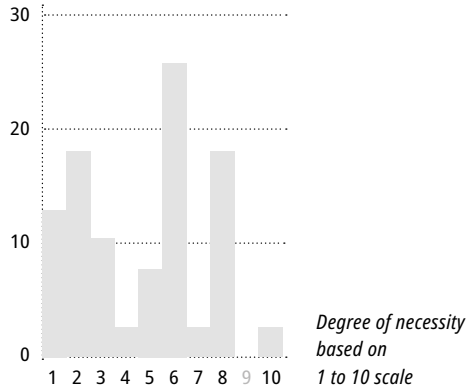
Figure 4. **On the need to legislatively and normatively support the use of the achievements of Russian education and science in the Russian higher education sector**



Source: Authors illustration

Figure 5. **On the need to legislatively and normatively protect the Russian educational sector from international influences**

% of respondents



Source: Authors illustration

Russian scholars the support they need in order to become internationally competitive.

While the first three questions reflect an acceptance of international integration, answers to the fourth question reveal that the majority of academics view the support of the state as key in this process, to ensure that Russian scholars, principles and ideas are given "a fighting chance" in the new competitive environment. The survey findings show a clear demand for the protection of Russian content and for the state to implement LC policies. Concretely, it means that the state should offer priority to Russian content, to Russian scholars over foreign ones in the realization of different projects and when creating educational programs not because they are more competitive but because it is necessary to support a national "industry".

The fifth question (Figure 5) reveals a lack of majority consensus among academics about whether the state should protect the Russian higher education sector from international influences. The distri-

bution of answers to this question is the most disperse among all the questions, with two statistically significant and polarized groups of respondents becoming apparent: one that believes the Russian higher education sector requires protection and another assessing that by and large it does not. These results reveal that half of respondents believe that there is an international threat to the Russian higher education sector requiring state intervention.

Two conclusions can be made based on these findings: There is a common understanding among respondents that the participation of Russian universities in the international educational space is necessary and that the success of this participation should be assessed through a system of international ratings. There are common expectations that Russian higher education should be supported and, to some extent protected, by the state. This survey reflects the fact that while the policy of internationalization of the Russian state is accepted; there is a significant demand for the development of LC policies aimed at promoting Russian scientific and education content and, to a lesser extent, at protecting Russian higher education from uncalled for foreign intervention.

Discussion: LC policies help an "infant industry" adapt to international competition

The analysis of Russia's current LC policy in the sphere of higher education and of the results of the survey on demand for LC policies among academics suggests internationalization and LC policies can harmoniously co-exist and even that the later can help support an active internationalization process. First, because de facto existing LC measures have not disrupted the implementation of Project 5–100 and second because successful internationalization has not eliminated the demand for LC policies as reflected in the Survey findings.

The effect of these measures on internationalization depends on their design and wording. LC policies in the higher education sector in Russia do not seek to limit the number of foreigners as the emphasis is currently put on internationalizing universities. On the contrary, international actors are being brought into Russia to share best practices and help Russian universities to become globally competitive. However, LC policies are constantly being elaborated by the government with several aims: to protect the country against security threats and breaches in confidential information, to control the brain-drain of qualified academics, to ensure that its higher education system is efficient and adapted to local needs and values. While the concrete LC measures taken in the sphere of higher education may differ from other sectors, they are used for similar reasons: to protect the region/country from excessive foreign interference and to ensure a smooth transition to conditions of international competition. The Russian higher education system appears in this light to be a "fledgling industry" in need of state support. LC policies allow the educational system some extra time to mature: indeed the highly ambitious Project 5–100 is tempered by a

series of cross-measures aimed at preserving social stability. LC policies appear as an effective way to protect a country against some of the repercussions of an intense "catch-up" internationalization program. While LC policies are often designed to be limited in time, the Russian transition away from these measures appears to not yet have started.

LC policies are often categorized as protectionist measures and undergo criticism for being an obstacle to internationalization (Warner 2017). Their use in the field of higher education is understudied, but from the academic literature they appear to be more frequently employed in countries that have adopted "catch-up" strategies as regards the internationalization of higher education and government-led programs aimed at promoting the global competitiveness of their universities (e. g. China, Taiwan, South Korea, Russia) than in countries that progressively internationalized their higher education systems (e. g. the U.S., Great Britain). Measures that can be qualified as LC policies in higher education have been documented in Taiwan [Lo, Hou 2019] and in China [Lin, Wang 2021; Wei, Johnstone, 2020] and focus on promoting quality over competitiveness in the teaching process, social responsibility towards regional economies and on preserving national values. LC policies are more likely to be developed in countries where resistance to internationalization is the most robust and where internationalization is viewed as and likened to westernization, but they come across as measures to address resistance rather than as an attempt to overturn the internationalization of higher education, as reflected by the Russian case study presented in this paper.

As Russian Project 5–100 comes to a natural close by the end of 2021, the upcoming launch of the ambitious new "Priority 2030" initiative (Governmental Decree 3697-p, 2020) reveals that while the Russian government intends to maintain its course of rapid internationalization of higher education and to support its global competitiveness, it also plans to integrate into the design of the new project LC policy measures aimed at addressing some of the concerns of Russian academics. Priority 2030 shares many common features with Project 5–100 [Appendix 2], including the fact that universities are to be selected to participate on a competitive basis, the focus on developing research and state funding. However, Priority 2030 is being designed to support a larger number of universities, to encourage inter-university cooperation through the creation of consortiums of universities, to contribute to the development of Russian territories and the local economies, to meet nationally defined goals rather than just progress in international rankings. While the projects share the final goal of internationalization and becoming globally competitive, the second aims to promote a more even development of regions with its wider coverage (100 versus 21 participating universities) and has changed its reference points to national ones; responding to some degree to academics' demands to support the growth of less competitive universities and to shield university staff from excessive competition.

Conclusion

This paper analyzes the tensions between modernization and stability in the higher education sector, identifying the difficulties experienced when internationalizing universities and the opportunities for national governments to support academics. Through a case study devoted to the Russian higher education sector, the authors establish that the rules adopted by the government to ensure that internationalization processes are beneficial to Russian universities and the country as a whole bear a striking similarity with LC policies in other spheres. The survey of Russian academics reveals that the large acceptance among them of internationalization of higher education is accompanied by expectations that the state will help with capacity building and protect them from the negative aspects of a rapid integration into the international educational space. LC policies are shown to aid the internationalization of higher education as they help "rub the edges off" an intensive catch-up internationalization program and support what is a "fledgling industry" in its transition to international competition. The changes accompanying the transition from Russian Project 5–100 to the Priority 2030 initiative reflects the desire to meet the popular – and academic according to our findings- demand for more LC policies all the while maintaining the previous trend of internationalizing universities.

Appendix 1

Survey Questions

Q1: Rate the degree of integration of Russian Higher education in the global system
Q2: To what extent do Russian universities need to participate in international ratings to confirm their educational status?
Q3: Should the Russian state use international ratings to evaluate the performance of Russian universities?
Q4: To what extent should the state legislatively and normatively support the use in the Russian educational field of the achievements of Russian education and science?
Q5: How necessary is it to legislatively and normatively protect the Russian educational space from international influences?

Appendix 2

Comparing the features of Project 5–100 and Priority 2030

	Project 5–100	Priority 2030
Project participants	Individual universities	Consortiums of universities
Coverage	Limited (21 universities)	Wider (100 universities)
Selection method	Competition	Competition
Official goal	International competitiveness of universities	Reaching national priorities/development of Russian territories
Performance reference point	Progress in international rankings	Reaching nationally defined goals
Financing	State (minimum 20% co-financing of university)	State (co-financing to be defined case by case by the government)

	Project 5–100	Priority 2030
Key features	Developing university-based research and international publishing	Developing university-based research and teaching quality
Summary	International goal, international wording	International goal, national-priorities wording

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Predictors of Russian Students' Financial Literacy: The PISA 2018 Results

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Abstract

Based on the OECD PISA financial literacy data released in 2020, Russian students' strengths and deficits are analyzed to examine the relationship between financial literacy and a variety of factors. Regression analysis shows that both individual and school-related characteristics are significant predictors of students' performance in financial literacy. In particular, when controlling for socioeconomic status (SES), non-cognitive factors, and school climate, 15-year-old girls score lower on financial literacy than boys of the same age (b = –7.04, p < .05). Family SES is positively associated with financial literacy scores (b = 15.24, p < .01), and school SES demonstrates an even stronger association (b = 35.78, p < .01). Among non-cognitive factors, interest in money matters (categorical variable) and confidence in dealing with money matters (b = 7.95, p < .01) play a significant role. Teacher behavior hindering learning has a negative effect on financial literacy (b = –4.72, p < .05). The findings are used to develop practical recommendations for promoting financial literacy, addressed to both teachers and parents.

Keywords

financial literacy, PISA, international large-scale assessments, multilevel analysis, non-cognitive factors.

For citing

Kolachev N. I., Rutkovskaya E. L., Kovaleva G. S., Polovnikova A. V. (2021) Faktory finansovoy gramotnosti rossiyskikh shkol'nikov na primere rezul'tatov issledovaniya PISA-2018 [Predictors of Russian Students' Financial Literacy: The PISA 2018 Results]. *Voprosy obrazovaniya / Educational Studies Moscow*, no 4, pp. 166–186. https://doi.org/10.17323/1814-9545-2021-4-166-186

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How Schoolmates Affect Your Chances of Getting into College:

School Socioeconomic Composition and Inequality in Access to Higher Education

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Received in August 2021

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Abstract

The problem of socioeconomic inequalities in Russian education takes on particular significance in the context of massification and increasingly differential quality of higher education. Relevant research is mostly focused on individual student characteristics and regional aspects as factors for inequality. Less often, researchers' attention is attracted to school factors, such as school socioeconomic composition (SEC) which is considered one of the most powerful school predictors of student achievement. The long-term effect of school composition on students' educational trajectories remains underinvestigated, although higher education is more important for life chances than school achievement.

In the present study, Russian data (the Higher School of Economics' project Trajectories in Education and Careers) is used for the first time to measure the effect of school SEC on educational choices and chances of getting into college. This effect is analyzed successively for key decisions and outcomes at every stage of long-term educational trajectories. Analysis is performed with due regard to the specifics of Russian education and the sorting of students into the academic and hybrid tracks in pursuit for college degrees.

School composition is found to be positively associated with proceeding from middle to high school, obtaining a college degree, and pursuing a Master's degree. The largest influence of school SEC on college enrollment is observed for students who enroll in vocational studies after middle school. The compositional effect is extremely robust and persists even when student achievement and family characteristics are controlled for. Adding school SEC to the model offsets the effect of individual socioeconomic status on the likelihood of going to college, which means that exclusion of SEC from analysis may lead to invalid inferences in educational research. The effects detected cannot be explained by differences in achievement, so it would be reasonable to explore the social mechanisms behind the compositional effect in further research. School desegregation measures suggested on the basis of prior findings may turn out to be hasty and overly drastic in practice for russian context.

Keywords

academic track, school socioeconomic composition (SEC); compositional effect; hybrid track, inequality of educational opportunity; selective colleges.

For citing

Kersha Y. D. (2021) S kem uchit'sya, chtoby popast' v vuz: sotsial'no-ekonomicheskaya kompozitsiya shkoly i neravenstvo dostupa k vysshemu obrazovaniyu [How Schoolmates Affect Your Chances of Getting into College: School Socioeconomic Composition and Inequality in Access to Higher Education]. *Voprosy obrazovaniya/Educational Studies Moscow*, no 4, pp. 187–219 https://doi.org/10.17323/1814-9545-2021-4-187-219

Along with school education, higher education has traditionally been regarded as a powerful social elevator, leveler of opportunities, and driver of social mobility [Brown 2018; Esping-Andersen 2015; World Economic Forum 2020]. Higher education gains particular significance in post-industrial societies where, according to the principle of meritocracy, educated and talented individuals are supposed to take advantageous positions in the social structure [Shkaratan 2011], and where cases of upward mobility—when children achieve higher levels of educational attainment than their parents—are perceived as a successful step toward sustained socioeconomic growth and development [Aiyar, Ebeke 2019].

On the one hand, the higher education system does actually cope with its duty of levelling life chances. Over the recent decades, higher education has shifted from being a privilege for a small elite to a mass phenomenon: access to tertiary programs has been growing rapidly around the world, and the number of people with college degrees is constantly growing.[1] By 2012, the gross tertiary enrollment ratio reached 90% in 14 countries [Marginson 2016a]. Higher education becomes a good investment in one's own human capital for almost anyone. In addition to improved skills and knowledge, tertiary schooling also yields economic returns in the form of higher lifetime earnings [Blagg, Blom 2018; Moretti 2004; Psacharopoulos, Patrinos 2018].

On the other hand, there is ample evidence that massification of higher education tends to exacerbate the socioeconomic gap rather than narrow it. In a number of aspects, education systems reproduce the existing social structure, ensuring the transmission of cultural capital and privileges across generations in advantaged families [Bourdieu, Passeron 1977]. Among European and U.S. college graduates, for instance, coming from higher socioeconomic backgrounds is still associated with higher occupational and earning returns [Jacob, Klein 2019; Triventi 2013a].

Why does it happen? According to the *effectively maintained inequality* theory, even if universal access to some level of education is provided, within-level differences will begin to emerge [Lucas 2001]. Tertiary education is highly stratified, advantaged families being able to afford choosing the best educational options for their children in terms of quality and future occupational outcomes [Marginson 2016b; Triventi 2013b]. Selective institutions with the highest levels of academic performance and education quality are mostly attended by students from families with a high socioeconomic status (SES) [Prakhov 2015; Prakhov, Yudkevich 2012; Khavenson, Chirkina 2018; Shishkin 2006; Jerrim, Chmielewski, Parker 2015]. The same students tend to enroll in majors

[1] UNESCO (2020) Towards Universal Access to Higher Education: International Trends. https://globaleducationforum.org/wp-content/uploads/2021/10/DOC-11-Towards-universal-access-to-higher-education-international-trends.pdf

associated with better chances of labor market success [Blagg, Blom 2018; Triventi 2013a; 2013b; Wolniak et al. 2008].

Furthermore, despite the globally increasing participation in higher education, social origin inequalities in access to college are still continuing. Having a college-educated parent and coming from a high-SES family is still associated with better chances of getting into college [Argentin, Triventi 2011; Chesters, Watson 2013]. In the Russian context, the problem of inequality in access to higher education is particularly acute today, compared to previous periods, as the growing stratification of the system creates significant barriers to inclusion [Malinovskiy, Shibanova 2019]. A number of findings show that students from upper-class families are more likely to go to college [Kosyakova et al. 2016; Roshchina 2006; Khavenson, Chirkina 2018; Shishkin 2006; Konstantinovskiy 2012] and perform better in admission tests [Prakhov, Yudkevich 2019], while universal access to higher education basically turns out to be a myth [Bessudnov, Kurakin, Malik 2017]. Remarkably, the effects of social background on getting into college are significant even when prior academic achievement is controlled for [Kosyakova et al. 2016; Khavenson, Chirkina 2019]. Essential regional differences are observed as well, as higher education programs and their quality are distributed unevenly among the federal subjects of Russia, explicitly leading positions being held by a very limited number of regions [Malinovskiy, Shibanova 2020].

The end of middle school (Grade 9) in Russia, when students choose between high school and vocational studies, is a particularly important milestone, as this transition is where inequality of educational opportunity starts. According to the 2019 statistics, only 51% of middle school graduates proceeded to high school, as compared to 68% in 2001 (a downward trend). At the same time, there has been an increase in the percentage of students who leave school after Grade 9 and enroll in vocational programs (around 34%).[2] Very few of them obtain higher education down the road. Most often, withdrawal before high school is observed among low-SES and low-achieving students. For this reason, the educational transition after middle school is considered even more important a factor of inequality than the transition after high school (11th grade), when student composition is less heterogeneous [Bessudnov, Kurakin, Malik 2017].

However, transition to a vocational institution after middle school does not cut off access to higher education, quite the contrary. The hybrid track (middle school—vocational studies—college) has been gaining popularity lately [Alexandrov, Tenisheva, Savelyeva 2015]. The advantage of this pathway toward higher education is that it mitigates the risks associated with high-stakes testing (graduates of vocational

[2] Bondarenko N. V., Gokhberg L. M., Kuznetsova V. I. et al. (2021) *Indikatory obrazovaniya: 2021: statisticheskiy sbornik* [Indicators of Education in the Russian Federation: 2021: Data Book], Moscow: NRU HSE.

track can get into college without passing a Unified State Exam (USE)). According to the latest findings, it is mostly low-performing students from advantaged families who use the hybrid track as a bypass strategy. However, this trajectory is fully accessible to low-SES students as well, so it also contributes to inequality reduction to some extent [Yastrebov, Kosyakova, Kurakin 2018].

In the majority of publications on factors of inequality in access to quality higher education, the primary focus is placed on student/family SES, one of the pivotal factors of educational outcomes in general [Hattie 2009; Sirin 2005]. Less attention is paid to a similar indicator at the level of school: socioeconomic composition (SEC).

For the first time, socioeconomic composition of educational institutions came into focus of sociological research in Coleman's 1966 report [Coleman 1966]. School SEC is understood as student SES characteristics aggregated over the school, i. e. the school's average SES that measures advantage and disadvantage for the entire school composition instead of individual families. In his study, Coleman showed that although school characteristics are less important than individual ones for academic achievement, SEC is the strongest school-level predictor of student performance. A recent study applying more advanced methods to the same data revealed that compositional effect of school on educational outcomes can even be a few times stronger than the student-level effect of family resources [Borman, Dowling 2010].

The strong effect of peer average SES on student achievement has been confirmed by researchers from different countries—Belgium, United States, England, Australia, and others [Opdenakker, Damme 2007; Palardy, Rumberger, Butler 2015; Strand 2010; McConney, Perry 2010; Slik van der, Driessen, De Bot 2006]—and, more importantly, from different academic disciplines [Ewijk van, Sleegers 2010]. A methodology for measuring the so-called compositional effect was developed to assess the independent contribution of school SEC to student achievement.[3] Applied for the first time to a Russian sample, this methodology showed that attending a low-SEC school results in a significant decrease in academic achievement regardless of student ability, family SES, and some other characteristics. If the same child attended a high-SEC school, their educational outcomes would be better irrespective of their baseline skill level [Kersha 2020].

It is no surprise that a factor with such a strong influence on school achievement affects longer educational trajectories as well. However, few studies measuring long-term compositional effects are available even beyond Russia—and this despite the fact that the longer-term consequences of school SEC are more important than near-term effects on achievement as the former have greater implications for students' life [Palardy 2014]. The few available recent studies have doc-

[3] For a review of relevant literature and methodology description, see [Kersha 2021].

umented a positive association between SEC and college enrollment [Palardy 2013] as well as college persistence and completion [Niu, Tienda 2013]. There is also evidence that the relationship between school SEC and college destinations are non-linear [Klugman, Lee 2019].

No similar analysis of long-term compositional effects has been performed in the Russian context. International studies do examine the impact of SEC on enrollment in college programs of different duration, but they provide no information on how SEC affects college enrollment for students in different educational tracks. Does school composition affect early school leavers' chances of getting into college? Is this effect determined by the choice of educational trajectory alone, or does it also apply to students within the same track? Neither is there data on the relationship between school SEC and longer-term educational choices, i. e. participation in graduate and doctoral programs.

This study seeks to answer four research questions:

1. How is school SEC related to choosing the academic track at the end of middle school?
2. How is school SEC related to college enrollment for high school graduates and middle school graduates who transitioned to a vocational institution? Are there track-related differences in this connection?
3. How is school SEC related to college completion? Are there track-related differences?
4. How is school SEC related to pursuing a graduate degree?

Answers to the questions posed above will allow not only documenting the presence or lack of independent SEC effects on participation in higher education but also establishing at which stage and for which category of students the compositional effect is the strongest as well as how and when it emerges—the latter being the focus of most research works in the field today.

1. Research Methodology

1.1. Sample

Data from the panel study Trajectories in Education and Careers (TrEC)[4], administered by the Higher School of Economics' Institute of Education since 2011, constitutes the empirical basis of the present research. The first round of TrEC was based on a representative sample from the Trends in International Mathematics and Science Study (TIMSS-8), which involved 4,893 eighth-graders from 210 schools across Russia. In 2012, almost all the same students participated in the Programme for International Student Assessment (PISA). Further on, the same school students—and later vocational and college students and graduates—were surveyed every one or two years. As of now, nine rounds

[4] http://trec.hse.ru/

Table 1. **TrEC rounds and sample size in 2011–2020.**

Round	Period	N of respondents
TIMSS8	2011	4,893 (100%)
Round I	2012	3,377 (69%)
PISA	2012	4,399 (90%)
Round II	2013, fall/winter	4,138 (85%)
Round III	2014, spring	4,239 (87%)
Round IV	2015, spring/fall	3,618 (74%)
Round V	2016, spring	3,866 (79%)
Round VI	2017, fall	3,954 (81%)
Round VII	2018, fall	3,793 (78%)
Round VIII	2019, fall	3,732 (76%)
Round IX	2020, summer	3,743 (76%)

Grey color indicates rounds used in the present study.

of the panel study are available, providing data for the period from 2011 through 2020. Data has been collected using survey methods (online survey, telephone survey, interview). Administrative data and data from parent, teacher, and school principal surveys are also available for some of the rounds. The key survey topics are students' participation in education and their educational and career trajectories.

To answer the research questions posed, this study uses data from nine rounds of TrEC that allow tracing how students build and move along their long-term educational trajectories. By the end of the study, 76% of the first-round sample was left (Table 1). Weight coefficients are used to minimize the effects of non-random attrition and keep the data representative [Bessudnov et al. 2014].

1.2. Variables

At the stage of data analysis, four milestones in respondents' educational trajectories were selected as outcome variables: choosing the academic track after middle school, college enrollment, college completion, and pursuing a graduate degree.

Choosing the academic track after middle school. A dichotomous variable is introduced for all the middle school graduates, coded 1 if the student proceeded to high school, and 0 if they chose any other track, i. e. transferred to a vocational school or some other educational institution or withdrew from the education system.

College enrollment. Because Russian school students have two ways of getting into college, college intentions are analyzed depending on the choice made in the previous transitional point. For this purpose,

two different variables are used as dependent in different subsamples. For those who proceeded to high school, the outcome variable is coded 1 if the respondent reported being enrolled in college one year after graduation from high school and 0 if not. Additionally, the probability of attending a selective college (1) vs. a nonselective one (0) is assessed for high school graduates admitted to college. Selective college is understood here as an educational institution with the mean Unified State Exam score of at least 70 among the students admitted in 2013–2014 [Prakhov 2015]. For the subsample of middle school graduates who transitioned to a vocational institution, the outcome variable is coded 1 if the respondent reported being enrolled in college in at least one round of TrEC after 2014 (Rounds IV–IX). College selectivity is not assessed in this case, as information on college status is only available for a small proportion of this respondent category.

College completion. In addition to college enrollment, TrEC data also allows tracing whether the respondents persisted through their selected track and successfully obtained their college degrees. For this purpose, a variable is constructed on the basis of data from the last round (six years after high school or eight years after middle school) to reflect whether the respondent had a college degree (1) or not (0) by then.

Pursuing a graduate degree. The study also looks at whether the respondent was a graduate student between 2017 and 2020. This information is used to construct a variable coded 1 if the respondent was enrolled in a Master's degree program and 0 if not.

The main predictor variable is school SEC, measured as the percentage of students with college-educated mothers (parental education being the strongest predictor of individual SES [Erola, Jalonen, Lehti 2016; Triventi et al. 2016]) in the relevant cohort of a specific school. Based on the distribution of SEC, all the schools in the sample are divided into three equal parts, or tertiles: low-SEC (0–27%), medium-SEC (29–52%), and high-SEC schools (52–100%).

Since a sizeable proportion of students leave school after Grade 9, the socioeconomic composition of those who proceed to high school changes. School leavers are mostly students from low-SES backgrounds, so the average percentage of high-SES peers (those with college-educated mothers) increases from 46% in middle school to 56% in high school. For this reason, two SEC variables are created for students proceeding to high school: SEC (middle school) and SEC (high school).[5] In models using high-school SEC, students who changed school after Grade 9 (about 10%) are excluded from analysis as no information is available on their new school.

The methodology for calculating the compositional effects to measure the independent contribution of school SEC to students' educa-

[5] The indicators are included in different models as being correlated quite highly with each other (0.92).

tional trajectories requires that prior student achievement and family SES are included in the models [Thrupp 1995]. In addition, the models also account for a number of student- and school-level control variables that may be important factors shaping educational trajectories. The final set of predictor variables looks as follows:

- Gender (female = 1, male = 0);
- Family SES (mother has a college degree = 1, mother has no college degree = 0);
- TIMSS-2008 scores (interval scale from 1 to 1,000 points);
- PISA-2012 Reading scores (interval scale from 1 to 1,000 points);
- Basic State Examination (BSE)-2012 scores in Russian and Mathematics (ordinal scale from 2 to 5);
- Unified State Exam (USE)-2014 scores in Mathematics and Russian (interval scale from 1 to 100 points);
- Region of residence (Moscow, Moscow Oblast, Saint Petersburg = 1, other = 0);
- Tuition (government-funded = 1, self-funded = 0);
- School SEC (percentage of students with college-educated mothers in the relevant school cohort);
- Type of school locale (urban = 1, rural = 0);
- School type (regular school = 1, elite school/gymnasium = 0).

1.3. Analysis Strategy

The data is analyzed using Multilevel Logistic Modelling (MLM) [Sommet, Morselli 2017]. This method is chosen for two reasons:—the outcome variables are dichotomous;—the data has two levels because students are grouped into schools. The main purpose of applying MLM is to assess the probability of an event happening as a function of the set of student and school variables.

This study uses a random intercept, fixed slope model in which the probability of an event may vary across schools. Level-1 units are students, and level-2 units are schools. Student variables include gender, family SES, academic achievement, region of residence, and tuition. School variables include SEC, type of school locale, and school type. The general model formula looks as follows:

$$\text{Logit}_{(\text{odds})} = B_{00} + B_{10} \cdot x_{ij} + B_{01} \cdot X_j + u_{0j},$$

where B_{00} is the average log-odds that the outcome variable equals one when all predictor variables are set to zero; B_{10} is the average effect of level-1 variable x_{ij} on the odds ratio; B_{01} is the average effect of level-2 variable X_j on the odds ratio; and u_{0j} is the deviation of level-2 log-odds from the average log-odds.

When it comes to not only defining whether an effect is positive or negative but also measuring its magnitude, interpretation and cross-model comparison of odds ratios in logistic regression can be really challenging [Norton, Dowd 2018], the most preferred alterna-

tive being average marginal effects (AME). In the present study, average marginal effects show how the average probability of an event changes if a particular predictor variable changes by one (or by one standard deviation (SD)) with all the other covariates fixed at their reference levels. Since SEC is the main predictor variable, only the average marginal effect for this variable is presented in the results section. The constructed regression models are used to calculate the predicted probability of specific events after graduation for students from schools with different SEC (from 0 to 100%) and assess the average marginal effects of a change in SEC by one SD (23%).

All the interval variables are standardized before adding them to the models. Descriptive statistics for unstandardized variables are given in the online appendix (Table 11), available here. Where logical discrepancies between different rounds of TrEC are revealed (e.g. the respondent reported having never engaged in higher education but obtained a college degree by the last round), responses are recoded as missing values. All the multilevel logistic models are constructed separately for Mathematics and Russian, with a focus on the former. Indicators of achievement in Russian (BSE, USE) and Reading (PISA-2012) are only used to test the robustness of results because, strictly speaking, PISA-2012 Reading scores cannot be used as direct indicators of prior achievement in Russian. In accordance with the research questions about the effects of school SEC not only on students' trajectories but on their further educational decisions within a track as well, analysis is performed for each subsample independently [Puhani 2000]. A detailed description of regression results for different model specifications and the Stata 16 code are given in the online appendix.

1.4. Limitations

There are a few limitations to the methodology used in this study. First, only data for the cohort of eighth-graders is used to assess school SEC due to the lack of access to information about family SES of all school students. If family SES varies a lot across cohorts within a school, it may affect the accuracy of SEC measurement. It is assumed, however, that there are no major differences among cohorts within schools and, consequently, within regions. Second, despite using panel data, there is no way to directly measure the academic progress and reliably control for prior achievement, as required by the SEC measurement methodology. Available TIMSS, PISA, and State Final Exam (SFE; includes both BSE and USE) scores are obtained with different test instruments. As TIMSS is more similar to SFE, it is used as an indicator of prior achievement when making allowance for SFE in the main phase of analysis. Third, at some stages analysis was impossible to perform for students in the hybrid track due to the small size of this category.

2. Results

2.1. How school SEC is related to choosing the academic track at the end of middle school.

According to TrEC data, 61% of middle school graduates proceeded to high school in 2012. The rest of the students did not choose the ac-

ademic track and either transferred to vocational schools (37%) and other educational institutions (1%) or decided to withdraw from education (2%). At this stage already, educational trajectories differ as a function of SEC (Figure 1). While nearly 80% of ninth-graders proceed to Grade 10 in high-SEC schools, the respective proportion in low-SEC schools is only 47%.

The analysis of factors shaping educational trajectories at this stage confirms previous findings: low-achieving and low-SES students are more likely to withdraw from school after Grade 9 (online appendix, Tables 1–2). Of no less importance is school SEC, even when student characteristics are controlled for. The probability of proceeding to Grade 10 is 47% in schools where no student has a college-educated mother, which is almost twice as low as in schools where mothers of all students have a college degree (83%) (Figure 2). This effect remains virtually unchanged when achievement at the end of middle school is added to the model, which means that high achievement is not the reason why students in high-SEC schools are more likely to choose the academic track.

2.2. How school SEC is related to college enrollment.

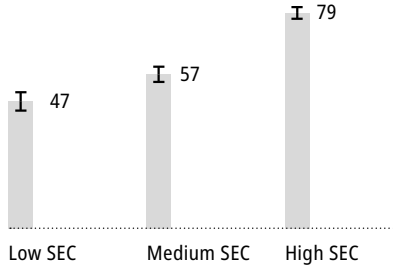
Of those who chose the academic track and proceeded to Grade 10 without changing school-53% of middle school graduates in 2012–82% were admitted to college after graduation. In 2015, one year after admission, 80% of them were still college students, while 12% were enrolled in vocational programs, and 7% were not engaged in any type of education. Of those who entered higher education, 37% were admitted to selective colleges.

The overwhelming majority (93%) of high school graduates from high-SEC schools went to college (Figure 3), as compared to only 63% in low-SEC schools, which is significantly lower than even in medium-SEC schools. About half of the graduates from high-SEC schools (49%) and less than 25% of those from low-SEC schools were admitted to selective colleges.

College intentions of high school graduates are associated with their academic achievement (TIMSS Mathematics and USE scores), type of school locale, and school SEC (online appendix, Tables 3–4). For the highest-SEC schools, the probability of high school graduates enrolling in college approaches 100%, which is significantly higher than in the lowest-SEC schools (75%) (Figure 4). Similar effects are observed for SEC measured in middle school, chances of getting into college also being higher for students from high-SEC schools (online appendix, Table 3).

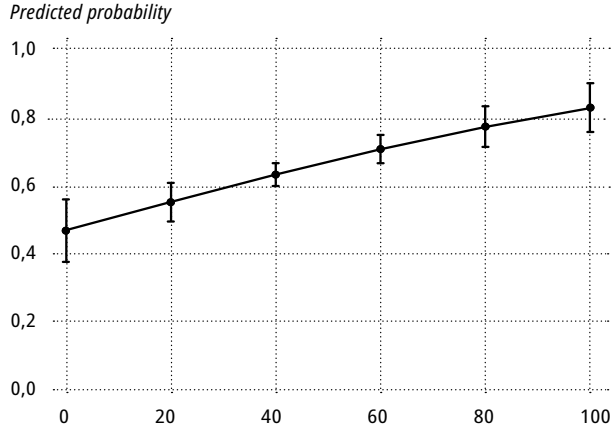
Other factors come into play when assessing the probability of getting into a selective college, not just any college (online appendix, Table 3). Region of residence turns out to be the strongest predictor, chances of attending a selective college being much higher for students living in Moscow, Moscow Oblast, and St. Petersburg (where

Figure 1. **Percentages of middle school graduates proceeding to high school as a function of SEC.**
(Percentage of middle school graduates proceeding to high school)



Here and elsewhere in this article, mean values (CI = 95%) are given in charts.

Figure 2. **Predicted probability of proceeding to high school as a function of school SEC.**



With all the other covariates set at their sample mean values, AME = 9%.

most of such colleges are concentrated) than for those in other cities, towns, or rural areas. With the region of residence controlled for, compositional effects on choosing a selective college are rather weak (Figure 5); and with the test scores in Russian added to the model, the effect of SEC becomes altogether insignificant (online appendix, Table 4).

Of those who transitioned to a vocational institution right after completing middle school-37% of the cohort in 2012–34% reported being enrolled in college in at least one of the TrEC rounds that followed. The hybrid track was most often selected by students from high-SEC schools (53%). Among the respondents from low-SEC schools, only 23% went to college after vocational studies (Figure 6).

By contrast with the academic track, it is not student achievement but school SEC that becomes the decisive factor of college enrollment

Figure 3. **Percentages of high school graduates enrolled in college as a function of school SEC.** (Percentage of high school graduates enrolled in college)

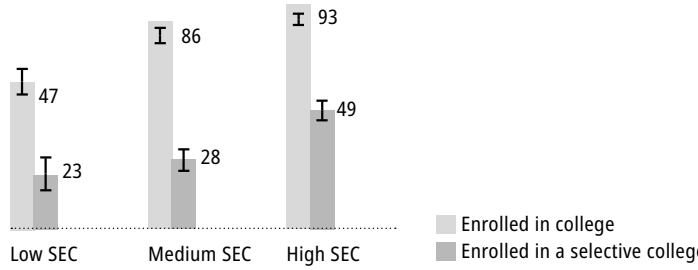
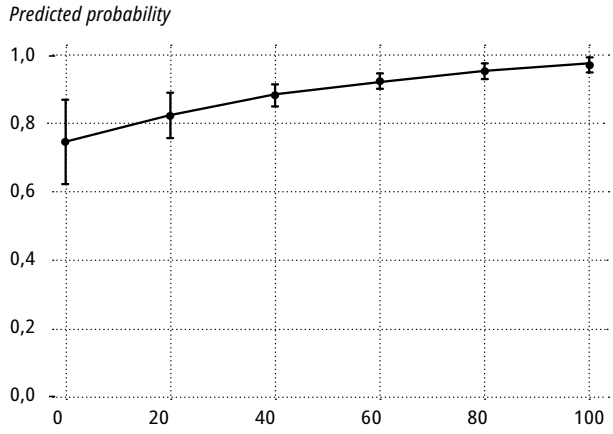


Figure 4. **Predicted probability of college enrollment after high school as a function of school SEC.**



With all the other covariates set at their sample mean values, AME = 5%.

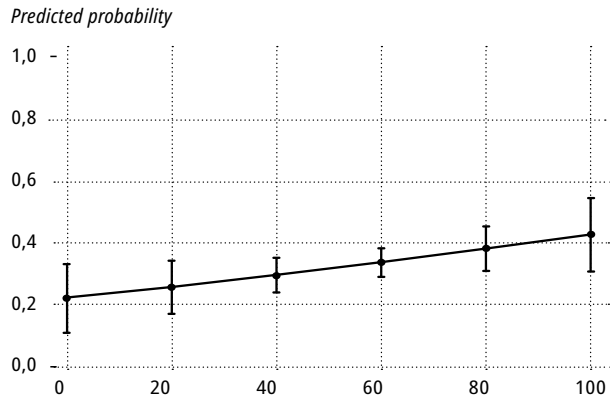
for students in the hybrid track (online appendix, Table 5–6). The probability of getting into college after vocational studies is 85% for the highest-SEC schools and 22% for the lowest-SEC ones (Figure 7).

2.3. How school SEC is related to college completion.

By the last round of TrEC, 44% of the respondents had a college degree. Among the graduates from low-SEC schools, on average 27% had obtained higher education by 2020 (both tracks) (Figure 8), which is more than twice as low as among the graduates from high-SEC schools (66%).

Of the respondents who enrolled in college immediately after graduation from high school, the percentage of college degree holders is very high, ranging from 81 to 86%, as compared to only 27–35% in the hybrid track. In this case, no significant variance in compositional ef-

Figure 5. **Predicted probability of getting into a selective college after high school as a function of SEC.**



With all the other covariates set at their sample mean values, AME = 5%.

Figure 6. **Percentages of middle school graduates transitioning to vocational programs who later enrolled in college.**

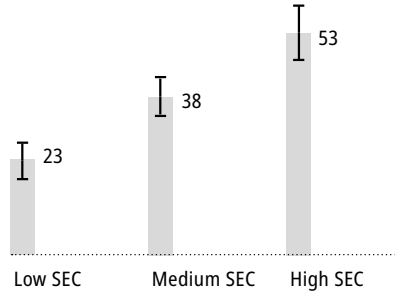
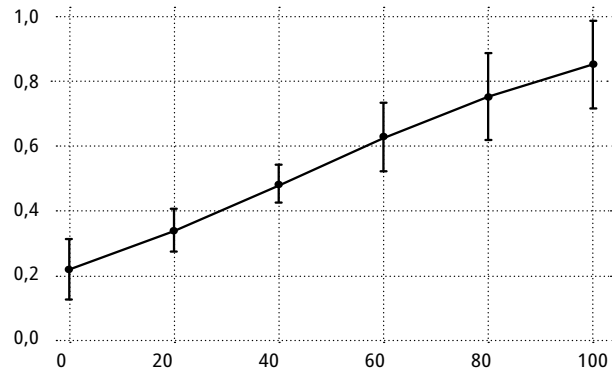
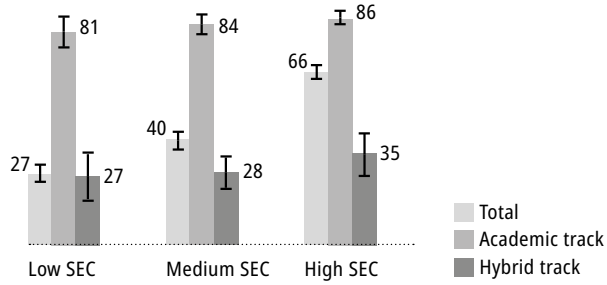


Figure 7. **Predicted probability of college enrollment after vocational studies as a function of SEC.**



With all the other covariates set at their sample mean values, AME = 17%.

Figure 8. **Percentages of college degree holders among school graduates as a function of SEC.** (Percentage of college degree holders)



fect is observed: once the trajectory has been selected, SEC seems to have no influence on student persistence.

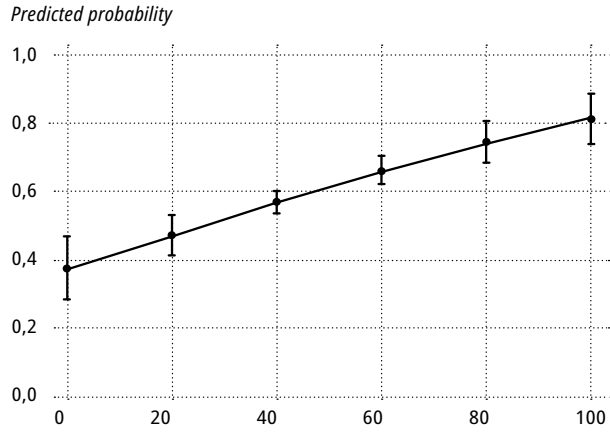
The inferences made are confirmed by the results of regression analysis (online appendix, Tables 7–8). Along with female gender and high level of academic achievement, school SEC contributes to college persistence in the complete sample. The probability of obtaining a college degree is more than twice as high for graduates from schools where all peers have college-educated mothers (81%) than for students from schools where no peer has a college-educated mother (38%) (Figure 9). Nevertheless, when analysis is performed separately for each track, compositional effects become insignificant.

2.4. How school SEC is related to pursuing a graduate degree.

In 2020, 16% of the last-round respondents reported having been a Master's degree student at least once between 2017 and 2020, i. e. they at least enrolled in a graduate program. Among graduates from low-SEC schools, only 6% pursued Master's degrees (Figure 10), as compared to 27% of the graduates from high-SEC schools. The percentage of respondents enrolling in Master's programs is considerably higher among high school graduates with college degrees than among students in the hybrid track. In the latter case, no more than 6% of respondents (graduates from medium-SEC schools) pursue Master's degrees, while in the academic track, the percentage of Master's degree students varies from 21% for graduates from low-SEC schools to 39% for graduates from high-SEC schools.

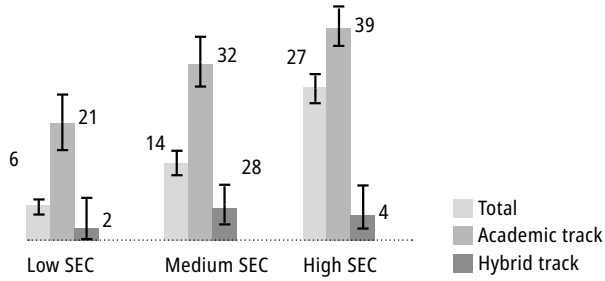
Along with academic achievement, school SEC is a key factor increasing the likelihood of pursuing a Master's degree (online appendix, Tables 9–10). The average probability that a graduate from the lowest-SEC school will enroll in a Master's program is 8%, as compared to 37% for graduates from the highest-SEC school (Figure 11). The compositional effect within the academic track is similar. However, the aver-

Figure 9. **Predicted probability of college completion as a function of school SEC.**



With all the other covariates set at their sample mean values, AME = 11%.

Figure 10. **Percentages of Master's degree students among school graduates as a function of SEC.**
(Percentage of graduate students)



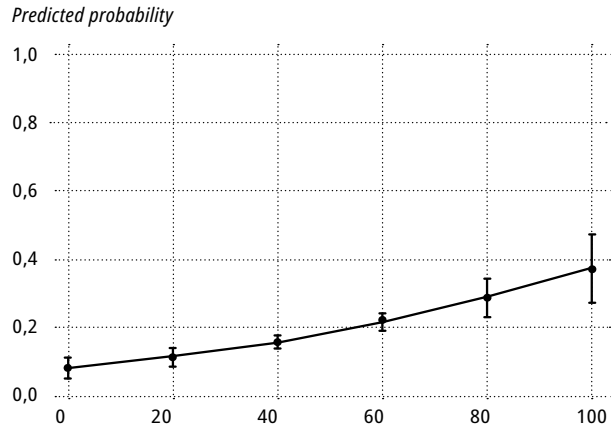
age probability of pursuing a Master's degree is higher for graduates of academic track, ranging from 20 to 46% as a function of school SEC (online appendix, Figure 1).

3. Conclusion and Discussion

Key Findings

- School socioeconomic composition is positively related to proceeding to high school, completing college, and pursuing a Master's degree.
- Compositional effect is explained by a strong relationship between SEC and the choice of educational trajectory in the first place, rather than by within-trajectory variance in student characteristics.

Figure **11. Predicted probability of pursuing a Master's degree as a function of SEC.**



With all the other covariates set at their sample mean values, AME = 6%.

- The strongest effect of SEC on academic intentions is observed for middle school graduates transitioning to vocational education.
- Family SES is not related to college enrollment when school SEC is controlled for.
- The existing effects cannot be explained entirely by differences in student achievement as a function of SEC.

The findings obtained in this study dismiss the widespread belief that school factors are less important than student characteristics for academic achievement and access to higher education—at least when it comes to school composition. Analysis of nine rounds of the Trajectories in Education and Career panel study shows that school socioeconomic composition is significantly related to college-going in Russia, even when individual variables such as student ability and family socioeconomic status are controlled for. School SECdemonstrates a robust effect on long-term educational outcomes across model specifications. In addition, school composition has an influence on college completion (AME=11%) and pursuing a graduate degree (AME=6%). These results are consistent with the findings from other education systems [Klugman, Lee 2019; Niu, Tienda 2013; Palardy 2014], proving that school factors, SEC in particular, not only contribute to student achievement at school but also determine the life chances of students to a large extent.

The key milestones where the compositional effect is the strongest are when students choose a trajectory after Grade 9 (AME=9%) and when they decide whether or not to go to college after obtaining a vocational diploma (AME=15%). Associations between SEC and college enrollment are equally strong when measured for middle and high school students, which means that compositional effect begins

to emerge in middle school at the latest, and factors shaping prospective trajectories are already in play at this stage. After choosing a trajectory, the compositional effects persist but become weaker. That is to say, school composition has a greater impact on trajectory choice than on further stratification of students within a track. No significant relationship is observed between SEC and the selectivity of college attended, the latter being affected most of all by region of residence and student achievement. Such inferences regarding college selectivity are somewhat inconsistent with the findings from another study [Palardy 2014], although an earlier publication found school composition to enhance the prospects for attending a selective college for males only [Alexander, Eckland 1977]. Similar results were obtained on a Russian sample for student SES, which was found to be related to college enrollment in general but not to getting into a selective college [Roshchina 2006]. The lack of a significant relationship between SEC and college selectivity in the present study may be due to the specific procedure of transition from middle to high school in the Russian education system. Since student composition becomes much more homogeneous by the end of high school than it was at the end of middle school, compositional effects on further decision-making become weaker. Within the effectively maintained inequality framework [Lucas 2001], it could be concluded that equality of access to higher education has not been achieved for schools with different composition so far, which is why there may be no essential stratification by education quality observable.

Unexpectedly enough, family SES was found to be unrelated to educational trajectory choice and college completion, when controlling for school SEC. This finding essentially contradicts the inferences made in most of the Russian publications on access to higher education, which report a relationship between family SES and college enrollment [Bessudnov, Kurakin, Malik 2017; Kosyakova et al. 2016; Prakhov 2015; Roshchina 2006; Khavenson, Chirkina 2019; Shishkin 2006]. However, those studies do not make allowance for school SEC. When using multilevel models and adding the school SEC variable, the relationship between family SES and college enrollment is not observed in most cases except transition to high school. On average, where the SEC measurement methodology is applied, SEC can explain close to 25% of variance in academic achievement beyond that accounted for by individual student characteristics [Borman, Dowling 2010]. Consequently, exclusion of such a powerful school factor affecting students' educational outcomes may lead to invalid inferences in educational research.

In particular, while the combination of low academic achievement and high family SES was found to be the strongest predictor of accessing college via vocational education in previous literature [Yastrebov, Kosyakova, Kurakin 2018], the present study reveals the decisive effect of school composition. The effect of SEC on the odds of getting into college after obtaining a vocational diploma is the strongest of all the

effects analyzed (AME=15%); meanwhile, the effect of family SES becomes insignificant once the SEC variable is added to the model. It is also important that in this study, college enrollment in the hybrid track was assessed over a few years, which allowed considering delayed decisions to go to college made during vocational studies or after completing them. Given these model parameters, compositional effect of a specific school can be expected to persist even after graduation and affect the future lives of graduates. However, further research is needed to test this hypothesis.

Conclusions drawn from the findings of this study may seem quite disappointing at the first glance. The phenomenon of school socioeconomic composition looks like a society in miniature, the so-called *sui generis* reality. It manifests the fundamental attributes of Durkheim's "social facts", constituting the sum of all the individual students but having a character of its own and imposing its own independent influence on everyone within it, whether they want it or not [Durkheim 1982]. It becomes hard to refrain from drawing analogies between deciding to go to college and making the most important decision of ending one's life: both choices turn out to be strongly determined by social factors in the first place [Durkheim 1952]. Just as altruistic suicide, enrollment in college may well be the result of caring about the interests of others, e. g. family, friends, or peers. This way, not only school achievement but also further educational trajectories and, hence, future lives of children depend on who their classmates or schoolmates are. As if it was not enough that some of the biggest life decisions are made on the grounds that are far beyond individual effort, responsibility, and often even perception—it also remains unknown how exactly this largely decisive effect emerges.

Even when student achievement at the end of high school is controlled for, the compositional effect is still there, which means that it is unlikely to emerge from cross-school variance in academic performance. The few attempts to find mediators of the relationship between SEC and educational outcomes undertaken by international researchers provide no general idea about the effect and at first glance complicate things. In particular, possible sources of compositional effect may include students' sense of futility [Agirdag, van Houtte, van Avermaet 2012], school practices [Boonen et al. 2014; Palardy 2014], peer influences [Palardy 2013], and teachers' beliefs [Agirdag 2018]. All these factors make their small contribution to the effect but provide no comprehensive understanding of how the relationship between SEC and educational outcomes is formed. It also remains unclear how the described mediators correlate with one another, which are stronger than others, and whether they are the same within long-term effects on educational trajectories. All of this is yet to be discovered.

In the context of Russian education, school socioeconomic composition and its effects are nowhere near the research frontier, let alone the political agenda. Meanwhile, parental definitions of a "good

school" are based, among other things, on perceived school composition: according to the 2020 Monitoring of Education Markets and Organizations (MEMO)[6] (household survey), over 40% of parents consider peer group quality at school to be a factor of academic success. In addition, available research findings basically demonstrate that school composition may foster the reproduction of social inequality in Russia just as in other countries—and this one is hard to ignore. However, it is also rather hard to give any practical advice without understanding the nature of compositional effect. This is not a problem that can be solved using the established methods of school and student support, e. g. by increasing schools' resources, hiring more teachers, providing opportunities for teachers' professional and career development, etc. Because social effects are much more difficult to control than teaching practices or material resources, their mitigation should also employ subtler mechanisms.

Anyway, forewarned is forearmed. A search for effective problem-solving strategies should be preceded by an in-depth analysis of the existing international practices. The simplest—and, in fact, the only available—method of reducing the negative manifestations of compositional effect is to introduce desegregation and student selection practices. No idea how SEC works? No problem—it can be simply eliminated by selecting a more advantaged population of students into a school. This policy is implemented through a number of reforms that regulate school admissions [Söderström, Uusitalo 2010] and introduce student transfers, e. g. based on voucher scholarship programs [Shakeel, Anderson, Wolf 2021]. However, such measures seem to be overly drastic and hardly applicable in the Russian context. First, geographical specifics should not be discounted: when there is only one school within a few kilometers, student transfers may be a challenge. Second, the effects of mixed-SEC schools on educational outcomes differ as a function of student SES. While attending a high- or medium-SEC school will be a growth opportunity for low-SES students, the effects will be strongly negative for high-SES students [Belfi, Haelermans, Fraine]. Inequality will be undoubtedly reduced by this approach, but should it be done at the expense of advantaged students' outcomes? Apparently, it would be wise to continue research before taking any radical measures. By unpacking the mechanisms behind short- and long-term compositional effects, we will be able to develop targeted initiatives to mitigate their negative consequences without acting hastily.

This study was supported by Basic Research Program of the Higher School of Economics.

I would like to thank Roman Zvyagintsev for providing his valuable comments and assistance for this study.

[6] https://memo.hse.ru

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Age and Gender Differences and the Contribution of School Size and Type in the Prevalence of Bullying

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Abstract This article looks into methodological issues in the assessment of bullying, providing cross-national bullying statistics and discussing the possible causes of essential variation in prevalence rate estimates. Individual- and school-level characteristics of bullying are described based on the results of a large-scale representative survey of school students (201 schools, 18 433 students) in Kaluga Oblast (Russia). Our findings show that 15.3% of all students in grades six through nine become victims of bullying during the school year, which is in line with the data obtained in the Health Behavior in School-Aged Children (HBSC), a WHO cross-national study, carried out on a nationally representative sample in Russia. In the age cohort analyzed, prevalence of bullying is the highest (19.4%) among sixth-graders and the lowest (11.1%) among ninth-graders. Girls and boys are bullied at approximately the same frequency, but boys are exposed more to physical abuse while girls are more likely to be victimized verbally and socially. Prevalence rates of bullying behavior vary dramatically across schools, from 0 to 40% of students in a school being exposed to bullying during the school year, yet the prevalence of bullying is unrelated to schools' structural characteristics (type, urban/rural, size, socioeconomic status). The relationship between school climate and bullying is discussed in the article, and further avenues of research are outlined.

Keywords bullying, bullying assessment instruments, prevalence of bullying, school climate.

For citing Ivaniushina V. A., Khodorenko D. K., Alexandrov D. A. (2021) Rasprostranennost' bullinga: vozrastnye i gendernye razlichiya, znachimost' razmera i tipa shkoly [Age and Gender Differences and the Contribution of School Size and Type in the Prevalence of Bullying]. *Voprosy obrazovaniya / Educational Studies Moscow*, no 4, pp. 220–242. https://doi.org/10.17323/1814-9545-2021-4-220-242

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Learning Analytics in MOOCs as an Instrument for Measuring Math Anxiety

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Received in August 2021

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Abstract

In this paper, math anxiety descriptions are extracted from Massive Open Online Course (MOOC) reviews using text mining techniques. Learners' emotional states associated with math phobia represent substantial barriers to learning mathematics and acquiring basic mathematical knowledge required for future career success. MOOC platforms accumulate big sets of educational data, learners' feedback being of particular research interest. Thirty-eight math MOOCs on Udemy and 1,898 learners' reviews are investigated in this study. VADER sentiment analysis, *k*-means clustering of content with negative sentiment, and sentence embedding based on the Bidirectional Encoder Representations from Transformers (BERT) language model allow identifying a few clusters containing descriptions of various negative emotions related to bad math experiences in the past, a cluster with descriptions of regrets about missed opportunities due to negative attitudes towards math in the past, and a cluster describing gradual overcoming of math anxiety while progressing through a math MOOC. The constructed knowledge graph makes it possible to visualize some regularities pertaining to different negative emotions experienced by math MOOC learners.

Keywords

BERT, educational data mining, learning analytics, Massive Open Online Courses (MOOCs), math anxiety, text mining, VADER.

For citing

Dyulicheva Y. Y. (2021) Uchebnaya analitika MOOK kak instrument analiza matematicheskoy trevozhnosti [Learning Analytics in MOOCs as an Instrument for Measuring Math Anxiety]. *Voprosy obrazovaniya/Educational Studies Moscow*, no 4, pp. 243–265 https://doi.org/10.17323/1814-9545-2021-4-243-265

With the rapidly growing number of mass online open courses (MOOC) and MOOC learners all over the world, huge sets of heterogeneous data have been accumulated, from age, status, and baseline level of knowledge to performance and progress through courses. Additional data may be obtained at the start and at the end of the course using questionnaires, unit tests, and final exams, and throughout the course by analyzing video viewing behavior, clickstreams, number of downloads, etc.

Learner–instructor interactions in MOOCs are being limited, learners can use reviews, forum comments, messengers, and social media to say what they think about course content and instructors. Analysis of learner reviews has given rise to a new field of learning analytics: educational data mining.

Mathematics MOOCs are often designed to improve basic mathematical knowledge. For instance, a project to develop a free open online course to help adults with low mathematical/statistical knowledge has been launched in the UK, outlining the universal requirements for online courses to explain the fundamental mathematical concepts in plain language [Griffiths et al. 2019]. Sometimes, math MOOCs are also created as scaffolding learning experiences to support students with low self-efficacy and high level of math anxiety, or as a tool to get students back into math after a holiday break [Lambert 2015]. MOOCs in mathematics can be applied to enhance teaching skills, serve as a network for exchanging effective teaching practices within the teachers' community [Taranto, Robutti, Arzarello 2020], and be adjusted to address the needs of specific target populations: individuals wishing to update their math skills; those who feel the need to acquire basic knowledge; and teachers who may use these resources with their students to develop teaching methodologies [Soares, Lopes 2016]. A distinct category of math MOOC learners is people with severe visual impairments and blindness [Kosova, Izetova 2020].

The recent years have seen a growing research interest in MOOC learning analytics, which is manifested in the emergence of MOOC datasets on data science platforms and Kaggle machine learning competitions (see kaggle.com). On Kaggle, for instance, one can find a dataset containing EEG brainwave data from college students while they watched MOOC video clips, a dataset with MOOC lecture data, etc.

1. Learning Analytics in MOOCs: Key Methodologies and Applications

The key methodologies in MOOC learning analytics include sentiment analysis, target group identification, analysis of content-based and clickstream data, course quality assessment, dropout prediction, and design of course and content recommender systems.

Sentiment analysis in MOOCs is often used to investigate students' attitudes, opinions, or emotions by detecting patterns in textual data and measuring their sentiment. Data obtained by analyzing learner feedback sentiment is used for identifying the reasons for attrition and lack engagement in MOOCs, developing strategies for improvement of MOOC content and teaching strategies, and getting a better understanding of student behaviors. Analysis of social media data (user profiles and comments) sheds light on MOOC learners' emotions and sentiment when progressing through a course. Learner feedback and forum posts are analyzed using hierarchical recurrent neural networks [Capuano et al. 2020]; two-polarity (positive/negative) sentiment analysis of MOOC reviews is performed using an ALBERT-BiLSTM mod-

el with three layers: word-embedding layer, semantic-extraction layer, and output layer [Wang, Huang, Zhou 2021]; collective sentiment from MOOC forum posts and its impact on student attrition are evaluated using survival analysis [Wen, Yang, Rose 2014]; social network analysis, cohort analysis, and identification of students who are actively participating in course discussions may assist in visualizing students' posting patterns in the course forum and building models of information diffusion [Sinha 2014]; and topic modeling is applied to trace discussion forum posts to MOOC content [Wong, Wong, Hindle 2019]. Another important task in educational data mining is to identify resource mentions in MOOC forum threads (sequence tagging), which is performed using the LSTM–CRF model [An et al. 2018].

Target group identification may help MOOC instructors develop strategies for better interaction with the course audience. Cluster analysis is often applied to solve learning analytics tasks of this type. Course satisfaction depends on the sentiment of target student groups which are identified using the VADER algorithm. In particular, it has been shown that most beginners are positive about MOOC content, while experienced participants often expect to learn about topics that are beyond the scope of the MOOC [Lundqvist, Liyanagunawardena, Starkey 2021]. Another criterion in target group identification is the differences in MOOC video learning behaviors, which serve the basis for content personalization [Zhang, Liu, Liu 2020].

Analysis of content-based and clickstream data allows detecting difficult or boring fragments of MOOC content and developing strategies for content personalization so as to improve the quality of study materials and resources. Learning analytics tasks in this subfield include using recurrent network modelling to predict the exact resource that a student will interact with next based on previous sequences of resource views and interactions in a MOOC [Tang, Peterson, Pardos 2016]; modelling student behaviors by analyzing video-watching clickstreams and sequences as well as other characteristics such as duration of video content viewing and in-video quiz completion rate [Brinton et al. 2015]. The data obtained can be used to build individual MOOC video interaction trajectories and develop strategies for personalized course recommendations.

Course quality assessment and development of reasonable assessment criteria constitute a challenging task, which can be solved, in particular, with the use of learning analytics tools. For instance, MOOC learning behavior and content perceptions can be studied by analyzing video traffic, forum posting, and the number of people who obtained the certificate [Luo et al. 2018].

Dropout prediction. Changes in student engagement throughout the course are monitored to develop retention strategies. One of the approaches to solving this task is to analyze learner activity and address the lack of feedback in a timely manner. Learner activity can be predicted, in particular, by obtaining weekly learning behavior statis-

tics using long short-term memory recurrent neural networks (LSTM-RNN) [Liu et al. 2018]. MOOC attrition can also be predicted by modelling representations of clicks and video [Jeon, Park 2020]. Furthermore, learning analytics tools are used for predicting student success as well [Bystrova et al. 2018].

Design of course and content recommender systems. As the number of available MOOCs is constantly growing, it becomes more and more difficult to select a course that would be affordable and matching the individual's needs. One of the approaches to developing course recommendations consists in constructing a binary tree of courses based on MOOC big data that allows identifying user preferences to find optimal solutions [Hou et al. 2016].

Development of big data mining algorithms in education has produced some tools for MOOC learning analytics. MOOCviz, a platform for visualizing data from edX and analyzing log data from Coursera, contains databases with information on students, including their activity and feedback. MOOCviz designers employed cohort and statistical analysis and used various heuristics to identify cohorts of students in MOOC courses based on resource use, country, etc. [Dernoncourt et al. 2013]. Other examples of MOOC analytical tools include PerspectivesX, a collaborative learning tool designed to support content and learner curation using topic modelling and deep learning techniques, and MessageLens, a visual analytics system to explore MOOC forum discussions [Bakharia 2017; Wong, Zhang 2018].

No studies of math anxiety in MOOC learners based on sentiment analysis of their reviews and comments can be found in the literature on MOOC learning analytics. This paper seeks to develop a methodology for detecting math anxiety based on analysis of math MOOC learners' feedback using machine learning techniques.

2. Approaches to Studying Anxiety

2.1. Math Anxiety

Mathematics anxiety is a serious problem associated with frustrating math learning experiences. The growing feelings of tension, failure, and disappointment can translate into resentment, fear, anxiety, chronic stress, and unwillingness to pursue careers requiring math knowledge and skills in the future. Math anxiety is understood as a specific emotional state of the student that triggers strong emotions such as hate and disgust and contributes to avoidance of any math-related experiences [Ashcraft, Moore 2009]. It is a widespread problem, affecting even engineering college students if they have difficulty learning the fundamental math concepts [Ma 1999]. Some scholars even qualify mathematics anxiety as a clinical pathology that impairs cognitive processes, contributes to social avoidance, and leads to negative emotional states even in well-performing students [Stella 2021].

There is empirical evidence of correlations between math anxiety and low mathematics achievement [Ashcraft, Moore 2009; Ma 1999]. In addition, mathematics anxiety may be exacerbated during the tran-

sition from elementary to secondary school or from secondary school to vocational or higher education due to changes in the learning environment [Field et al. 2021].

Survey response scales have been developed to measure math anxiety and discomfort experienced by math learners, e. g. the Abbreviated Math Anxiety Scale (AMAS) measuring anxiety in adolescents and adults and its modified versions mAMAS and EES-AMAS that measure math anxiety in children. The scales are based on evaluating emotional reactions toward math-related tasks [Carey et al. 2017; Primi et al. 2020].

Math anxiety prevention methods are built around the promotion of positive experiences, which is achieved by focusing the effort on adaptation with the use of innovative augmented and virtual reality teaching tools and a scaffolding system to support students in math problem solving [Dyulicheva 2020].

Making allowance for the nature and sources of math anxiety is particularly important when developing mathematics MOOCs, as they imply no direct learner-instructor interactions. The prevalence of math anxiety is indirectly captured in the titles of some MOOCs. Udemy, for instance, offers a math course for beginners entitled *Calculus for Those Who Hate Calculus*, and an intermediate-level course under the title *Stress-Free Statistics for College and IBDP/AP Students: Mini-Course 2*.

Meanwhile, studies seeking to identify the right methods of MOOC design and teaching to prevent math anxiety as a result of online interactions have been extremely scarce. Diagnosis of math anxiety in MOOCs also remains an open question, as online learners are reluctant to participate in any additional questionnaires.

2.2. Text Mining for Anxiety Detection

Sentiment analysis of textual data (comments, reviews, social media profiles) has been successfully applied not only to measure the prevalence of negative sentiment in a community but also to diagnose depressive states, anxiety, and other mental disorders.

Depressive states are detected based on social media entries, using CollGram text analysis and sentiment analysis based on the Bidirectional Encoder Representations from Transformers (BERT) architecture. CollGram profiles include such measures as mutual information factor, t-score, and the number of idiosyncratic units describing painful reactions to some triggers in social media entries [Wołk, Chlasta, Holas 2021]. Anxiety triggered by the COVID-19 pandemic was assessed through analysis of YouTube comments using various text vectorization techniques (Term Frequency—Inverse Document Frequency (TF-IDF), bag-of-words) and machine learning methods (Support Vector Machines (SVM), Random Forest, boosting, etc.) [Saifullah, Fauziah, Aribowo 2021]. Social media comments were analyzed using the Transformer-based Robustly Optimized BERT Pre-Training Approach (RoBERTa) model, LSTM neural networks, and BERT to classify five prominent kinds of mental illnesses: depression, anxiety, bipolar disorder, Atten-

tion Deficit Hyperactivity Disorder (ADHD), and Post Traumatic Stress Disorder (PTSD) [Murarka, Radhakrishnan, Ravichandran 2020]. Detection of depression and anxiety was performed on a set of 4,500 tweets using SVM with various text vectorization techniques and the BERT and ALBERT pre-trained language models [Owen, Camacho-Collados, Espinosa-Anke 2020].

Taking cue from the findings available [Wolk, Chlasta, Holas 2021; Murarka, Radhakrishnan, Ravichandran 2020; Stella 2021], we propose a methodology to analyze math anxiety by detecting math MOOC reviews with negative sentiment, clustering them, and visualizing the diagnosed states using a knowledge graph.

3. Dataset and Methods

Today, Coursera, Udemy, and EdX offer a variety of mathematics MOOCs with the most basic filtering options: by rating, price, video duration, skill levels, subtitles, etc. Figure 1 displays the number of English-taught math MOOCs on these three platforms found when searching for the keyword "math". The largest number of math MOOCs for beginners and the smallest number of advanced-level courses is offered by Udemy.

For every skill level, we analyzed the MOOC titles and created word clouds representing the most frequent words (see Table 1). Generation of word clouds using the Python wordcloud library was preceded by preprocessing of the course titles, which involved removal of punctuation marks and stop words.

Two categories of English-taught beginner-level math courses on Udemy were analyzed: 27 courses with the keywords "fundamental", "basic", and "master" in the title, and 11 courses with the keywords "mental" and "vedic" in the title. Next, course reviews were scraped for both categories: 1,326 unique user reviews on the Fundamental/Basic Math Courses and 572 unique user reviews on the Mental/Vedic Math Courses.

As seen in Table 1, which is based on word frequency analysis, beginner-level math MOOCs on Udemy pay a lot of attention to the fundamentals of algebra, statistics, calculus, trigonometry, probability theory, graph theory, mental mathematics, and mathematics for machine learning. Coursera offers narrowly specialized math courses and courses with a focus on programming languages, machine learning (deep learning in particular), and data analysis. On EdX, beginner-level math courses are designed more to introduce learners into machine learning and quantum and classical mechanics, intermediate-level MOOCs teach fundamental mathematics (matrix algebra, linear algebra, differential calculus, etc.), mechanics, and electronics, and advanced-level courses focus on quantum calculus and applied problem solving.

Figure 2 displays key stages in the analysis of Udemy math course reviews and the detection of math anxiety based on negative feedback.

At the first stage, reviews are preprocessed by removing punctua-

Figure 1. **The distribution of math MOOCs by skill levels**, %.

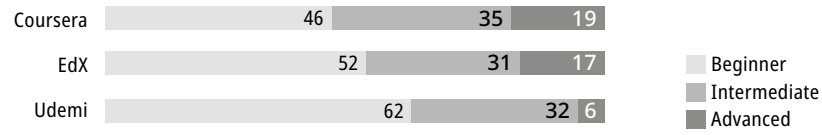


Table 1. **Word clouds describing math MOOCs at different skill levels.**

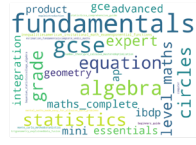
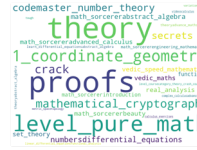
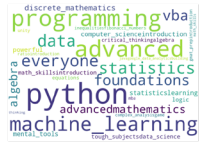
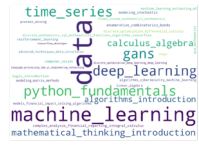
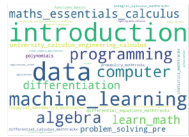
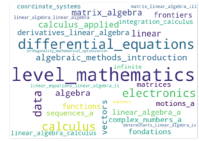
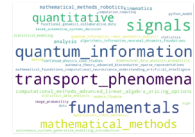
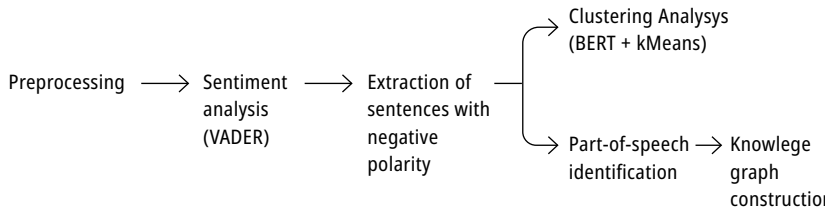
MOOC platform	Skill level		
	Beginner	Intermediate	Advanced
Udemy			
Coursera			
EdX			

Figure 2. **Key stages in the analysis of math MOOC reviews.**



tion marks and stop words, converting all words to lowercase, and tokenizing them using Python Natural Language Toolkit (NLTK).

At the second stage, sentiment analysis of reviews is performed with the help of the VADER algorithm. Sentiment is measured using the lexicon and rule-based approach or machine learning methods. VADER analysis based on rules and lexicons yields four polarities: positive, neutral, negative, and mixed. The advantage of applying the VADER tool is that it does not require using a dataset to teach the algorithm, and the disadvantage is that it overlooks words outside the sentiment lexicon when calculating the sentiment scores. The overall sentiment is described by the compound score, which is the normalized sum of valence scores calculated based on a particular heuristic and a sentiment lexicon. Normalization of the sum of valence scores from –1 (extremely negative sentiment) to +1 (extremely positive sentiment) is performed using the formula [Hutto, Gilbert 2014; Adarsh et al. 2019]:

$$\text{compoundScore} = \frac{x}{\sqrt{x^2 + \alpha}},$$

where α equals 15 by default, and x is the sum of all sentiment scores for the phrase (review).

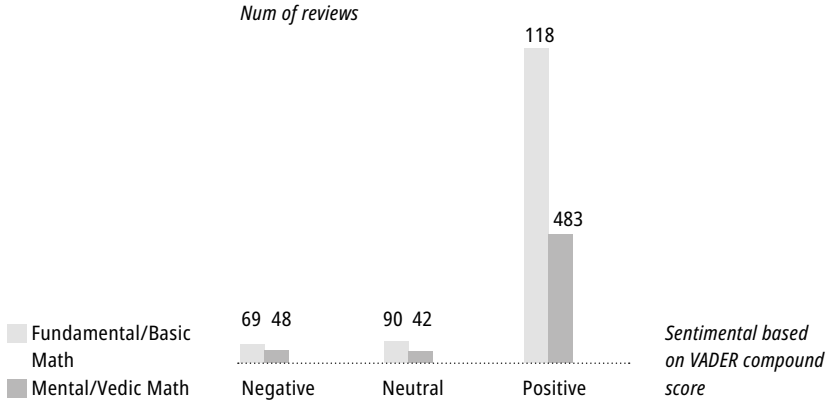
At the third stage, sentences with negative sentiment that contain no keywords but describe the course and/or instructor are identified using custom vocabularies, which comprise the words “course”, “lesson”, etc. and their synonyms, the words “instructor”, “tutor”, etc. and their synonyms, as well as instructors’ names (e. g. “Krista King”).

At the fourth stage, semantically related sentences describing math anxiety are identified and grouped using BERT, *k*-means clustering, and principal component analysis (PCA).

Representation of reviews as dense vectors of floating point values (embedding vectors) is performed using the pre-trained BERT model based on a bidirectional encoder neural network with the Transformer architecture [Devlin et al. 2019]. BERT demonstrates high accuracy and productivity on small datasets. After building vector representations of sentences with negative sentiment, the optimal number of clusters is determined using the elbow method and *k*-means clustering is performed according to the following procedure:

1. The optimal number of clusters *k* is used as the input data; *k* vector representations of math anxiety are randomly chosen as initial cluster means (centroids).
2. Each vector representation of a sentence describing math anxiety is assigned to the cluster with the least squared Euclidean distance, i. e. the one with the nearest mean.
3. According to the partitioning results, centroid coordinates are recalculated as the means of all vector representations assigned to each cluster.
4. Steps 2 and 3 are repeated until the assignments no longer change.

Figure 3. **The initial distribution of sentiment (negative, neutral, and positive) for reviews about the Fundamental/ Basic and Mental/Vedic Math MOOCs.**



Combining BERT with *k*-means clustering allows identifying sets of sentences (clusters) based on structural specifics of the language.

Step 5 consists in identifying parts of speech and expression-like templates or patterns to capture relationships between different entities and construct a knowledge graph describing attitudes and emotional states extracted from the reviews.

4. Analyzing Student Feedback in Mathematics MOOCs to Detect Math Anxiety

4.1. Sentiment Analysis of Math MOOC Reviews

Below, we present the results of sentiment analysis of 1,326 reviews about the Fundamental/Basic Math Courses and 572 reviews about the Mental/Vedic Math Courses.

As it follows from the histogram in Figure 3, reviews about mathematics MOOCs are mostly positive. Sentiment analysis is performed using the VADER algorithm [Hutto, Gilbert 2014] and vaderSentiment library in Python.

The challenging part of math MOOC review sentiment analysis is that reviews with the overall positive or neutral sentiment sometimes contain one or more sentences describing frustrating experiences related to mathematics learning. A typical example of such review is presented in Table 2. The first row shows the original review about a math MOOC on Udemy, while the second row separates the fragment that contains no words describing the course or instructor. The columns display sentiment scores for the entire review (positive sentiment) and the separated fragment (negative sentiment) calculated in VADER.

Henceforth, we zero in on the negative feedback. By extracting sentences with negative sentiment that do not contain lexicon words describing the course or the tutor from the original dataset, we obtain

Table 2. **An example of VADER sentiment analysis of a review about a math MOOC on Udemy.**

Review/Fragment	Sentiment score			
	Positive	Neutral	Negative	Compound
I always despised Math throughout school because the teachers never made it fun. I almost didn't graduate HS because of my failure to attend Math class because I hated that much. After completing this course I definitely have a good foundation on fundamentals so this was not just a great refresher but I actually had to relearn all the concepts. Krista is an amazing teacher and I could only imagine how great she would be if she taught a live class. This course is packed with notes and practice tests to utilize in your learning and if you go through everything you will come out well equipped to learn the next level of Mathematics. I am moving on to Algebra next and Linear Algebra by Krista and who knows, if things go well I might go on to Calculus, Geometry and Probability & Stats. Krista has a really pleasant voice and she simplifies these concepts so well that even a child can grasp it. Highly recommended, there's a reason why her courses has the best reviews. Thanks Krista, you're awesome!	0.212	0.74	0.048	0.9913
I always despised Math throughout school because the teachers never made it fun.	0	0.677	0.323	–0.917

a dataset of 231 sentences with negative sentiment in the Fundamental/Basic category and 93 in the Mental/Vedic category.

4.2. Clustering of Negative MOOC Reviews

Of all the sentences with negative sentiment, those with the keywords "math", "mathematic", etc. are singled out on the basis of patterns, ending up with 52 sentences in the Fundamental/Basic category and 10 in the Mental/Vedic category. Clustering of these sentences is performed through vector representations using the BERT model and the *k*-means method. BERT produces dense vector representations of sentences describing math anxiety. The result is depicted in Figure 4.

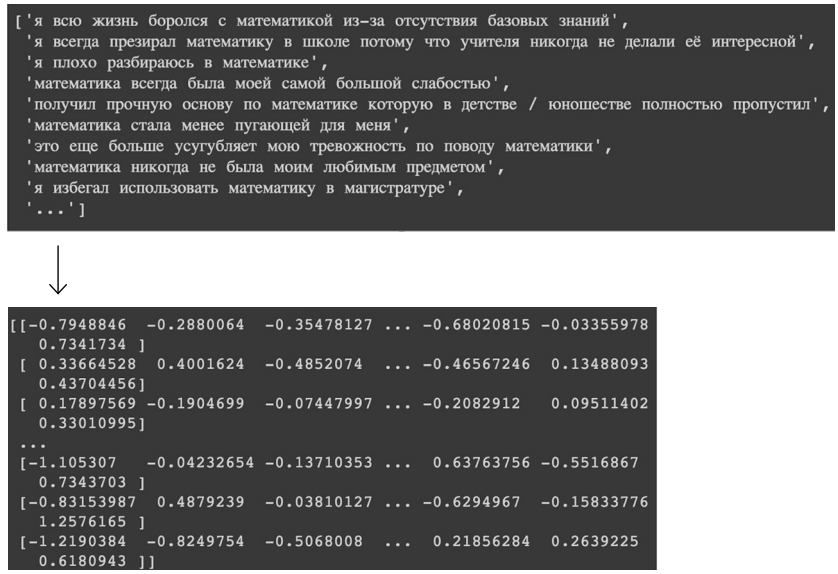
The combination of BERT and *k*-means clustering allows identifying clusters based on semantic similarity [Li et al. 2020]. The optimal number of clusters, required to apply the *k*-means algorithm, was determined using the elbow method and is equal to 5. Figure 5 shows the distribution of sentences describing math anxiety by clusters based on PCA and *k*-means clustering. Table 3 displays the clustering results.

Cluster 1 contains sentences that describe successful learning in the course despite prior frustrating math learning experience, using such words as "mental blocks" and "gaps in school knowledge".

Cluster 2 includes descriptions of decreasing math anxiety, e. g. those that refer to math as "less intimidating" and "less confused".

Cluster 3 consists of sentences expressing strong emotions about math-related problems, e. g. "math has always been my biggest weakness", "math has always been my enemy", "I always hated math with a passion".

Figure 4. **Sentence embedding in using BERT.**



['i have struggled with math my whole life',
'i always despised math throughout school because the teachers never made it fun',
'i am not good at math',
'math has always been my biggest weakness',
'got solid foundation from math which in my childhood/teen missed totally',
'math has become less intimidating now',
'makes anxiety around math even worse',
'math was never my favorite subject',
'i avoided using any maths in my masters,'
'...']

Sentences in Cluster 4 describe how learners gradually overcome math learning problems as they are guided step by step into mathematics and acquire more and more skills within the course. For example, they include phrases like "grow in my math skills", "the teacher teaching the math problems helps me understand how to work the problem", "...it goes step by step and showing how the problem can be worked out".

Cluster 5 features sentences that describe regrets about prior bad math learning experiences and missed opportunities, e. g. "It's a pity that in my school days there wasn't such a great teacher", "...not being proficient in math caused me to fail a test", "I almost didn't graduate HS because of my failure to attend Math class because I hated that much".

Figure 5. **Distribution of sentences describing math anxiety by clusters based on PCA, *k*-means clustering, and BERT (Principal Component Analysis + *k*-means clustering)**

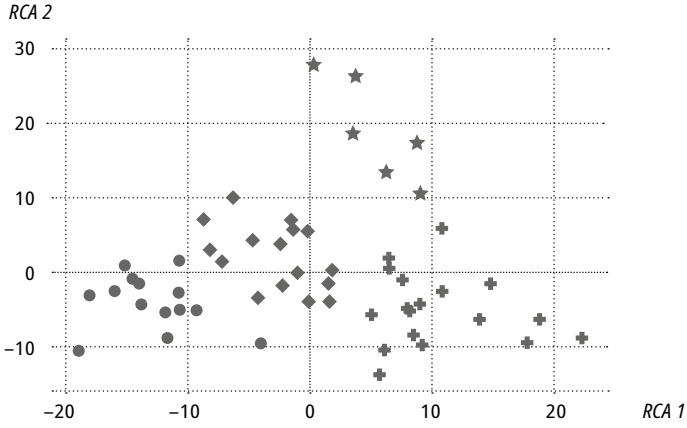


Table 3. **Results of clustering of sentences with negative sentiment based on their semantic similarity.**

Cluster No.	Cluster size	Random sentence example	Keywords	Mean compound sentiment score
1	7	I found I learnt quite a few new tricks that I wasn't taught in school	Mental blocks, gaps, school	–0.286
2	6	Math has become less intimidating now	Less, intimidating, confused, strange	–0.383
3	16	Math has always been my biggest weakness	Weakness, enemy, phobia, hate	–0.405
4	16	Each lesson challenged me and made me grow in my math skills	Challenge, skills, help, step by step, experience, negative, gradually	–0.326
5	17	It's a pity that in my school days there wasn't such a great teacher	Pity, wasn't, testing, school, negative	–0.498

Keywords in every cluster are determined using word frequency analysis.

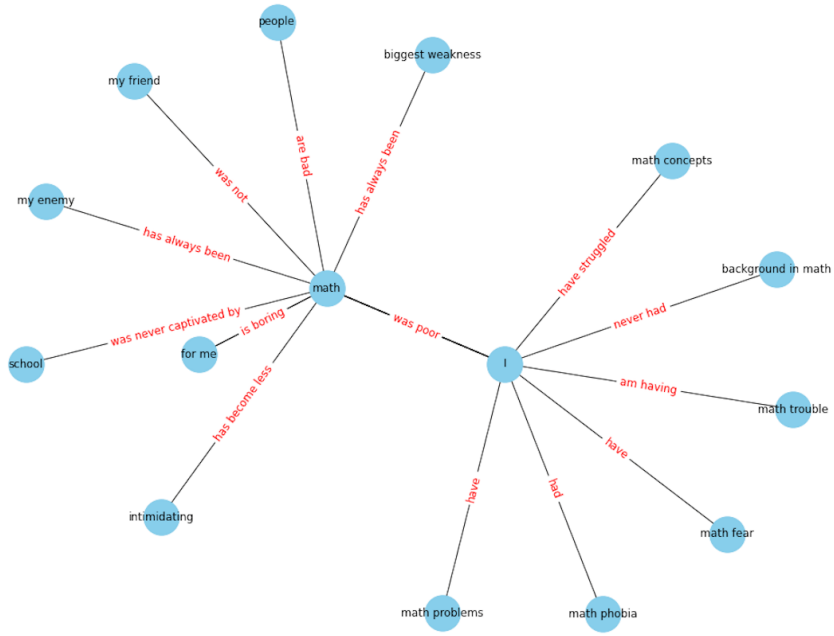
4.3. Constructing a Knowledge Graph Based on the Analysis of Negative Math MOOC Reviews

Knowledge graphs allow to visualize and structure relationships between entities as well as to describe their attributes. Nodes represent entities (documents, skills, job postings, tunes, etc.), and edges represent relationships (the Jaccard distance, events, etc.).

Knowledge graph and machine learning technologies are used in analysis of scientific publications [Chi et al. 2018]. Knowledge graphs can also be applied for mapping skills and matching them to job postings to facilitate labor market analysis [Groot de, Schutte, Graus 2021].

To explore math anxiety, we construct a knowledge graph based on part-of-speech identification and entity recognition using SpaCy

Figure 6. **Knowledge graph constructed based on sentences with negative sentiment.**



and NX Python libraries, respectively. For this purpose, we extract from the sentences with negative sentiment the pronoun 'I" and the words "math", "school", etc. as well as the pattern consisting of the word "math" preceded or followed by a noun or pronoun that serve as subjects and objects defining the graph nodes. Relationships between the subject and the object are assigned to graph edges and labelled with verbs preceded or followed by an adverb or an adjective (if any).

The knowledge graph constructed based on the set of sentences with negative sentiment is shown in Figure 6. It allows visualizing the entities and relationships between them and facilitates result interpretation. In particular, it demonstrates negative emotions experienced by math learners—such as math phobia, apprehension about math, bad past experiences with math—and identifies their attitudes toward mathematics, e. g. "has always been" "is boring", etc.

Visualization of entities describing math anxiety and relationships between them can be used by instructors, tutors, MOOC designers, and psychologists to analyze the sources of mathematics anxiety, search for ways to eliminate them, and render timely support to students.

5. Conclusions

Mathematics anxiety remains a serious problem hindering mathematical knowledge acquisition. This paper suggests a methodology for detecting math anxiety based on intelligent data analysis. In particular, the VADER algorithm for sentiment analysis was used to identify sentences with negative sentiment describing attitudes toward mathematics and math learning experiences at school; the BERT pretrained language model was used to represent sentences with descriptions of math anxiety as vectors; the elbow method, *k*-means clustering, and principal component analysis were used to determine the optimal number of clusters, generate clusters of semantically related sentences describing math anxiety, and visualize them; and the part-of-speech identification and knowledge graph methods were used to visualize the relationships between learners and their emotions about past bad math learning experiences. The results can be used by MOOC instructors to improve the content of math courses, and by psychologists to develop recommendations on preventing and managing math anxiety disorders.

Despite the limited pool of math learner reviews with detailed descriptions of attitudes toward mathematics and specific courses and instructors, the findings obtained in this study can be used for diagnosing math anxiety and math phobia when working with large review datasets in various languages, and can be applied as an additional learning analytics tool in analyzing anxiety disorders in math learners.

This article was published with the support of the University Partnership Project run by National Research University Higher School of Economics.

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On the Current Trends in Math Olympiad Training for School Students

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Abstract

The evolution of math Olympiad training for school students in Russia since the second half of the 20th century is analyzed in this article in the context of sociocultural transformations and changes in the post-industrial society's didactic knowledge. A retrospective analysis of a large body of empirical data (organization charts and content of the All-Union and All-Russia Mathematical Olympiads for school students in 1974–2021 and the International Mathematical Olympiads in 1994–2020) reveals trends in the development of the mathematical Olympiad movement, in particular changes in the network infrastructure of mathematical Olympiads, objectives and content of Olympiad problems, Olympiad material design practices, and value-and-meaning orientations of math Olympiads. Accordingly, new approaches are proposed to prepare school students for math competitions.

Analysis of changes allows substantiating the insufficiency of the "cognitive-reproductive" method of school student training widely applied both in Russia and beyond, which is based on a thematic principle of selecting problems by content and demonstrating examples of their solving to students. This method does not conform to the objectives of contemporary math competitions.

Today, it is important to find and recognize the potential for mathematical creativity in solving problems within multidisciplinary professional spheres. The goal of modern Olympiad training is not only to teach school students a system of problem-solving procedures but also to promote their ability to identify the semantic structure of problems in order to pick adequate solving strategies. The assumption that Olympiad math problems can be classified by the logic of their solutions is supported by a relevant taxonomy of Olympiad math problem solving techniques.

Keywords didactic knowledge, math Olympiads, math Olympiad training for school students, Olympiad problem solving strategies, teacher's methodological competence.

For citing Agakhanov N. H., Marchukova O. G., Podlipskii O. K. (2021) O sovremennykh tendentsiyakh v podgotovke shkol'nikov k matematicheskim olimpiadam [On the Current Trends in Math Olympiad Training for School Students]. *Voprosy obrazovaniya / Educational Studies Moscow*, no 4, pp. 266–284. https://doi.org/10.17323/1814-9545-2021-4-266-284

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School Education for the Indigenous Small-Numbered Peoples of the North: Between Cultural Preservation and Educational Quality

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Received in June 2021

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Abstract

Today, many ethnic minorities belong to the so-called "culture of poverty", and education can be a major vehicle of upward social mobility for such groups. This article explores the characteristics of school education in the indigenous small-numbered peoples of the North living in the Sakha Republic (Yakutia) of Russia, the educational trajectories pursued by indigenous youths, and how their preferences are influenced by national education policy and the ethnic component of education.

Data from a sociological survey of youth in areas of compact settlement of the indigenous peoples of the North and Unified State Exam (USE) scores served as the empirical basis of this study. Analysis of indigenous education policy documents allows making an inference that, even though the problems of teaching indigenous languages and setting up nomadic schools have been widely discussed, approaches to solving them are rather formalistic. At the same time, little attention is paid to problems experienced by stationary schools located in areas of compact settlement of the indigenous peoples of the North, which has negative effects on children's starting opportunities and the development of their educational strategies. Interest in higher education has been noticeably decreasing among young people aged under 19, and educational inequality in the Sakha Republic (Yakutia) has been exacerbated by the COVID-19 pandemic. For the indigenous small-numbered peoples of the North, social mobility opportunities hinge upon Internet access, so low levels of education digitalization in localities inhabited by indigenous peoples (compared to regional and national levels) predict a negative scenario for social wellbeing of this category of population.

Keywords

digitalization, ethnic minorities, ethnocultural education, indigenous small-numbered peoples of the North, school, secondary education, social inequality, social mobility, social structure.

For citing

Vasileva O. V., Okhlopkov V. E. (2021) Shkol'noe obuchenie korennykh malochislennykh narodov Severa: mezhdu sokhraneniem kul'tury i kachestvom obrazovaniya [School Ed-

ucation for the Indigenous Small-Numbered Peoples of the North: Between Cultural Preservation and Educational Quality]. *Voprosy obrazovaniya/Educational Studies Moscow*, no 4, pp. 285-310 https://doi.org/10.17323/1814-9545-2021-4-285-310

National development is largely contingent on the country's intellectual potential, so today national authorities closely monitor the state of the education system, in particular with respect to conditions for providing quality education to the populations of Arctic regions. However, organization of education for the indigenous small-numbered peoples of the North and Siberia rarely becomes a subject of substantive discussion. Meanwhile, education of those ethnic groups is critically important both from the perspective of indigenous youths' individual educational and career trajectories and for the purpose regional socioeconomic development. Education system is responsible, on the one hand, for the integration of the rising generation in the modern Russian society, and on the other hand, for the preservation of unique cultures of the indigenous peoples of the North and Siberia.

In this article, the experience of solving those problems and the impact of educational organization on indigenous peoples of the North's educational trajectories and life prospects are analyzed using the example of the Sakha Republic (Yakutia). Apart from the dominant ethnic groups of the Yakuts and Russians, this region is home to five more ethnicities classified as indigenous small-numbered peoples of the North (hereinafter in this article referred to as indigenous minorities of the North, or IMN): Evenks, Evens, Dolgans, Yukaghirs, and Chukchi.

Ethnic Education in Today's World

In international research on the relationship between ethnicity and education, one of the most prominent areas is the assessment of inequality in access to various types of education among different ethnic and racial groups, and of the impact of ethnicity, nationality, and race on an individual's educational and career opportunities [Troyna, Rizvi 1997; Gillborn 1995]. This body of literature provides evidence for racial and cultural discrimination in education [Mickelson 2003] and a strong influence of race and ethnicity on educational attainment and career growth, mediated by social stratification. A relevant explication of the phenomenon is proposed by Balibar and Wallerstein: in accordance with their neo-Marxist research perspective, such categories as race, nation, and ethnicity were constructed and impressed in people's minds to ensure effective axial division of labor in the capitalist world-system, and they are designed to sustain inequality [Balibar, Wallerstein 2004]. Meanwhile, as racism transforms over time, racialization in the modern world is being based on cultural differences [Malakhov 2007]. Cultural reproduction theory [Bourdieu, Passeron 2007] also emphasizes the contribution of cultural and educa-

tional disparities across social groups to the inequality of educational opportunity.

Ethnic education can be approached from two different perspectives: integrationist and separationist. In the former case, ethnicity is regarded as a driver of inequalities, hence a barrier in the educational process and the development of individual life strategies [Tishkov 2003]. The most popular example is the so-called culture of poverty, a concept describing a vicious circle of poverty, which is typical of ethnocultural minority enclaves where standards of living are lower than the national average due to historical reasons. Nationalist movements in such enclaves often translate into renunciation of progress (e. g. by reducing or even abolishing official language teaching hours), disguising it as cultural identity. Adolescents in ethnocultural enclaves thus find themselves excluded to some extent from the contemporary system of elementary and secondary education [Klyucharev et al. 2014].

The separationist approach to ethnic education regards ethnicity as a value that its bearers would like to conserve, so the school should adjust to their demands. This vantage point is widely shared by critics of colonialism and its consequences for native tribes. In particular, they argue that Eurocentric models of scientific knowledge established through formal education devalue and reject indigenous knowledge systems, refusing to recognize indigenous beliefs and practices in knowledge construction and acquisition [Brayboy et al. 2012].

The ethnocultural situation in Russia differs quite essentially from what is observed in Europe and the United States. Indigenous peoples in Russia are mostly integrated into the dominant culture's social environment: according to ethnographers, very few families live isolated from the cultural context [Sokolovsky 2008]. Still, researchers report differences in the educational attainment and its dynamics across ethnic groups [Drobizheva 2002:103], although no essential ethnic disparities are observed in the academic success of school students [Tenisheva, Alexandrov 2016].

Education remains the most popular vehicle of upward social mobility in Russia, and cultural orientations to receive education as well as the socioeconomic status (SES) of ethnic groups become powerful factors of population differentiation.

In the literature on IMN education systems, organization of school education for specific ethnic groups is associated with ethnic culture revitalization and preservation opportunities [Zhozhikov 2017; Pimenova 2012; Martynova 2012]. School education is recognized as one of the most effective tools for the social construction of ethnic identity, so development of ethnic models of education becomes part of the agenda. In the case of IMN, such models imply nomadic educational institutions, which are designed to contribute to the conservation of traditional northern lifestyles. Forms and content of ethnocultural education have a number of specific features [Neustroev 1999; Matis 1999; Borisov 1998; Robbek 1995].

When considering educational trajectories, indigenous school students and their parents in the Russian North have to choose between education quality and the ethnocultural component in education [Markin, Silin, Voronov 2019; Rudakov 2021; Borgoyakov 2016], a significant proportion of them being not interested in the latter [Rudakov 2021:83].

Ethnocultural education in Russia's national republics remains a live issue [Vinokurova 2020], its role in the construction of youth educational trajectories still being largely understudied.

Data

This article looks into the indigenous education policy documents of regional governments, statistics describing the socioeconomic and demographic characteristics of IMN, and the Unified State Exam (USE) scores in the localities of the Sakha Republic (Yakutia) classified as areas of compact settlement of IMN.

The study also makes use of the results of a sociological survey carried out in March–April 2021 in Yakutia among indigenous youths (n=261) as part of the project "Identity, Language, and Culture of Indigenous Small-Numbered Peoples of the North in the Sakha Republic (Yakutia) as a Resource: Current State and the Local and Global Contexts of Transformations".[1]

Sociodemographic Status of IMN in Yakutia

Indigenous minorities of the North in Yakutia are mostly rural dwellers (70.8%).[2] As for administrative divisions, areas traditionally inhabited and used by IMN are represented by 71 rural localities in 21 *uluses* (districts).[3] Most often, these are the least accessible localities at the farthest periphery of the region (relative to the regional center) with no year-round transportation access. As of January 1, 2018, those rural localities were home to 42,100 people (4.4% of total Yakutia population), most of them being representatives of IMN [Ignatyeva 2020:109]. Indigenous minorities of the North living in urban areas are mostly concentrated in Yakutsk, the regional center of the republic.

According to economic statistics, the probability of being poor is four times higher among rural dwellers in Yakutia, which is direct consequence of the lack of jobs [Popova 2020]. Because 70% of IMN pop-

[1] Funded by a grant from the Institute for Humanities Research and Indigenous Studies of the North (Siberian Branch of the Russian Academy of Sciences) as part of the Fundamental and Applied Research Project.

[2] The 2035 Agenda for Sustainable Development of Indigenous Small-Numbered Peoples of the North in the Sakha Republic (Yakutia): https://arktika.sakha.gov.ru/dokumenty/normativnye-pravovye-akty/normativno-pravovye-akty-v-oblasti-razvitija-arkticheskih-i-severnyh-territorij

[3] Law of the Sakha Republic (Yakutia) No. Z 167-II "On the List of Indigenous Small-Numbered Peoples of the North and Areas of Their Compact Settlement in the Sakha Republic (Yakutia)" of April 11, 2000.

ulation lives in rural areas—usually in the most remote and hard-to-access localities—it would be logical to suggest that the poverty rate is higher in this category than in more urbanized ethnic groups. As of the 2010 census, 83.9% of IMN population aged 15–72 was economically active, which is lower than the republic's average (96.2%).[4] According to regional data of the Federal State Statistics Service (Rosstat), 169,200 people (17.4% of total population) in Yakutia lived in poverty in 2020. Of them, 45% were children and adolescents aged 7 to 16.[5]

In addition to the lack of jobs in rural areas, multiple-child parenting is another factor of poverty among indigenous peoples of the North. As of the 2010 census, IMN children and adolescents aged 0–19 accounted for 40.6 to 47.2% of rural population.[6]

Researchers suggest that poverty among indigenous minorities of the North is caused to some extent by the predominance of traditional occupations [Gavrilyeva et al. 2019:44] that do not require high levels of skills. However, statistics on the average number of employees in organizations located in the areas traditionally inhabited and used by IMN in Yakutia, by type of economic activity, shows that only 12.6% of working population (1,687 people) are employed in agriculture, forestry, fishing and hunting.

Still, IMN communities feature higher rates of poverty and low-educated population than other ethnic groups. According to census data, indigenous minorities of the North have on average lower levels of educational attainment compared to other ethnic groups in Yakutia. In 2010, professional qualifications were held by 46.4% of IMN population (as compared to 63% of the Sakha people and 66% of Russians in the region). Educational attainment differs not only across ethnic groups but also between urban and rural areas. In 2010, professional qualifications were held by 19,490 IMN rural dwellers, which is only 41% of total rural population, including 43.4% of all Evenks, 42.3% of Dolgans, 38.1% of Evens, 34.7% of Yukaghirs, and 28.3% of Chukchi [Vasileva 2020:151].

Therefore, indigenous minorities of the North are mostly integrated in Russia's sociocultural environment, only a small proportion maintaining the traditional ways of life. At the same time, IMN communities feature higher rates of socioeconomically disadvantaged population. In present-day Russia, poverty is often reproduced across consecutive

[4] Indigenous Small-Numbered Peoples of the Russian Federation Aged 15–72 Living in Private Households by Area of Usual Residence and Economic Activity. Rosstat's official website: data from the 2010 census of the Russian Federation population: https://www.gks.ru/free_doc/new_site/perepis2010/croc/Documents/Vol4/pub-04–33.pdf

[5] Poverty Rate in the Sakha Republic (Yakutia). Statistical Bulletin No. 104/208. Yakutsk: Sakha Republic (Yakutia) Regional Office of the Federal State Statistics Service, 2020. P. 31.

[6] Results of the 2010 Census of the Russian Federation Population. https://www.gks.ru/free_doc/new_site/perepis2010/croc/perepis_itogi1612.htm

generations within a family [Yaroshenko 2010], parental social status being directly correlated with young people's academic performance [Ibragimova, Frants 2021], so the sociodemographic profile of IMN described here offers quite pessimistic socioeconomic prospects for this ethnic group.

One of the most effective ways to decrease economic inequality is to raise skill levels of the lowest-skilled population categories, recent findings suggest [Maskin 2015]. The present article addresses the school stage of education for indigenous minorities of the North, as this is where starting opportunities for social mobility are shaped and the ethnocultural focus is preserved. In our study, we intend to evaluate to what degree the IMN's demand for quality education is satisfied by school education policies and to find out how indigenous youths construct their educational trajectories.

Education System in Yakutia

The system of school education in Yakutia is represented by 642 schools, including seven part-time schools, 27 boarding schools, 102 schools with boarding options,[7] and 207 ungraded schools.[8] In the 2010/21 academic year, comprehensive schools of all types in Yakutia had an aggregate population of 145,100 students. Of them, the absolute majority (144,100) attended full-day schools. According to statistics, public full-day schools in Yakutia are employers to 14,348 teachers, of whom 86% have college degrees (81% in rural areas and 90.1% in urban localities).

In 2019, 61.2% of rural schools in Yakutia lacked wastewater disposal systems, 67.6% had no running water, 20.3% functioned without central heating, 72.2% occupied wooden facilities, and 27.6% of school buildings needed overhaul.[9] Wooden structures are more prone to wear, present greater fire risk, and are seriously limited in digital infrastructure development [Zair-Bek, Mertsalova, Anchikov 2020]. By these indicators, Yakutia is one of the most disadvantaged regions in Russia.

Yakutia is now witnessing a migration of skilled workers from rural to urban areas, which leads, coupled with dispersed settlement, to a shortage of teachers in a number of rural schools. The greatest reduction in the number of teachers between 2020 and 2019 was observed in the following districts: Allaikhovsky (by 42.5%), Verkhnekolymsky

[7] Data as per Federal Statistical Monitoring Form No. OO-1 "Information about educational institutions providing education programs in elementary, lower and upper secondary education" for the Sakha Republic (Yakutia) at the beginning of the academic year 2020/21.

[8] Resolution of the Government of the Sakha Republic (Yakutia) No. 314 "On Approving the List of Ungraded Educational Institutions in the Sakha Republic (Yakutia)" of August 27, 2015.

[9] Consolidated reports on Form No. OO-2 "Information about material and information resources and financial and economic activities of educational institutions in the Russian Federation and its federal subjects in 2019".

(by 32.3%), Ust-Yansky (by 25%), Olyokminsky (by 17.45%), Ust-Maysky (by 17.45%), Abyysky (by 13.75), and Bulunsky (by 13.4%).[10] All these regions are inhabited by indigenous minorities of the North. Naturally, the observed trend is part of the centripetal migration that has concentrated one third of Yakutia population in the regional capital over the past three decades.

Digitalization of education in Yakutia is impeded by the great extent of the region and dispersed settlement. Regional statistics report that only 86.1% of the population have access to fiber-optic networks; 454 organizations have Internet connection, but its speed is not always adequate; and Internet speeds higher than 1 Mb/s are only available to 47% of those organizations.[11] Arctic *uluses*, accounting for only 6.9% of the republic's population and for the majority of areas of compact settlement of IMN, currently have virtually no access to fiber-optic networks. In particular, according to the Arctic Zone development policy documents, 13 Arctic districts use 2G networks, which only allow making phone calls and sending text messages, while Internet access is provided through communication satellites.[12]

Education digitalization in Yakutia is focused in the first place on monitoring the quality of education, organizing enrollment campaigns in schools and preschool institutions, evaluating teachers, and providing information and advice services. For example, the "E-Services. Education" system is designed to keep records on children waitlisted for preschool and to arrange online application to schools, summer camps, and institutions of vocational education. The stated paramount objective of this portal is to provide maximum access to public services on both national and municipal levels for all citizens while ensuring full protection of personal data in compliance with Federal Laws of the Russian Federation No. 152-FZ "On Personal Data" and No. 149-FZ "On Information, Information Technologies and the Protection of Information".

As we can see, education development indicators in rural areas of Yakutia are essentially below the regional and national averages, fostering the reproduction of social inequalities.

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[10] Estimates are based on: *Activities of Secondary Education Institutions in the Sakha Republic (Yakutia). Statistical Digest of the Sakha Republic (Yakutia) Regional Office of the Federal State Statistics Service*. Yakutsk, 2020. P. 30.

[11] Consolidated reports on Form No. OO-2 "Information about material and information resources and financial and economic activities of educational institutions in the Russian Federation and its federal subjects in 2019".

[12] The 2035 Strategy for Socioeconomic Development of the Arctic Zone of the Sakha Republic (Yakutia): https://minimush.sakha.gov.ru/news/front/view/id/3205069

Table **1. Number of children in Yakutia by language of instruction.**

Academic year	2016/17	2017/18	2018/19	2019/20	2020/21
Dolgan	–	–	–	–	–
Chukchi	–	–	–	–	–
Even	135	195	–	160	164
Evenk	66	143	98	117	98
Yukaghir	23	–	–	28	27
Yakut (Sakha)	55,530	55,706	52,168	51,035	51,688

Source: Data as per Federal Statistical Monitoring Form No. OO-1 "Information about educational institutions providing education programs in elementary, lower and upper secondary education" for the Sakha Republic (Yakutia) in the academic years 2016–2021: https://edu.gov.ru/activity/statistics/general_edu

Specifics of IMN Education Policy

The specific and most significant problems in indigenous education are native language instruction and nomadic education. Three language-of-instruction models are currently in place in Yakutia:

1. Native speakers of Russian are taught in Russian throughout school.
2. Native speakers of indigenous languages are taught in their native language from 1st through 4th/7th/9th grade (depending on the sociocultural situation and teaching practices in the particular school) with subsequent transition to instruction in Russian. In high school (10th-11th grades), instruction is delivered in Russian. This model is predominantly applied in schools with the Yakut (Sakha) language as the language of instruction located in rural areas and Yakutsk.
3. Instruction is delivered in Russian, while native (indigenous) languages are taught as second languages.

Most often, indigenous children of the North learn to speak their native languages within separate subjects or elective courses. Not many children receive education in the IMN languages (Table 1). Indigenous languages as a subject are taught in 49 schools, both nomadic and stationary (Table 2).[13]

The state republican program "The 2020–2024 Agenda for Preserving and Developing the National and Official Languages of the Sakha Republic (Yakutia)" projects an increase in the percentage of children

[13] The 2019 Report of the Commissioner for Human Rights of the Indigenous Small-Numbered Peoples of the North in the Sakha Republic (Yakutia): https://iu-upkm.sakha.gov.ru/news/front/view/id/3205611

Table 2. **The number of children learning their native language as a separate subject in the public schools of the Sakha Republic (Yakutia).**

Academic year	2016/17	2017/18	2018/19	2019/20	2020/21
Dolgan	95	115	137	0	0
Chukchi	51	59	51	2	2
Even	608	375	755	717	332
Evenk	677	562	713	745	277
Yukaghir	94	85	83	40	41
Yakut (Sakha)	19,720	25,674	30,253	28,528	30,255
As an elective course (all languages)	1,567	1,923	2,337	2,095	1,388

Source: Data as per Federal Statistical Monitoring Form No. OO-1 "Information about educational institutions providing education programs in elementary, lower and upper secondary education" for the Sakha Republic (Yakutia) in the academic years 2016–2021: https://edu.gov.ru/activity/statistics/general_edu/

learning their native IMN languages from 1.17% of the overall school student population in 2020 to 2.1% by 2024. However, given yearly fluctuations in school student enrollment, such an increase may not exceed statistical error.

Teaching indigenous minorities' languages is hindered by the fact that the federal list of curricula and textbooks recommended for use and requiring governmental approval prior to use include curricula and complete series of textbooks only for Yakut Language and Yakut Literature. The Federal State Education Standard features no exam requirements for IMN languages—development of such requirements would involve working out the standards for teaching the official languages of Russia's republics.

In addition to native language learning, indigenous education policy of the first post-Soviet decade involved creating a network of nomadic schools, the earliest nomadic schooling experiences dating back to the Soviet Union. However, as indigenous peoples of the North switched more and more to sedentary lifestyle, nomadic schools would get closed, giving way to stationary and boarding schools all over the areas of compact settlement of IMN.

Nomadic schooling resurged in the 1990s, with the opening of Kueneleken Nomadic School in Olenyoksky District (1990), School No. 38 in Ugut tribal community of Aldansky District (1992), School No. 39 in Amma tribal community (1992), Ulakhan-Kyuyol School in Anabarsky District (1995), Even Nomadic School in Kobyaysky District (2002), a nomadic school in Verkhoyansky District (2004), a school in

Nutendli tribal community of Nizhnekolymsky District (2004), a school in Urodan community of Srednekolymsky District (2004), and a school in Cheroda community of Olekminsky District (2004) [Robbek 2011:546].

Instruction in the areas traditionally inhabited and used by IMN as well as in base schools[14] is centered on individualized learning plans as prescribed by the Law of the Sakha Republic (Yakutia) "On Nomadic Schools in the Sakha Republic (Yakutia)" of July 22, 2008.[15] Today, seven *uluses* of the republic have nomadic schools, which are attended by 103 children (147 in 2017), including 35 preschoolers (45 in 2017).[16] Nomadic schools provide elementary and lower secondary education. Leaders of IMN ethnic movements believe that, in theory, nomadic schools could provide upper secondary education as well but will hardly realize this potential due to low and declining enrollment. In their opinion, the decline in nomadic school enrollment has to do with the decreasing number of domestic reindeer livestock and the overall downturn in the reindeer herding industry in Yakutia. Indeed, over 80% of IMN students in Yamalo-Nenets Autonomous Okrug, which is home to the largest reindeer livestock population in Russia, attend nomadic schools.

However, the practices of Yamalo-Nenets Autonomous Okrug, in which nomadic education has gained a more widespread use, cannot be regarded as absolutely positive. Nomadic schools were expected to produce educational outcomes comparable in quality to those of regular schools, but research findings show that teachers find arguments against nomadic schooling as a way of receiving elementary and lower secondary education. Teachers believe that children attending nomadic schools experience more difficulties with school examinations than students of boarding schools and are more likely to have socialization issues. Therefore, some teachers of base schools are convinced that nomadic schools are less effective than regular and boarding schools [Lyubimova, Semenov 2017].

A very small proportion of IMN children attend nomadic schools in Yakutia, yet such schools have been a top priority. Stationary and boarding schools attended by indigenous children receive much less research attention and government funding. Of the 72 stationary schools in the rural localities classified as areas of compact settlement of IMN, only 55 offer upper secondary education programs. The rest provide only elementary and lower secondary education, so if their graduates want to proceed to high school, they will have to move to the regional center and live in a boarding school.

[14] Base schools are comprehensive schools on the basis of which nomadic schools or ungraded nomadic classrooms operate.

[15] http://docs.cntd.ru/document/445029377

[16] The Ministry of Education and Science of the Sakha Republic (Yakutia)'s Report on Performance in 2020 and Goals for 2021. Yakutsk, 2021.

Table 3. **USE Russian scores in the areas of compact settlement of IMN in the Sakha Republic (Yakutia) (mean scores).**

	District	Rural locality	2016	2017
1	Abyysky	Kubergene	51.9	58.6
2	Aldansky	Khatystyr	60.4	61.1
3	Aldansky	Kutana	47.8	54.5
4	Aldansky	Ugoyan	48.8	47.2
5	Allaikhovsky	Olenegorskaya	46.0	52.0
6	Allaikhovsky	Nychalakh		
7	Allaikhovsky	Chkalov		
8	Allaikhovsky	Russkoye Ustye		
9	Allaikhovsky	Oyotung		
10	Anabarsky	Saskylakh, Saskylakh School	55.3	50.7
11	Anabarsky	Saskylakh, Anabar Ulus Gymnasium	67.3	65.4
12	Anabarsky	Yuryung-Khaya	47.6	51.9
13	Bulunsky	Kyusyur	47.7	50.7
14	Bulunsky	Namy	26.0	40.6
15	Bulunsky	Nayba	51.9	56.0
16	Bulunsky	Taymylyr	51.2	53.8
17	Bulunsky	Siktyakh		
18	Bulunsky	Bykovsky	35.2	56.5
19	Bulunsky	Ust-Olenyok		
20	Eveno-Bytantaysky	Kustur	48.8	57.2
21	Eveno-Bytantaysky	Dzhargalakh	43	47
22	Eveno-Bytantaysky	Batagay-Alyta	56	54.9
23	Kobyaysky	Sebyan-Kyuyol	50.4	49.7
24	Kobyaysky	Segyan-Kyuyol	57.2	51.9
25	Mirninsky	Syuldyukar	61	49.5
26	Momsky	Sasyr	42.8	35.8
27	Momsky	Kulun-Yelbyut	61.7	54.5
28	Momsky	Chumpu-Kytyl	54.5	74
29	Momsky	Buor-Sysy	49.5	49.5
30	Momsky	Khonuu	53.2	62.8
31	Momsky	Sobolokh	62.8	58
32	Neryungrinsky	Iyengra	53	55.5

	District	Rural locality	2016	2017
33	Neryungrinsky	Arktika Experimental Boarding School	57.4	60.1
34	Nizhnekolymsky	Kolymskoye	50.3	59
35	Nizhnekolymsky	Pokhodsk	45.0	
36	Nizhnekolymsky	Andryushkino	48	44.4
37	Olekminsky	Tokko	57.7	57.8
38	Olekminsky	Tyanya	51.0	81.0
39	Olekminsky	Byas-Kyuyol		
40	Olekminsky	Kundu-Kyuyol		
41	Olekminsky	Uolbut		
42	Olenyoksky	Olenyok	54.1	55.1
43	Olenyoksky	Kharyyalakh	37.7	42.4
44	Olenyoksky	Zhilinda	48.9	43.8
45	Olenyoksky	Eyik	43.3	53.3
46	Oymyakonsky	Tomtor	59.4	60.7
47	Oymyakonsky	Orto-Balagan	37	56.5
48	Oymyakonsky	Yuchygey	51.3	56.3
49	Srednekolymsky	Berezovka	56	69.7
50	Srednekolymsky	Urodan		
51	Tomponsky	Topolinoye	58	47.9
52	Ust-Maysky	Kyuptsy	54.0	47.0
53	Ust-Maysky	Ezhantsy	55.3	56
54	Ust-Maysky	Petropavlovsk	58	70.4
55	Ust-Maysky	Troitsk		
56	Ust-Maysky	Tumul		
57	Ust-Yansky	Khayyr	54.1	62.7
58	Ust-Yansky	Tumat	61.5	53.4
59	Ust-Yansky	Sillyanyakhskaya School	41.6	39.7
60	Ust-Yansky	Kazachye	54.2	49.3
61	Ust-Yansky	Ust-Yansk	50.3	56.3
62	Ust-Yansky	Uyandi		
63	Ust-Yansky	Yukagir		
64	Verkhnekolymsky	Nelemnoye	54.4	54.3
65	Verkhnekolymsky	Utaya		

	District	Rural locality	2016	2017
66	Verkhnekolymsky	Verkhnekolymsk		
67	Verkhnekolymsky	Usun-Kyuyol	43.0	
68	Verkhoyansky	Ulakhan-Kyuyol	50.7	51.8
69	Zhigansky	Zhigansk	57.7	62.5
70	Zhigansky	Kystatyam	44.0	49.0
71	Zhigansky	Bakhynay		
72	Zhigansky	Bestyakh		

Table 4. **Mean USE Russian scores.**

	2016	2017
Areas of compact settlement of IMN	51.2	54.6
Sakha Republic (Yakutia)	54.6	59.5
Russia	64.3	69.1

Table **5. Mean USE Mathematics scores (advanced level test).**

	2016	2017
Areas of compact settlement of IMN	35.4	38.5
Sakha Republic (Yakutia)	42.2	41.3
Russia	46.3	47.1

USE Scores and the Desired Level of Educational Attainment among IMN

In order to assess the effectiveness of schools located in areas of compact settlement of IMN and the competitive positioning of their graduates, we will look at the USE Russian scores (Table 3).

In schools located in the areas of compact settlement of IMN, on average only eight students per school take the exit examinations. Smaller numbers of graduates translate into a greater influence of random factors and, as a result, a greater variance of the scores. Nevertheless, mean USE Russian scores in such schools have been consistently 3–5 points below the regional average and 13–15 points below the national average (Table 4). In mathematics, mean scores are 9–11 points lower than the national average (Table 5).

USE performance demonstrates that graduates from schools located in areas of compact settlement of IMN have comparatively low chances of going to college, becoming a professional, and improving their quality of life. Such schools do not provide conditions for using education as a vehicle of upward social mobility or as a tool for increasing indigenous minorities' SES.

Educational inequality for IMN has often been regarded as the result of their disposition toward traditional farming and rather low lev-

els of educational ambition. The most recent data on the desired level of educational attainment among indigenous youths and their attitudes toward the need for ethnocultural education, language competencies, and the role of ethnic identity is provided by a study carried out in Yakutia in March–April 2021.

It was a formalized questionnaire survey covering rural localities classified as areas of compact settlement of IMN in seven districts of Yakutia: Bulunsky, Verkhnekolymsky, Verkhoyansky, Mirninsky, Momsky, Ust-Yansky, and Eveno-Bytantaysky. All the respondents (n=261) belonged to indigenous minorities of the North—Evenks, Evens, Yukaghirs—or came from mixed-ethnicity families of biethnic identity. Quota sampling by age and gender was performed for the survey. The sample consisted of IMN people at the age of 14–40 divided into two age categories: school students aged 14–19 (51.7%) and adults aged 20–40 (48.3%). Selection of these two age cohorts is explained by our interest in how perceptions differ between present-day school students and people who built their educational trajectories during the post-Soviet years. Males accounted for 44.1% of the sample.

Raw data was processed using SPSS software, results being represented as descriptive statistics; in-depth analysis was performed using the chi-squared statistic (χ^2).

The item on educational ambitions is formulated as follows: "Which level of educational attainment do you consider sufficient for yourself?" Responses show the following distribution: 13% would be satisfied with a high school diploma, 36% would like to obtain a vocational certificate, 48.7% aspire for a college degree, and 2.3% would only be content with a postgraduate degree.

Contrary to the assumption that school students tend to have inflated expectations, educational ambitions in the younger group of respondents turned out to be lower than among adults. School students were more likely to select high school as the sufficient level of educational attainment, while respondents aged 20 and older intended more often to get at least a Master's degree ($\chi^2 = 8.511$, $p < 0.075$).

Among IMN youths, females are more likely to aspire for higher levels of educational attainment than males ($\chi^2 = 18.266$, $p < 0.019$), which is consistent with the national trend—according to the Trajectories in Education and Careers cohort panel study [Kondratenko, Kiryushina, Bogdanov 2020], girls in Russia have overall higher educational ambitions than boys.

Representatives of different age cohorts differ in their attitudes toward the traditional occupations of their ancestors: reindeer herding, hunting, and fishing. Among school students, 52.3% perceive such occupations as prestigious and respectable, 37.7% say that they used to be respectable but have lost their importance, and 10% believe that those occupations are in low demand and offer no career prospects. Among respondents aged 20–40, only 32.2% regard traditional occupations as prestigious, while 47.9% are convinced that they have

lost their importance, and 19.8% see them as a blind alley ($\chi^2 = 11.766$, $p < 0.008$).

To answer the question, "Do you think school education for indigenous minorities of the North should have an ethnocultural component?", respondents were to choose between two response options: "School education should be standardized to ensure better competitiveness of graduates" or "Education should be ethnocultural, designed to preserve the language and culture and develop ethnic identity and domestic skills in children while at the same time introducing them to global cultural values".

Ethnocultural focus in school education of IMN was supported by 47.1% of the respondents. The standardized curriculum response option was selected by 63.8% of school students and by only 40.3% of adults ($\chi^2 = 14.079$, $p < 0.000$). No gender differences were observed ($\chi^2 = 1.336$, $p < 0.513$).

Rural school students were more likely to have vocational orientations and vote for standardized school curricula, but those intending to enroll in college favored the ethnocultural component in school education.

To measure the significance of ethnic identity for the respondents, they were asked to compare two statements and choose the one that better described their attitude: "I care more about my own and my family's wellbeing, achievement of my personal goals and interests" or "I care more about the interests of my people, first of all the preservation of our culture and traditions and the protection of my people's rights even if it runs counter my own goals".

Personal and family wellbeing was selected by 80.7% of the respondents. Preservation of the people's culture and traditions and protection of its rights even if it runs counter personal goals were preferred by 19.2% of the survey participants. Among school students, personal wellbeing was chosen by 89.7%, as compared to 70.4% among adults aged 20–40 ($\chi^2 = 13.399$, $p < 0.000$).

Of those who prioritize personal wellbeing, 55.9% believe that education for IMN should be standardized. Among those prioritizing their ethnic group's interests, standardized education is favored by only 27.9%, while 72.1% advocate for the ethnocultural component ($\chi^2 = 10.842$, $p < 0.001$).

A sociological survey revealed that only 3.4% of the respondents living in areas of compact settlement of IMN perceived their access to Internet as adequate, while 67.4% reported low-quality Internet connection, and 29.1% had no access to the Internet at all.

Efficiency of IMN Education Policy

The policy of integrating the indigenous minorities of the North into the dominant culture's social environment has taken effect: modern IMN communities differ dramatically in their SES from their predecessors who mostly engaged in natural resource management. At the

same time, within the predominantly Russian society, IMN represent a socioeconomically disadvantaged social group, mainly due to dispersed settlement and low access to information.

The lower the urbanization rate in the locality of school graduation, the lower an adolescent's chances of obtaining a college degree, so rural school graduates become outsiders in the race for education [Konstantinovsky 2020:215]. A school leaver from a remote village who wants to go to college encounters a number of barriers—geographic, economic, sociocultural, and information—all interacting, mediating and amplifying the effects of one another [Ibid.]. However, little attention in education policy is paid to this objective factor and ways of reducing its impact on school students' educational trajectories.

Indigenous education policymakers are mostly focused on the needs of nomadic peoples, overlooking the problems of school education for IMN living in rural areas, in particular the problems of remote stationary schools and their teaching quality. With regard to this category of IMN, it is only ways of preserving traditional lifestyles that have been discussed, while the ethnic-oriented approach has been implemented somewhat superficially.

Educational ambitions of IMN school students are quite consistent with the overall Russian trend of the past decade toward an increase in demand for vocational education. Research shows that the growing popularity of this track is the product of mutually reinforcing factors in the education system, the downward economic cycle, and the labor market. The shrinking real disposable household income—the key trigger for an increase in demand for vocational education programs—coupled with the decreasing access to higher education "push out" low-SES students from the academic track [Maltseva, Shabalin 2021].

In Yakutia, with its outflow of skilled teachers from rural schools and multiple barriers in education (from geographical to technological), students curtail their own educational ambitions under the pressure of socioeconomic factors. Besides, the labor market in Yakutia is rather tight for skilled workers: since the 1980s, more and more college graduates have been overeducated for their jobs [Drobizheva 2002:47], and finding a job matching one's skills today is even harder. In this situation, traditional occupations are perceived as attractive. A recent study of educational and career trajectories of IMN in Yamalo-Nenets Autonomous Okrug showed that being college-educated is associated with much more interest in occupations other than traditional industries [Markin, Silin, Voronov 2019].

Great hopes were staked on information technology to break the geographical barriers in education. However, Internet speed is extremely low in the majority of Arctic schools, making it impossible to use web-based supplementary materials or distance-communication services such as Zoom, Google Meet, etc.

The lockdown measures imposed to prevent the spread of the SARS-CoV-2 coronavirus infection shifted part of educational responsi-

bility, specifically for access to the Internet, to the population. According to survey data, only 3.4% of the IMN respondents have access to high-quality Internet connection, so self-learning was substituted for distance learning during the pandemic. A learning process organized this way will lead to a substantial degradation of education quality in rural areas within the Arctic Zone of the Russian Federation in the Sakha Republic (Yakutia), widening the gap in youth access to professional education.

Conclusion

Education policy for indigenous minorities of the North is focused on ethnocultural development, while social and community aspects of educational organization are left virtually unattended, which has a substantial impact on indigenous peoples' wellbeing and social mobility opportunities.

If policymakers retain their performative approach to indigenous education with a focus on ethnocultural identity preservation, the urban-rural socioeconomic divide in the region will widen, decreasing the level of educational attainment among rural IMN population and inflating the groups dependent on social transfers for their income. Centripetal migration has become an important factor in the republic's education system: between 2001 and 2018, rural schools lost 23% of their student population, while school enrollment in Yakutsk increased by 27%. That is to say, college opportunities have been reduced for rural IMN school graduates. Under the pressure of the factors described above, school students adjust their educational and career intentions by curtailing their demand for education. Today, vocational orientations are much more prevalent among indigenous youths than among indigenous adults aged 20–40.

This article was ordered by the Federal Research Center "The Yakut Scientific Center of the Siberian Branch of the Russian Academy of Sciences". Topic: "The Sakha Republic (Yakutia) and the Big Challenges: Social Wellbeing, Mobility, and Adaptation Strategies", registration No.: 121031300008–7. The sociological survey was funded by grant "Identity, Language, and Culture of Indigenous Small-Numbered Peoples of the North in the Sakha Republic (Yakutia) as a Resource: Current State and the Local and Global Contexts of Transformations" within the Basic Research Program "Ethnocultural Diversity of the Russian Society and the Strengthening of Russian Identity" in the fulfillment of Article 6 of the Presidential Order No. Pr-71 of January 16, 2020

This article was published with the support of the University Partnership Project run by National Research University Higher School of Economics.

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François de La Mothe Le Vayer and His *De l'instruction de Monsieur le Dauphin*: The Concepts of the Golden Mean and Public Good

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Abstract This article investigates into the structure and content of *De l'instruction de Monsieur le Dauphin* by François de La Mothe Le Vayer. Le Vayer describes the four pillars of the state — religion, justice, finance, and military power — speculating on how thoroughly a hereditary prince of France should study liberal and mechanical arts. He does not recommend the majority of subjects for detailed study, making an exception for rhetoric in the first place and adding three more important subjects: geography, ethics, and physics. In fine arts, according to Le Vayer, the king had better be an experienced connoisseur than a creator. He also describes pretty much in detail the physical activities useful for a king in waiting (swimming, dance, and armed martial arts are recommended, while running is not), as well as possible games and ways of entertainment. A large proportion of the treatise is devoted to proving the harmfulness of astrology, chemistry, and magic. The key principles underlying Le Vayer's speculations are the "golden mean" and the use of general education as a basis, the elements of which he analyzes separately for applicability in the instruction of a hereditary prince.

Keywords instruction of the Crown Prince, Le Vayer, liberal arts, Louis XIV, mechanical arts.

For citing Lyubzhin A. I. (2021) Fransua de la Mot le Veye i yego traktat "O vospitanii monsenyora dofina": kontseptsiya "zolotoy serediny" i obshchestvennogo blaga [François de La Mothe Le Vayer and His *De l'instruction de Monsieur le Dauphin*: The Concepts of the Golden Mean and Public Good]. *Voprosy obrazovaniya / Educational Studies Moscow*, no 4, pp. 311–332. https://doi.org/10.17323/1814-9545-2021-4-311-332

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The Role of Instructional Design in Promoting Digital Pedagogy.

Review of the book: *Beetham H., Sharpe R. (2020) Rethinking Pedagogy for a Digital Age*

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Abstract

According to the authors of the joint monograph *Rethinking Pedagogy for a Digital Age: Principles and Practices of Design*, not only does the digital society shape the demand for new skills and methods of learning how to learn but it also generates challenges in economy, digital security, privacy, and ethics. From this standpoint, the authors show how instructional design responds to the challenges of digitalization, what should be taught to modern students, what learning outcomes students need, what kinds of resources, technologies and learning environments are required, and how the teacher's role is changing. Part One, *Theories and Principles*, looks for foundations for instructional design decisions, suggesting three perspectives: associationist, cognitive and situative. Learning activities are shown as the focus of instructional design, and learning outcomes are understood as clearly defined changes expected from the learner. Ideas for collaborative online and blended learning designs for learning communities are put forward as a response to the growing demand for methods of social learning in online environments. Part Two, *Practices*, analyzes the results of over ten years' work with teachers. A number of cases from Australian and British universities are used to demonstrate how pedagogical design projects helped solve the strategic problems of introducing a new framework of graduate attributes, promoting teacher research and its deeper integration into the learning process, and organizing a mass transition to blended learning. Part Three, *Influences and Futures*, addresses the challenges and prospects of instructional design for mobile and professional learning, providing a critical analysis of the datafication of education and learning analytics.

This monograph is an important step toward rethinking the role of pedagogical design in the coming age of digital reality. The principles of instructional design are discussed and adjusted by the authors with due regard to the ongoing transformation of the student and teacher roles, learning environment, and expected learn-

ing outcomes. The ideas expressed in the book become especially relevant amidst the emergency digitalization of education during the COVID-19 pandemic and the high demand for a quality redesign of educational products.

Keywords digital pedagogy, education digitalization, educational technology, e-learning, instructional design, learning analytics, mobile learning, open education, pedagogical design.

For citing Drugova E. A., Veledinskaya S. B., Zhuravleva I. I. (2021) Razvivaya tsifrovuyu pedagogiku: vklad obrazovatel'nogo dizayna. Retsenziya na knigy: Beetham H., Sharpe R. (2020) Rethinking Pedagogy for a Digital Age [The Role of Instructional Design in Promoting Digital Pedagogy. Review of the book: Beetham H., Sharpe R. (2020) Rethinking Pedagogy for a Digital Age]. *Voprosy obrazovaniya / Educational Studies Moscow*, no 4, pp. 333–354. https://doi.org/10.17323/1814-9545-2021-4-333-354

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