

SHORT REPORT ON

What affects reading and mathematics performance of primary school graduates and how

2021

PART II

Based on the materials of the report on the results of the second cycle of the National External Monitoring Study of the Quality of Primary Education



SHORT REPORT ON WHAT AFFECTS PRIMARY SCHOOL GRADUATES' READING AND MATHEMATICS PERFORMANCE AND HOW

Based on the materials of the report on the results of the second cycle of the National External Monitoring Study of the Quality of Primary Education *The State of Development of Reading and Mathematical Competencies of Primary School Graduates in 2021*

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The booklet is a summary of the main data represented in Part II of the report on the results of the second cycle of the National External Monitoring Study of the Quality of Primary Education *The State of Development of Reading and Mathematical Competencies of Primary School Graduates* conducted in 2021.

The main focus of the booklet is on the results of data analysis obtained as a result of testing and surveying primary school graduates in 2021 and surveying the teachers who taught them, from the point of view of relationship between students' success in mastering Mathematical and Reading competencies and the educational context, in particular such factors as demographic, institutional, material, social, preschool training and extracurricular activities, homework, atmosphere in the educational institution, reading practices, mathematical practices (based on student questionnaires); demographics, educational environment, professional self-realization, pedagogical practices (based on teacher questionnaires).

The materials can be useful for education administrators and managers, teachers, scientists, as well as for everyone dealing with issues of the quality of education, pedagogical measurements, and monitoring research in education.

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WHAT NEMSQPE IS AND PECULIARITIES OF NEMSQPE 2021

The National External Monitoring Study of the Quality of Primary Education “The State of Development of Reading and Mathematical Competencies of Primary School Graduates” (hereinafter referred to as NEMSQPE) was initiated by the Ministry of Education and Science of Ukraine in 2016. Its purpose is, on the one hand, to obtain objective data on the current state of development of the key (reading and mathematical) competencies of primary school graduates, and on the other hand, to trace the changes in the quality of primary education that follow implementation of the New Ukrainian School Concept throughout the country. To achieve the second of the mentioned goals, this monitoring study is biannual. The main study of the first cycle of NEMSQPE was successfully implemented in 2018, and the second one was planned for 2020. However, due to the COVID-19 pandemic, collecting data from schools became possible only in the spring of 2021.

The participants of NEMSQPE are Year 4 students who complete primary education and the teachers who teach them. The NEMSQPE participants, who completed their primary education in 2017/2018 and 2020/2021, studied according to the State Standard of Primary Education of 2011 and the educational programs based on that Standard. However, prospective Year 4 students participating in the next NEMSQPE cycles will be those studying according to the 2018 State Standard of Primary Education and curricula based on the principles of the New Ukrainian School.

During the Monitoring Study, students take a **Reading or Mathematics test** and complete **questionnaires**, and their teachers complete questionnaires related to the subject of the test their students take (Reading or Mathematics). The test data collected during NEMSQPE 2021 made it possible to draw objective conclusions about the levels of development of students’ reading and mathematical competencies, while the questionnaire data helped to trace the associations between the levels and various factors of the educational and non-educational environment. A comparison of the results of student testing based on the results of the first and second cycles of NEMSQPE enabled us to determine the trends in the educational achievements of Year 4 students over three years (between 2018 and 2021).

An innovation of the NEMSQPE second cycle was the expansion of the focus of attention on topical issues related to the implementation of distance learning in primary school and its impact on the quality of the educational process. In order to study these issues, the participants of NEMSQPE 2021 were additionally asked to complete questionnaires called “Distance Learning During the COVID-19 Pandemic”.

Based on the results of NEMSQPE 2021, “The Report on the Results of the National External Monitoring Study of the Quality of Primary Education “The State of Development of Reading and Mathematical Competencies of Primary School Graduates” was prepared. The abovementioned report consists of two parts: **“What Primary School Graduates Know and Can Do and How the Situation Has Changed over Three Years”** and **“Learning Prerequisites and Outcomes”**.

Part I of the report is devoted to the analysis of the participants’ test results, and Part II focuses on the study of the relationship between these results and the educational and non-educational context, in particular demographics, institutional, material, and social factors, preschool preparation and extracurricular activities, homework, school atmosphere, students’ Reading and Math practices, educational environment, teachers’ professional self-realization, etc. The proposed booklet summarizes the key points of Part II of the report. You can read the full text of the report on the Ukrainian Center for Educational Quality Assessment website.



THE SAMPLE OF THE NEMSQPE 2021 PARTICIPANTS

7,991 students and **475 teachers** from **355 institutions of general secondary education** took part in NEMSQPE 2021. All students participating in NEMSQPE 2021 studied in classes with the Ukrainian language of instruction. **4,192 students** took a Reading test and completed Reading questionnaires and **3,799 students** took a Mathematics test and completed Mathematics questionnaires.

The sample of participating students represented **426,375 Ukrainian primary school graduates** in 2021 according to various parameters (type of school, type of area, region of location of school). However, the sample of the teachers surveyed is unrepresentative, but it still can clearly reflect the characteristics of primary school teachers as of 2021.

The main study data collection in schools within the second cycle of NEMSQPE was in **April–May 2021**.

WHY IT IS IMPORTANT TO UNDERSTAND THE CONTEXT OF STUDENTS’ LEARNING

The information on the level of development of primary school graduates’ Reading and Mathematical competencies, that was collected within NEMSQPE 2021, cannot be considered fully informative without clarifying what factors influenced students’ learning outcomes. Most researchers in the field of education are convinced that this information is perhaps the most important within

monitoring studies, given the recognition of the fact that a student's academic performance is determined by a number of various factors. That is why, in NEMSQPE, our attention was focused not only on measuring Year 4 students' key competencies, but also on issues of data collection and analysis regarding the factors of the educational context.

In all international educational studies, such as PIRLS, PISA, TIMSS, etc., the study of the problem of students' socio-economic inequality takes an important place. The data of these studies prove that even in the most developed and economically stable countries, student's performance largely depends, in particular, on family's wellbeing and cultural status, the student's place of residence, the school that the child attends, etc. Levelling the influence of these factors and ensuring equal access of all students to quality education is one of the most important goals of any educational system, including that of Ukraine.

The concept of socio-economic status is quite broad and includes both material factors (access to certain material goods, the ability of the family make investments in their child's development, etc.) and socio-cultural factors, in particular parents' education and profession, the number of books available in the family, etc. In the NEMSQPE framework, the attention of researchers was focused on studying some of these factors, in particular, material ones, which made it possible to draw a number of important conclusions regarding their influence on students' academic success in developing their reading and mathematical competencies. In addition, the analysis highlighted the influence of a number of other factors, which in one way or another could affect students' success in mastering their reading and mathematical skills.



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PRIMARY SCHOOL GRADUATES' PERFORMANCE IN MATHEMATICS AND READING THROUGH THE PRISM OF EDUCATIONAL CONTEXT (BASED ON THE RESULTS OF THE STUDENT SURVEY)

Students' performance and some material factors

The student questionnaire within NEMSQPE included a number of questions about the number of books, smartphones, tablets, computers (laptops) and cars in the student's family, which indicate certain financial status of their family.

Almost 50% of participating Year 4 students responded that there were three or more smartphones, one tablet, one computer and one car in their family. Every third student mentioned having enough books at home to fill one shelf or bookcase. Few of the surveyed students have three or more tablets, cars and enough books to fill more than two bookcases at home and some of the students have no smartphones at home at all.

The generalized level indicator of the household wealth of students' families was measured in the form of the corresponding *index of student's household resources* (see Fig. 1). In total, 32% of primary school graduates have a low level of household resources, 24% have a high level, and the remaining 44% of students are classified as having a medium level of household resources. Students who live in cities, or those who study in specialized schools, gymnasiums and lyceums, have more household resources that can be used for their learning.

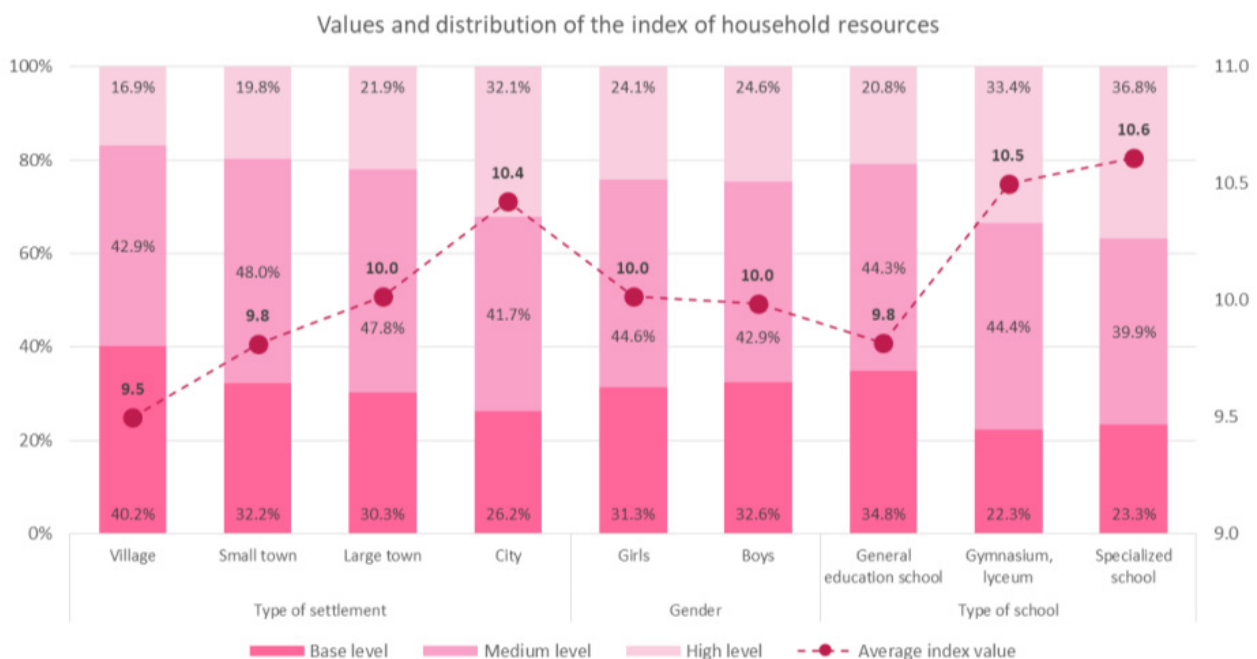


Figure 1 – Values and distribution of the levels of the index of household resources by students' type of settlement, gender and type of school

The data demonstrate that students with a higher level of the index of household resources have significantly higher mean scores in both Mathematics and Reading. Students with a medium level of the index have a 7-point higher mean score in Mathematics and a 7.7-point higher mean score in Reading than students with a low level of the corresponding index. Students with a high level of the index of household resources have, respectively, mean scores 10.6 and 9 points higher than students with a low level of the mentioned index. All in all, an increase in the index of students' household resources by one unit is associated with a significant increase in the mean scores in both Mathematics (by 2.4 score points) and Reading (by 2.3 score points).

Students' performance and some socio-economic and cultural factors

Both in the previous and this cycle of NEMSQPE, the data show that the efforts made in preparing children for school, their overall development, and pastime also have a positive effect on their academic performance.

Thus, students who attended kindergarten for more than two years (about 40%) have significantly higher performance in both Mathematics and Reading than their peers who attended kindergarten for less time or do not remember exactly how long they did it.

The vast majority of students (about 63%) prepared for school with their relatives, but just like 11% of children who had individual lessons with a tutor (teacher, care provider or someone else), they have significantly lower academic results in Mathematics (on average, by 6 score points), and in Reading (by 7 score points) than those of their peers who attended preparatory courses in kindergarten or school before enrollment in Year 1.

The primary school graduates, who also reported that they attended foreign language classes outside the school during the year when the monitoring study was held and who constitute about 30% of surveyed students, performed the highest mean scores in both Mathematics and Reading. Approximately one in four students was not involved in any extracurricular activities, and these are the students who have the lowest scores in both subjects. Almost 30% of the surveyed students played sports in sports clubs or sections associated with their schools. The children who visited classes in two or more extracurricular activity groups have significantly higher results in both subjects by 6 score points than their classmates who did not attend any extracurricular classes.

Those Year 4 students who, among other things, had the opportunity to visit a resort in Ukraine go or abroad in summer, performed significantly higher by 8-9 score points in both subjects than their peers who had to spend the summer only at home. At the same time, students who in addition to staying at home spent time in the country or visited their relatives in the summer before the fourth grade achieved results higher by 3 score points in both subjects than the others.

Students' performance in Mathematics and some motivational factors

Primary school graduates *feel quite confident about Mathematics*. About half of the students completely disagreed with the statement 'Mathematics is hard for me or I do not understand it well'. A third of primary school students agreed that they can easily cope with

math problems and that their teacher tells them that they are doing well in this subject. Only 10% of students agreed that Mathematics is more difficult for them than for other students in their class and that they do not understand it well. 32% of students were at the high level of the ***index of self-confidence in learning Mathematics***, 38% of them were at the medium level, and 30% of students were at the low level. Girls are significantly less self-confident than boys when it comes to mathematics.

The more confident students are in their abilities in Mathematics, the significantly higher their scores are. Students with the high level of the index have a mean score in Mathematics of 27 score points higher and with the medium one 14 score points higher than their peers, whose level of the index is low. Overall, a one-unit increase in students' index of Mathematics confidence is associated with a significant 5.4-point increase in average Mathematics achievement. This is the largest effect on Mathematics outcomes observed within this monitoring study.

By and large, Year 4 students have a positive attitude towards Mathematics. When constructing ***the index of love for Mathematics (index of attitude to Mathematics)***, the tendency of students to declare an exaggerated positive attitude towards the subject was taken into account, but even after that, only 22% of students have the low level of the index of love for Mathematics while 45% of students demonstrate the medium level, and 33% the high one. The level of positive attitude towards Mathematics does not differ significantly between boys and girls, as well as between students who study in different types of schools.

The high level of positive attitude to Mathematics is characterized by an increase in the mean score in Mathematics. Students with the medium level of the index have an average result that is 8 score points higher, and students with the high level of the index – by 15 score points higher, than their peers, whose level of the index of attitude to Mathematics is low. All in all, a one-unit increase in the index of students' love for Mathematics is associated with a significant 3-point increase in the mean score.

Most primary school graduates understand the *importance of learning Mathematics* for life. Students who said they learned a lot from Mathematics scored 9.5 points higher than those Year 4 students who partially or completely disagreed. Those students who agreed that Mathematics is important for success in life, performed by 4.5 score points better. It is quite expected that students who did not consider Mathematics as important as other school subjects performed 5.5 score points less.

Over one out of four primary school graduates (26.7%) reported that *the math test items* were very easy, and half of all students (49.6%) reported that the items were easy. As expected, these students performed significantly better than the others who found the tasks difficult (21.6%) or very difficult (2.1%) (Fig. 2). The fact that students are able to evaluate objectively both the difficulty of the tasks and their capabilities in Mathematics is confirmed by average values of the motivational indices for each category of students: students who found the math test items more difficult rated their capabilities and their attitude towards the subject lower.

Students' performance in Reading and some motivational factors

Primary school graduates feel the same way about Reading. Up to 60% of Year 4 students strongly agreed that they could usually easily cope with Literary Reading tasks, and up to 40% strongly agreed that the teacher told them that they read well. The vast majority of students believed that Literary Reading was not more difficult for them than other school

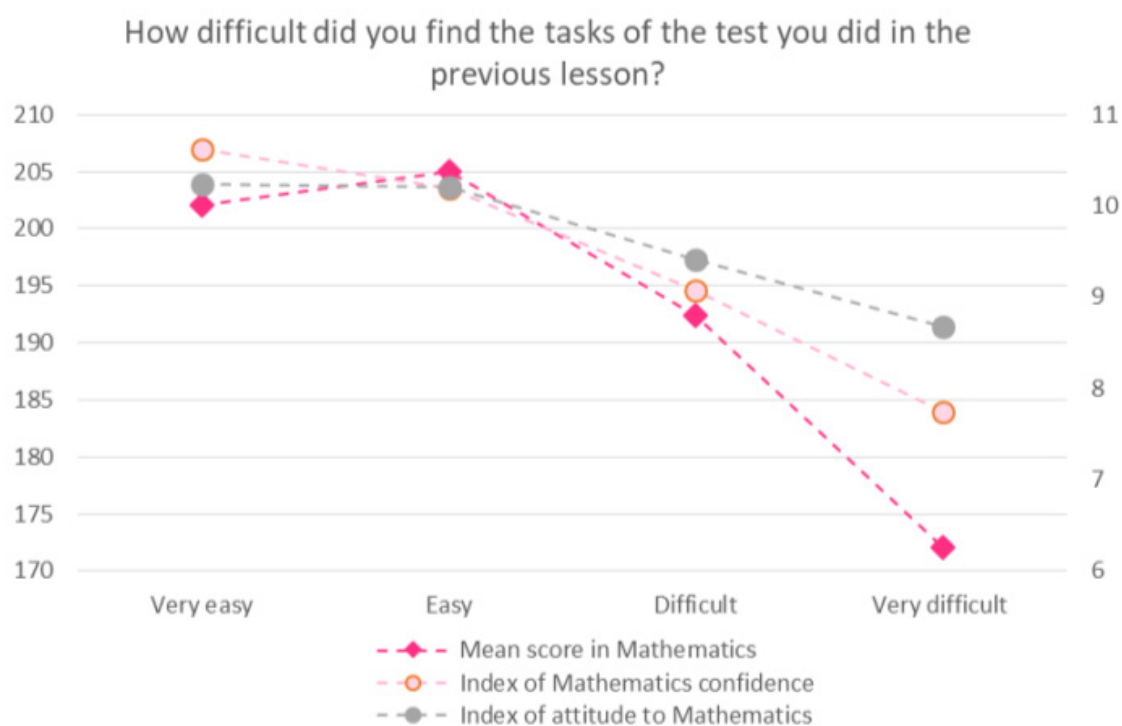


Figure 2 – Mean score in Mathematics and average values of motivational indices, by students’ answers to the question ‘How difficult did you find the tasks of the test you did in the previous lesson?’

subjects and that Reading was not more difficult for them than for other students in their class. Only 22% of students were at the low level of the index of self-confidence in learning Reading, 42% were at the a high level, and the remaining 36% of Year 4 students were at the medium level. In contrast to the situation with Mathematics, boys are significantly less confident in their Reading abilities than girls.

The more confident students are in their Reading abilities, the significantly higher their scores are. Students with the medium level of the index scored almost 16 points higher and those with the high level scored about 28 points higher than their peers with the low level. A one-unit increase in students’ index of self-confidence in learning Reading is associated with a significant 5.2-point increase in average Reading achievement. This is the largest significant difference between Reading outcomes seen in this NEMSQPE cycle.

More than 80% of students partly or completely agreed with the statement ‘I find what we read in the Literature Reading classes interesting’. At the same time, unfortunately, only every third student read on their own desire several times a week or almost every day for pleasure or entertainment or to learn something useful. And no more than half of the students agreed or partially agreed with the fact that reading was their favourite way of spending their free time. Perhaps the reasons for such an unenthusiastic attitude to reading should be sought, in particular, in the fact that every tenth participant of NEMSQPE 2021 reported that he/she was often bored in Literary Reading classes, never or almost never read on their own accord. Summarizing these answers, we found that 31% of students were at the low **level of the index of attitude to Reading**, 44% were at the medium level and 25% were at the high level of this index. Taking into account the previous monitoring cycle data, it was expected that the boys’ level of positive attitude to Reading was significantly lower than the girls’ one.

A higher level of positive attitude towards Reading is associated with an increase in the average Reading score. Students with the medium level of the index have a 5-point higher mean score than students with the low level of the index of attitude to Reading, and students with the high level of this index have a mean score of 7. A unit increase in students' index of attitude to Reading is associated with a significant but not considerable increase by 1 score point in the average result.

Most of the students partially or fully agreed that they 'learn a lot by studying literature and that reading is important for success in life'. About 40% of students partly or strongly agreed that Literary Reading is not as important as other school subjects, and about 24% of primary school graduates reported that their parents did not insist on their reading more. Students who fully or partially agreed with the statement that they learned a lot by reading are likely to score 10-point higher than other students. And students who considered Literary Reading not as important as other school subjects, as well as students whose parents encouraged them to read more, performed worse than their peers who partially or completely disagreed with the this statement.

About one in three students (32.2%) reported that the tasks of the Reading test were very easy for them compared to regular school tasks in this subject, and half of the students (50.4%) rated the tasks as easy. As expected, these students obtained significantly higher results than the others who found the tasks difficult (15.9%) or very difficult (1.4%) (Fig. 3). Students who found the Reading test tasks more difficult also rated their reading abilities and attitude to the subject lower. Interestingly, on average overconfident students who found the test tasks very easy scored lower than those who moderately overestimated their abilities, attitude to Reading, and task difficulty.

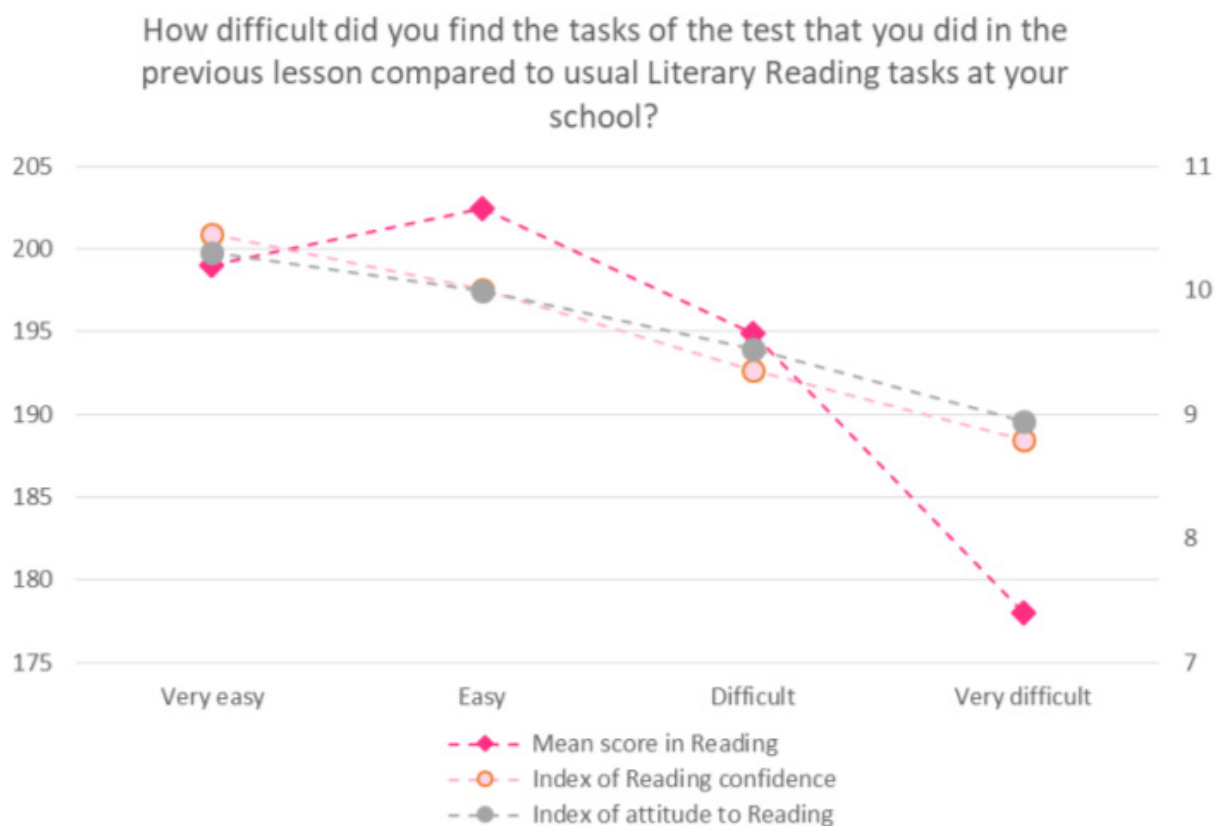


Figure 3 – Mean Reading score and the average values of the motivational indices based on the students' answers to the question 'How difficult did you find the tasks of the test that you did in the previous lesson compared to usual Literary Reading tasks at your school?'

Students' performance and family support

Two-thirds of students reported that their family members talk to them about their studies and check their homework every day or almost every day. 30% of students reported that their family members help them with their homework every day or almost every day. Students are more active in asking their parents for help with Mathematics tasks than with Literary Reading. 29.2% of students who took the Mathematics test and 27.6% of those who took the Reading test reported the high level of the **index of family support to students**. 18% of primary school graduates reported the low level of support from their family.

Students who reported the medium level of index of family support have slightly higher results in both subjects, but a high level of parental care is accompanied by a decrease in results, and more significantly in Mathematics. The same conclusion is confirmed by the results of the regression model with a continuous predictor. An increase in the index of family support by one unit is associated with a significant decrease in the mean scores in both Mathematics (by 1.16 score points) and Reading (by 0.77 score points). There is an obvious explanation for this: most often academically weak students need more attention from their parents.

The highest level of the index of family support (both in Mathematics and in Reading) is typical for those students who spend more than an hour a day on subject homework, and the lowest – for those who usually do not do their homework (Fig. 4). Therefore, this index in a certain way characterizes parents' help for those students who are weaker and need more support while their doing homework although, in the end, this support does not lead to a significant increase in academic performance. It partly explains why students with the high level of the index of family students' support (daily care and help with homework) have lower results in both subjects.

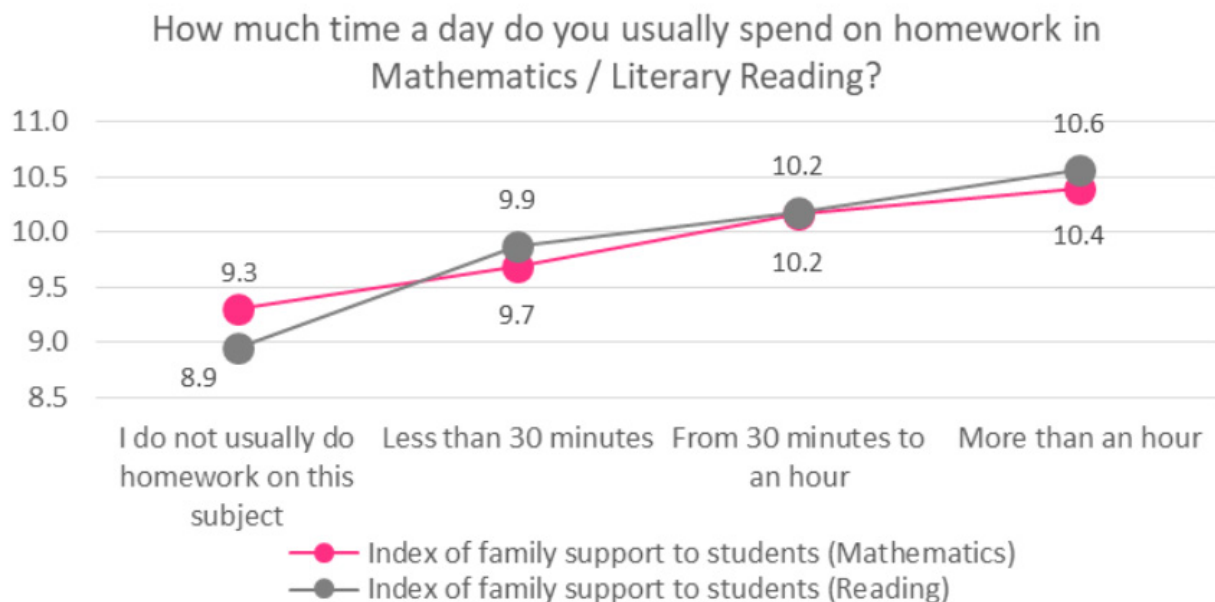


Figure 4 – Average values of the indices of family support (Mathematics and Reading) based on students' answers of to the question 'How much time a day do you usually spend on homework in Mathematics / Literary Reading?'

Students' performance and bullying in primary school

Most students (about 84%) liked their classmates, two-thirds (66.2%) felt happy at school. At the same time, every third student did not feel happy in their school. The absolute majority of students (almost 91%) agreed that teachers treated them well.

Students who like their classmates have significantly higher test scores in Mathematics and Reading than their peers who dislike their classmates (a difference of 7.1 score points in Mathematics and 9.0 score points in Reading). Students who feel happy in their schools scored 5.5 points higher in Mathematics and 7.6 points higher in Reading. Significantly lower results in both Mathematics (by 12.3 points) and Reading (by 13.1 points) are performed by those students who do not think that teachers treat them well.

Most students rarely experience bullying behaviour from their peers, senior school students, or adults. The vast majority of students (from 75% to 94%) reported that they were never or almost never hurt by adults, peers or senior school students at school. Most of all, students complained about their peers who did not invite them to their activities or offended them verbally. 11.6% of Year 4 students admitted that they were told offensive words every day or almost every day at school, and 15.6% reported that other children at school did not invite them to participate in games or do some work together every day.

The low level of *the index of bullying* is characteristic of 38% of students who never or almost never experienced any manifestations of bullying behavior or only one of the listed things happened to them several times a month. 31% of students experienced bullying at school at the high level. The remaining 31% of students belong to the group with the medium level of the index, i.e. they were rarely bullied. Boys suffered from bullying manifestations much more than girls: among them, 36% belong to the group with the high level of the index of bullying (in contrast, among girls, there are no more than 25%).

The lower the level of the students' index of bullying, the significantly higher mean scores that students perform in both Mathematics and Reading, and this dependence is more significant in Reading. Students with the medium level of this index scored almost 5 points higher, on average, in Mathematics and almost 9 points higher in Reading than students with the high level of the index of bullying. Respectively, students with the low level of the index of bullying performed 9.64 and 14.5 higher mean scores than students with the high level of this index. Overall, an increase in the students' index of bullying by one unit is associated with a significant decrease in the mean scores in both Mathematics (by 2.2 points) and Reading (by 3.3 points).



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EDUCATIONAL CONTEXT THROUGH 'THE EYES AND HANDS' OF PRIMARY SCHOOL TEACHERS (BASED ON THE TEACHER SURVEY RESULTS) AND ITS INFLUENCE ON STUDENTS' PERFORMANCE

A primary school teacher's portrait

NEMSQPE 2021 demonstrated the gender imbalance among the teachers who participated in it. That is characteristic of the education sector in general: only three respondents among 472 primary school teachers interviewed who reported their gender and whose students took tests in Mathematics or Reading are males.

In terms of age, the majority of primary school teachers are 51-65 and 41-50 years old (44.5% and 30.5%, respectively). Among the surveyed teachers, there is the least number of elderly (over 65) and young (under 30) people (2.5% and 7.6%, respectively). In general, in this monitoring cycle, compared to the previous one conducted in 2018, there is an increase of about 10% in the share of older teachers.

The vast majority of interviewed teachers completed Specialist's or Master's Degree programme (82.4%). The teachers were mainly educated in pedagogical universities (institutes / academies) and pedagogical colleges (schools). Some of them received their education gradually. Almost a third of pedagogical university graduates previously studied at a pedagogical college or school. The vast majority (93.4%) of teachers received training in Primary Education. Almost every fifth teacher is educated in two or more areas of specialization.

More than half of the teachers (54.1%) have a higher qualification category, which they received mostly after the age of 40, having worked in the school for, on average, 24 years. 32% of the teachers gained the status of a senior teacher. They are also teachers over 40. About 9% of the teachers accomplished for the pedagogical title 'a teacher-methodologist'. The share of such teachers increases rapidly in the age group after 50 years. The age of the teachers is proportional to the duration of their service in school which means that the vast majority of the interviewed teachers had been working in school continuously since they started their career. About 70% of the teachers started working in the 20th century, 43% of them entered the profession even before Ukraine gained independence.

The best results are demonstrated by students whose teachers have the *qualification category of teacher-methodologist*. Students whose teachers did not have any teaching qualifications performed worse in both Mathematics and Reading. Also, the higher the teacher's pedagogical qualification category was, the higher was the percentage of students overcoming the benchmarks of Reading and Mathematical competencies defined in NEMSQPE 2021. Almost every fourth student taught by a teacher-methodologist reached a high benchmark of Mathematics and Reading competencies, on the other hand, among those whose teachers were without teaching qualifications, every tenth fourth grader achieved that benchmark.

The teachers' view on material and technical support of the school

A significant proportion of the teachers who took part in the survey partially or completely agreed that the building of their school needed major repairs (58.5%) or that school classrooms needed repairs (72.3%). About 80% of the teachers emphasized the need for new classroom furniture, but this number is 10% fewer than in the last monitoring cycle. Also, in this cycle, a smaller share of the teachers complained about the lack of necessary didactic materials and support: only 55% of the teachers partially or fully agreed with the corresponding statement, whereas in the NEMSQPE 2018 cycle there were around 69% of such responses. However, half of the teachers still felt the lack of adequate support in the issues referred to the use of information and communication technologies in the educational process.

The information about the material and technical support from the school was summarized in the form of the ***index of poor working conditions for teachers***, the higher values of which correspond to more unsatisfactory working conditions. 26% of the teachers reported their working conditions as good (a low level of the index) and 37% – as average (a medium level of the index) or bad (a high level of the index). The level of teachers' dissatisfaction with working conditions varies little in different types of settlements. Along with this, the teachers in general education schools rate working conditions as significantly worse than their colleagues who work in other types of school (lyceums, gymnasiums, and specialized schools).

The teachers' worse working conditions are not accompanied by a significant decrease in students' performance in either subject. In general, a one-unit increase in the index of unsatisfactory working conditions for teachers (i.e., worsening working conditions) leads to a decrease in Mathematics and Reading scores by an average of 0.8 score points, but this difference is not statistically significant at the 0.01 level.

Answering the survey questions related to the availability of various units of NUS equipment in their classrooms, the teachers generally assessed it positively. Over 80% of the teachers reported that the classrooms where they worked were fully equipped with educational and cognitive activity centers, children's classroom libraries, and teacher centers. Fewer teachers in cities and specialized schools reported that there were also fully equipped centers of artistic and creative activity. From 50% to 70% of the teachers reported that they had zones equipped for games and changing themes in their classrooms. The teachers who agreed that the classroom was not spacious enough for the organization of the NUS zones reported the availability of a game zone less often. The corners of living nature for conducting experiments as well as recreation centers were the least equipped (on average at the level of 30%) in the classrooms where year 4 students of 2021 completed their primary education. The problem was especially acute in classrooms that were not spacious enough.

The teachers' view on students and their parents

The vast majority of primary school teachers (84.2%) partially or completely agreed that students in their classes were motivated to succeed in learning. At the same time, almost half of those teachers believed that their students were capable of succeeding in their studies. According to the majority of the teachers (66.7%), students had a favourable

attitude towards those classmates whose academic performance was especially successful. 92.1% of the teachers partly or fully agreed that parents actively participated in the life of their children's school and class. Also, the majority of teachers (91%) were sure that students' parents helped their children during the learning process.

Summarizing the teachers' answers in the form of the ***index of school focus on students' success***, we found out that 41% of the teachers rated their school's level of focus on students' success as high, 15% as low, and the other 44% as medium. Gymnasium and lyceum teachers rated their schools' focus on students' success the highest, and the teachers of general education schools – the lowest. The difference between different types of settlements was not significant.

A higher level of the index of school focus on students' success is *associated with higher students' achievements*, and in Mathematics, this increase is more visible and significant: the mean Mathematics score of students studying in the most success-oriented schools increases by 14.6 points, and in Reading – by only 5.5 points. If the index of school focus on students' success increases by one unit, the performance in Mathematics increases significantly by 2.3 score points, and in Reading – by 1.9 score points.

During data analysis, logical combinations of various factors were investigated. As a result, it was found that after accounting for the interaction of students' indices of self-confidence in learning Mathematics and Reading and the index of school focus on students' success, the contribution of their interaction to the improvement of subject scores is significantly greater than of each index separately. In such a model, a one-unit increase in the indices of self-confidence in learning Mathematics and Reading performance is accompanied by a significant increase in Mathematics performance by 8 score points, and in Reading by almost 7 score points. A one-unit increase in the index of the school focus on students' success entails a significant increase in Mathematics performance by almost 5 score points and in Reading by 3 score points.

The teachers' view on classroom management challenges

Students' passiveness, emotional indifference, low level of knowledge and smartphone addiction make teachers' work with the class the most difficult: almost every fourth teacher reported that the mentioned factors made their work with the class much more difficult. Such factors as social stratification, ethno-cultural differences and gender imbalance in the classroom make work difficult the least: 60 to 80% of the teachers reported that they did not make their work difficult at all. About half of the teachers reported that students' poor pre-school preparation, their unreasonable missing classes with their parents' permission, disobedience, and hyperactivity made their work more difficult or much more difficult. Every third teacher experienced problems due to students' regular being late for school.

20% of the teachers who experienced significant difficulties in working with the class had the low level of the generalized ***index of teachers' work challenges***. 24% of the teachers have the high level of this index, or no challenges / complications. 56% of the teachers reported having rather no complications. The teachers estimated classroom management challenges at approximately the same level, regardless of the type of settlement or type of school, age or qualification category.

Difficulties in working with the class affect students' performance in Reading more than in Mathematics. The fewer challenges a teacher experienced in classroom management, the higher performance in Mathematics their students had, but this increase is not statistically significant. In contrast, Reading scores increased significantly by almost 9 points compared

to those of students whose teachers reported significant difficulties at work. A one-unit increase in the ***index of teachers' work challenges*** results in a significant 1.3-point increase in Reading scores and a non-significant 1.0-point increase in Mathematics scores.

According to the teachers' answers, the classroom management challenges can be grouped into three categories: component 1 includes the difficulties in the teachers' work due to students' level of training and their behavior in the classroom; component 2 is related to students' socio-cultural characteristics; and component 3 includes the challenges due to students' after-school behaviour. The less the factors of components 1 and 2 complicate the teachers' work, the higher their students' performance is, especially in Reading. Component 3 in both cases is associated with a slight decrease in performance: the less the teacher is concerned about students' absence and being late for school, the lower their students' performance is.

The teachers' view on the level of colleagues' collaboration

More than 60% of the teachers participating in NEMSQPE 2021 often or very often interacted with their colleagues in order to ensure continuity in teaching, planning and preparation of didactic materials, and also cooperated working in groups to achieve educational goals. More than half of the teachers often or very often shared their teaching experience with their colleagues. At the same time, more than 55% of the teachers sometimes or rarely discussed with their colleagues how to teach certain topics or observed their classes to learn more about teaching methods.

The ***index of teachers' collaboration***, the generalized indicator, is constructed in such a way that the high, medium and low levels of collaboration are demonstrated by 24, 40 and 36% of the primary school teachers, respectively. The level of teachers' collaboration differs significantly between different types of settlements: in small towns, teachers reported the highest level of collaboration, and in villages – the lowest. According to the type of school, the difference is not so significant, but the interaction between teachers is noticeably less in general education schools. Surprisingly, young teachers rarely interact with colleagues, while teachers aged 51-65 show the peak average value of the index of teachers' collaboration.

The more time primary school teachers spent on professional development over the past two years, the higher the value of the index of teachers' collaboration was (Fig. 5). And this is natural because during joint professional development training teachers' active communication takes place as well as they establish professional ties, which further affect the level of interaction within the implementation of the educational process.

When teachers' collaboration increases to the medium or high level, it does not lead to significant changes in students' performance in either Mathematics or Reading. Viewing the index of teachers' collaboration as a continuous variable also confirms the absence of its significant effect on students' achievements: a one-unit increase in the index is associated with a marginal increase of 0.7 score points in Reading and 0.2 score points in Mathematics.

An in-depth analysis of the structure of data on teachers' interaction revealed a clear two-component structure: component 1 characterizes simpler forms of interaction between teachers in the form of mutual visits, sharing experiences, and cooperation for the realization of educational goals; component 2 characterizes higher-level collaboration related to teaching planning and preparation. In general education schools, we do not observe a

noticeable difference in the forms of interaction between teachers, but in gymnasiums and lyceums, as well as in general education schools in villages and small towns, interaction prevails in the form of visiting each other's lessons, sharing their own experiences, and collaborating with other teachers for the implementation of educational goals. On the other hand, in specialized schools and other types of schools in cities and large towns teachers more often prefer interaction at a higher level with the purpose of discussing teaching of certain topics with other teachers as well as planning and preparation of didactic materials.

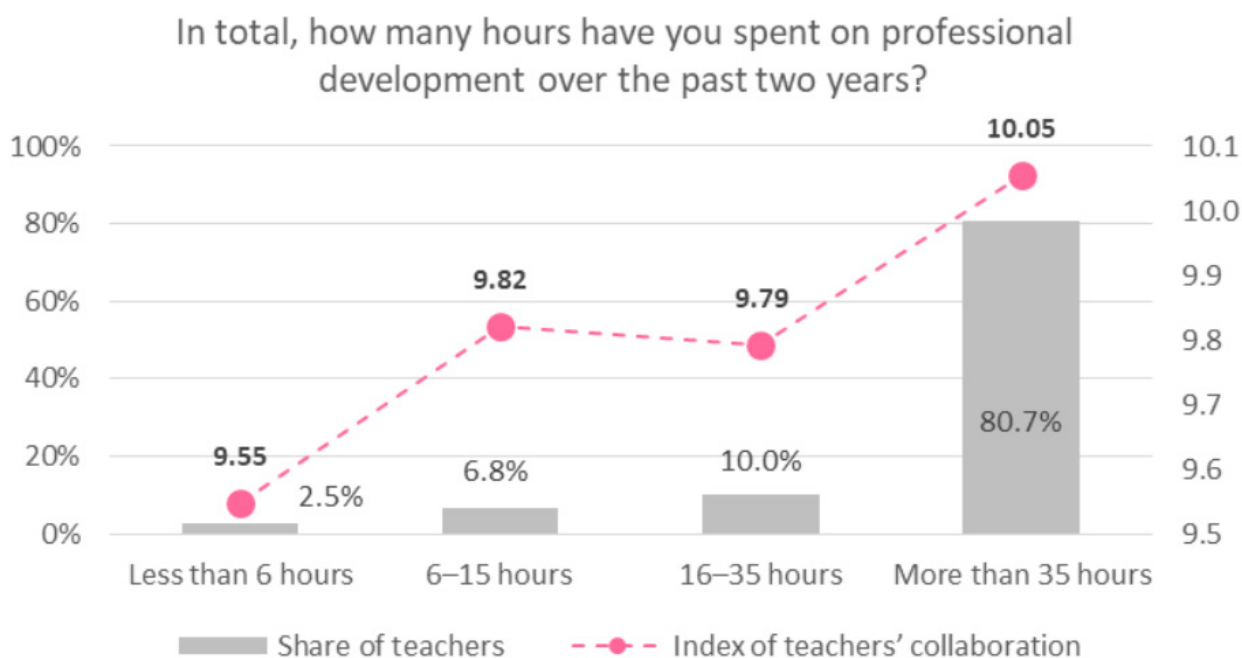


Figure 5 – The average value of the index of teachers' collaboration based on the time spent on professional development

However, we still do not observe a significant directed influence of each component on the change in the mean score for performed tests in Mathematics and Reading. The fact that the analysis did not reveal a direct relationship between students' achievements and the level of teachers' interaction does not mean that such a relationship cannot be mediated through the connection of teachers' collaboration with other factors (for example, with the level of their self-efficacy, job satisfaction, professional development, etc.), and the combination of various factors definitely has an impact on the final result – students' successful performance.

Methods, techniques, and organizational forms of teaching Mathematics and Reading in primary school

When answering questions about general (regardless of the subject) teaching methods, more than half of primary school teachers reported that they often used almost all known methods. However, using the principal component method, it was possible to combine teaching methods into two components based on the frequency of use without loss of information (Fig. 6): component 1 combined research-oriented methods that require a teacher to organize students' research activities and activities focused on the creative application of acquired knowledge (research, partial research, and problem-solving methods); component

2 characterizes reproductive methods, which are reduced to the communication of certain information by the teacher and its reproduction by students (reproductive and explanatory-illustrative methods).

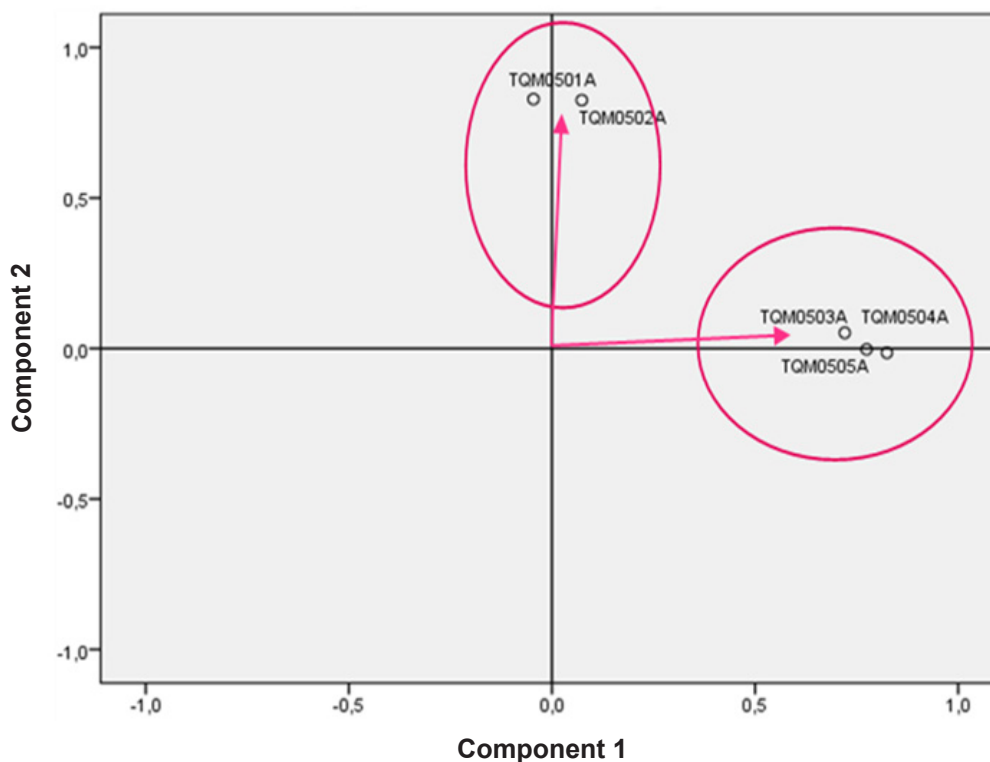


Figure 6 – The graph of locating teachers’ answers in the rotation space, by responses about teaching methods used for the class that participated in the test

The frequency of *using research methods* was higher than using reproductive methods in gymnasiums, lyceums, and specialized schools. The use of research methods by the teachers prevailed over the use of reproductive methods in all settlements, except for villages. Meanwhile, young teachers under 40 and their colleagues older than 65 reported the predominant use of reproductive methods. Research methods prevailed only in the work of the teachers aged 51–65 and teachers of the highest rank category. The teachers who demonstrated a high level of collaboration with colleagues used exploratory methods more often than reproductive methods, and those teachers who had little interaction with colleagues preferred reproductive methods. In schools with a higher level of focus on student success, the use of research methods was more common.

The results show that more frequent use of research methods of teaching (component 1) is accompanied by an increase in scores in both subjects, more significantly in Reading – by 2.7 score points. The more often the teachers used reproductive teaching methods (component 2), the lower their students’ results in both subjects were.

In order to encourage students to learn Mathematics, the teachers used various techniques. Most often, they gave examples of how Mathematics is applied in everyday life and monitored students’ individual educational progress emphasizing their achievements during assessment (about 95% of the teachers did that often or very often). All other techniques were used by 80 to 90% of the teachers just as often. The teachers also used high-complexity tasks for the most successful students, demonstration of alternative ways of solving problems, and a change of teaching approaches to engage students but slightly less often than other techniques.

16, 55, and 29% of teachers, respectively, fell into the categories with low, medium, and high levels of the ***index of pedagogical approaches to engage students in Mathematics***. The level of application of pedagogical approaches to engage students in Mathematics depends little on the type of settlement, type of school, age or teachers' qualification category.

The analysis shows a significant increase of about 7 score points in students' Mathematics performance whose teachers quite often used various pedagogical approaches of engaging students in Mathematics (the medium and high level of the index), compared to those students whose teachers used such methods sometimes (the low level of the index). In general, a unit increase in this index is associated with an increase of approximately 1 score point in Mathematics results.

Most often, when *teaching Literary Reading*, the teachers systematically teach students new words and ask them to read aloud. More than 95% of the teachers did these things often or very often. The least popular activities were reading aloud to the whole class and giving students time to read books of their own choice. Every third teacher used such techniques only at times.

Scrutinizing the answers to the questions about teachers' instructive actions when teaching Literary Reading to students, it became possible to see some regularities, when these actions were logically grouped into three groups: component 1 includes actions aimed at improving reading techniques; component 2 is related to preparing students for independent reading; component 3 includes reading aloud. Students' scores increased slightly (but the increase is not statistically significant) if their teacher more often used activities aimed at improving reading technique. Students' scores increased slightly faster, but also insignificantly, if their teacher encouraged them to read independently more often. On the other hand, when teachers read aloud or asked students to read aloud frequently, it led to a significant decrease in results by almost 2 score points.

Among *forms of organizing students' class work*, teachers most often used frontal and group work. Group work, when students are grouped according to certain criteria (not according to the level of educational achievements), was often or very often used by about 70% of teachers. A little more than 60% of the teachers often used group work, when students were grouped according to their level of academic performance. Over half of the teachers often practiced students' independent studying or their individual work according to the plan provided by the teacher. Individual work, which involves students' independent planning of their activities, was rarely used by the teachers. The data of this monitoring study are not substantial enough to draw a conclusion that the frequency of applying certain forms of organizing students' work has a significant effect on their achievements.

Primary school teachers' job satisfaction

The questions offered to the teachers in the questionnaire regarding job satisfaction to some extent related to the profession in general and working conditions in particular. As in the previous monitoring cycle, the teachers who taught Year 4 students in 2021 demonstrated the high level of satisfaction with their profession (95.7% felt satisfied often or very often). The majority of the teachers (95%) responded that they consider their work to be as socially useful. A significant part of the teachers (73%) rarely thought about changing a job, but 22.1% of the teachers sometimes thought about it. 75% of the teachers were planning to

work at school as long as possible. Due to the overwhelming number of positive answers, the teachers were unevenly divided into three groups whereas the majority had high and medium levels of the ***index of job satisfaction***.

The level of teachers' job satisfaction was similar in different types of settlements and schools. We observed significant differences in job satisfaction only in regard with the age of the teacher and the number of years of service at school. Job satisfaction reached its peak value among teachers aged 51 to 65, who had worked at school for 31–40 years. The least satisfied with their work were the teachers aged 31 to 40 or those who had been working at school for 11–20 years. The job satisfaction level decreased among older teachers who had worked at school for more than 40 years.

Teachers' job satisfaction does not depend directly on the size of the class the teacher worked with, but teachers who worked either with small classes (less than 10 students) or with large classes (more than 30 students) showed the higher level of job satisfaction. The teachers who worked with quite optimal in terms of size classes (21–25 students), had the lowest level of job satisfaction (Fig. 7).

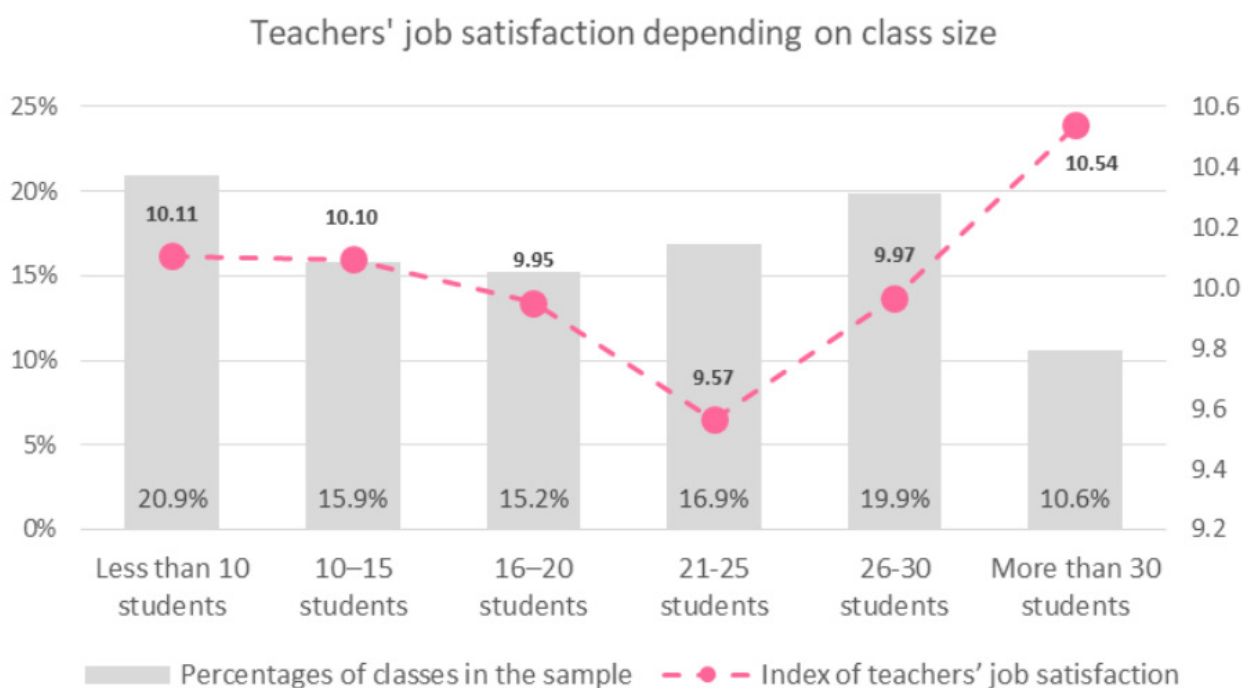


Figure 7 – Average values of the index of teachers' job satisfaction, based on the size of the class that participated in the study

No significant direct effect of teachers' job satisfaction on student performance in Mathematics or Reading was observed within this monitoring study. At the same time, teachers' job satisfaction is related to other factors that had significant impact on performance. For example, job satisfaction increased significantly if the teachers experienced fewer difficulties working with the class, their school was focused on students' success, and they managed to implement various methods of encouraging students to learn Mathematics (Fig. 8). Poor working conditions are most likely to reduce the level of teachers' job satisfaction.

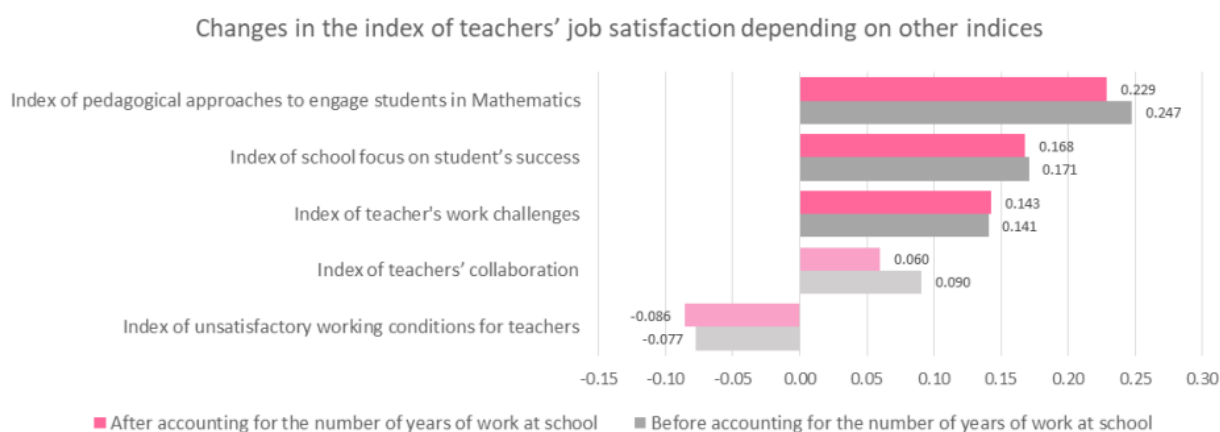


Figure 8 – Changes in the index of teachers' job satisfaction, based on the increase of the corresponding index by one unit, before and after accounting for the years of working experience at school

The teachers' view on who and how appreciates their work

Answering the questions in the survey, the primary school teachers rated on a 5-point scale how much, in their opinion, their work was appreciated by various actors of social relationships: students, parents, school administration, local authorities, central state authorities, mass media. The vast majority of the teachers believed that their work was highly valued by school administration (almost 93% of the respondents chose a score of 4 or 5) and students (almost 80% of the respondents chose a score of 4 or 5). At approximately the same but slightly lower level, according to the teachers, their work was appreciated by students' parents and local authorities. The teachers were the most dissatisfied with how their work was valued by central state authorities and mass media. Similar results were observed in the monitoring cycle in 2018.

Actors of social relations, according to the level of appreciation of the teachers' work, were divided into two groups (Fig. 9): one group (component 1) consists of governing bodies (central, local or school-level ones) and mass media; the second group (component 2) consists of students and their parents as actual participants of the educational process, who the teacher has the most contact with.

The teachers of specialized schools, in schools of cities and towns, as well as the teachers over 50 and those with a higher qualification category, rated the efforts of the authorities lower, and the students' and their parents' higher. The more teachers were satisfied with their work, the more attention they felt both ones from the authorities and from students and their parents. The teachers who experienced more difficulties working with the class believed that students and their parents appreciated their work less than the authorities. The teachers who rated the government's and school administration's efforts higher had students who had performed worse overall and significantly worse in Mathematics.

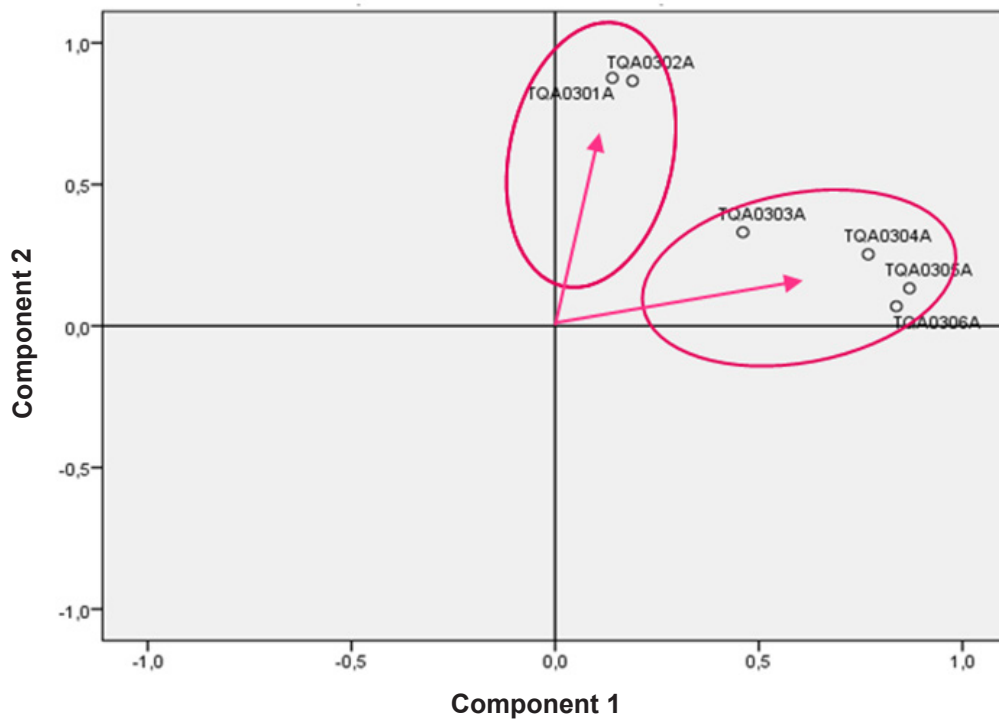


Figure 9 – The graph of locating primary school teachers’ answers in the rotation space, based on the questionnaire about how highly their work is appreciated by various actors of social relationships

Class size effects on student performance

The study of class size effects on student achievement is based, on the one hand, on the teachers’ answers about the number of students in the class that participated in Mathematics or Reading test, and, on the other hand, on the teacher’s beliefs about an optimal class size to achieve the best learning outcomes. In the NEMSQPE 2021 cycle, there were 4 students in the smallest class, and 40 in the largest one.

In primary school, the vast majority of students study in classes with more than 20 registered students (Fig. 10). The larger students’ class size was, the higher the students’ mean scores in Mathematics and Reading were. This association is not direct, since the class size depends very much on the type of settlement, and student performance success rate depends on the type of school. Therefore, below is an analysis of the impact of class size on student achievement after accounting for these two factors.

The Mathematics test scores in all classes with more than 10 students are slightly below the baseline score calculated here for students in classes with less than 10 students in a rural general education school. But this decline is not significant for any class size. The type of settlement has a much greater effect (students had significantly higher performance in cities and large towns) as well as the type of school (significantly higher results in specialized schools, gymnasiums, and lyceums).

The Reading test scores even increased slightly as class size increased. This was especially noticeable for classes with 21 to 25 students (by almost 6 score points). But even here this increase is not significant because the main effect was caused by the type of settlement and type of school.

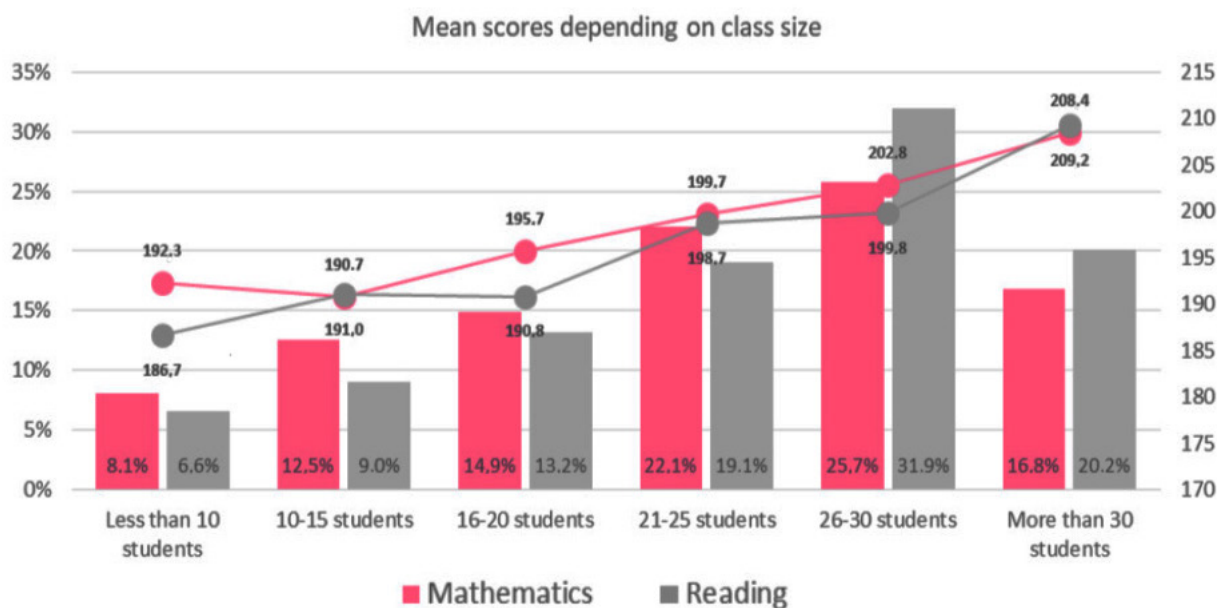


Figure 10 – Mean scores of primary school graduates in Mathematics and Reading, by the size of their class

The majority of the teachers (62.6%) rated their class as of average size (Fig. 11). The average class size is 18 students. Every fifth teacher considered the class they worked with as too large. On average, their size was 30 students. 16% of the teachers considered their classes with on average 10 students to be too small.

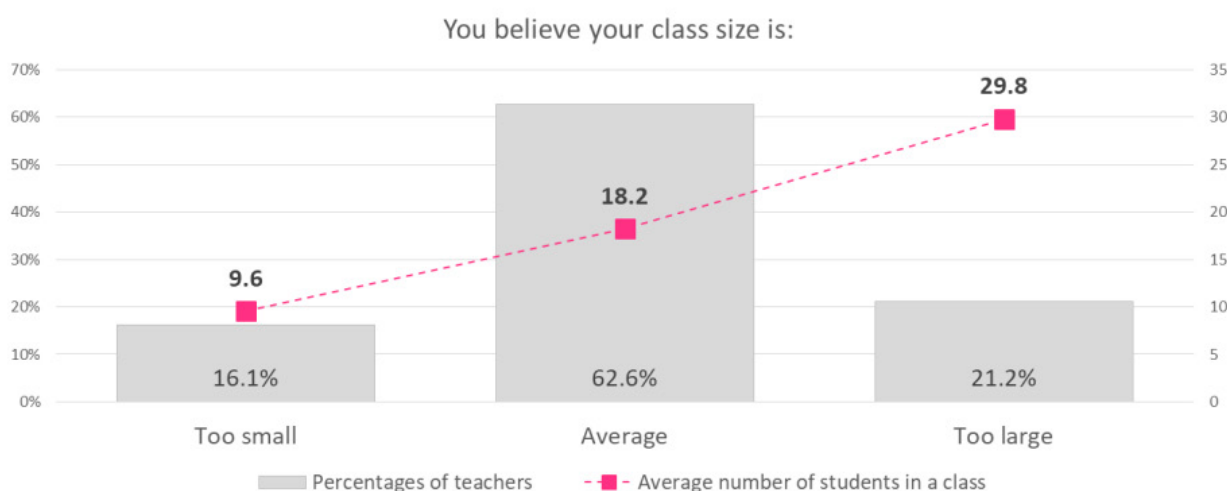


Figure 11 – The average size of the class that participated in the monitoring study, by the teacher’s belief about its size

Teachers of rural schools considered a class with only 14 students to be too large, although in settlements of other types or in different types of school, this number reached 30. According to the teachers, in classes of average size, Mathematics scores were often higher than average in comparison with the classes that they considered too big. On the contrary, the students’ scores in Reading were often higher than average in the classes that the teachers characterized as too large.

Over 60% of the teachers considered a class with 16–22 students as the one of optimal size, and almost a third of them mentioned that a class size of 4–15 students is optimal. Almost all the teachers worked in classes the sizes of which exceeded their dream limits.



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CONCLUSIONS

I. What do the data obtained from primary school graduates say?

- *Student performance in Mathematics and Reading depends significantly on factors that indicate a particular material and socio-cultural status of their families. Students whose families have a higher level of household resources (books, digital devices, cars) have higher achievements.*
- *The money and efforts in preparing a child for school, in their general development and recreation also have a positive effect on academic performance. The students who attended kindergarten for more than two years had higher performance in both Mathematics and Reading; the same effect was caused by preparing for Year 1 while attending preparatory courses in kindergarten or school, attending more than two clubs or classes after school, and visiting a resort in Ukraine or abroad during the summer vacation after Year 3.*
- *Almost every third primary school graduate showed the high level of confidence in their abilities regarding Mathematics and reported the high level of positive attitude towards this school subject. Girls were less confident in their own abilities in learning Mathematics, although they expressed a positive attitude towards it equally with boys. Most of the primary school graduates understood the importance of learning Mathematics for life. All these motivational factors have a significant impact on the success in mastering mathematical competency, but the students' confidence in their abilities, which they themselves evaluate, by the way, quite objectively has a more significant impact.*
- *A significant share of the primary school graduates demonstrated the high level of confidence in their reading abilities, and a slightly smaller share declared a positive attitude towards Reading as a school subject. The girls who felt confident about Reading and had a very positive attitude towards it remarkably outnumbered the boys. Most of the students understood the importance of Literary Reading. All of these motivational factors have a significant impact on students' achievement in Reading, but the students' confidence in their abilities as readers has a more significant impact.*
- *It seems logical that parents' attention to their children's school life should contribute to the improvement of their academic achievements, however, as it turned out, excessive care, and direct help with homework, on the contrary, are associated with worse academic performance. We explain this by the fact that assisting with homework is in the focus of the attention of those parents whose children's performance is not good and who could probably have even poorer academic achievements without their help.*

- *The students who did not feel comfortable at their schools, as well as those who suffered from bullying by peers, high school students, or adults, had lower test results in both Mathematics and Reading.*

II. What do the data obtained from primary school teachers say?

- *A typical primary school teacher in the last year, when the educational process in the first stage of general secondary education took place on the basis of the previous concept of the school education development, is a woman over 40, who has obtained a full higher education with qualifications of a specialist or Master's Degree at a pedagogical university (institute or academy) majoring in Primary Education and has a high qualification category, but at the same time has no professional title (a qualification rank). Since entering the profession, this teacher has worked at the school for more than 15 years.*
- *Students whose teachers have a teacher's professional title (a qualification rank) achieved higher results in both Mathematics and Reading. This association can be traced even after accounting for teachers' age, which indicates that teachers do not receive a pedagogical title simply because of years of service, although their share is greater in the group of older teachers.*
- *Although a certain proportion of the teachers reported that their working conditions in the school needed to be improved, this did not prevent their students from achieving good learning outcomes. At the same time, it is observed during this cycle of monitoring study, that the decrease in students' performance in Mathematics and Reading if the teachers' working conditions are poor, is not statistically significant.*
- *The factors taken into account when constructing the index of school focus on students' success (students' motivation, their ability to achieve success, favourable attitudes towards successful students, parental involvement in the school life) contribute to improving students' learning outcomes, especially in combination with other school and student characteristics.*
- *Regardless of the type of school or type of settlement, age or professional qualification, the teachers experienced common difficulties in working with the class at approximately the same level. The teachers in gymnasiums and lyceums, as well as in large towns, were most bothered by students' absenteeism and being late for lessons, however, the teachers in specialized schools and in smaller settlements (villages, small and large towns) were concerned about classroom discipline and students' poor preparation for lessons. Social stratification, ethno-cultural differences, or gender imbalance were nowhere a significant obstacle for a primary school teacher in working with the class. The fewer challenges the teachers had working with the class, the better scores their students performed, especially in Reading.*

- *The teachers collaborated most with each other at an older age, and their interaction was stronger if they spent more time on professional development. The teachers from small towns demonstrated the highest level of collaboration but there, as in villages, such simple forms of interaction as visiting colleagues' lessons, sharing experience, and co-operating with other teachers to achieve educational goals prevailed. Instead, in specialized schools and in cities and large towns, the teachers more often preferred higher-level interaction in order to discuss ways of teaching certain topics, planning, and preparation of didactic materials.*
- *The methods of teaching in the classroom, which the teachers actively used, according to the frequency of actualization, can be combined into two components: research methods and reproductive methods. The use of research methods prevailed in gymnasiums and lyceums and specialized schools, as well as in schools in all types of settlements, except for villages. The young teachers under 40 and their colleagues over 65 mostly used reproductive methods. The teachers who frequently interacted with their colleagues were more likely to use research methods. The application of research methods led to higher students' performance in Reading.*
- *The teachers' use of various pedagogical methods of encouraging students to learn Mathematics contributed to a significant increase in student performance. The teachers of specialized city schools, the teachers aged 51-65, and the teachers with higher qualification categories used such methods more actively.*
- *In teaching Literary Reading, the teachers concentrated their actions in three areas: improving reading speed, preparing students for independent reading, and reading aloud. The teachers' actions aimed at improving reading speed prevailed in specialized schools. The young teachers (up to 40) used the reading aloud technique more often, and the teachers over 65 less often taught students different reading techniques and new words. The higher teachers' qualification categories are the less often the teachers use the reading aloud method, which is associated with a decrease in students' performance in Reading.*
- *Organizing students' class work, the teachers most often used frontal and group work. Individual work, which involves a student's independent planning of their activities, was rarely used by the teachers. But this monitoring study does not provide enough data to draw a conclusion that the frequency of application of certain forms of organizing students' class work significantly affects their achievements.*
- *Ukrainian teachers working in primary schools are generally satisfied with their work. The highest level of job satisfaction was demonstrated by the teachers aged 51-65 who had worked at school for 31-40 years. Job satisfaction depends little on the class size and the school equipment, but more on the extent to which the teachers*

manage to perform their professional tasks. However, within the framework of monitoring study, no significant direct impact of teachers' job satisfaction on student achievements was observed.

- *The actors of social relationships according to the level of how they, based on the primary school teachers' beliefs, appreciated their work, were divided into two groups: governing bodies, and students and their parents. The teachers of specialized schools, in schools of cities and towns, as well as the teachers over 50 and those with a higher qualification rank, rated the efforts of the authorities lower, and of the students' and their parents' higher. The more teachers were satisfied with their work, the more attention they felt both from the authorities and from students and their parents. The teachers who experienced more difficulties in working with the class believed that students and their parents valued the teachers' work less than the authorities. The students of the teachers who rated the efforts of the authorities and school administration higher performed worse in NEMSQPE 2021, and significantly worse in Mathematics.*
- *A large class size is not a significant obstacle for students to achieve high results, especially in Reading. But in classes that the teachers considered too large, student performance in Mathematics was somewhat lower than in classes of average size. Ukrainian teachers, even those who believed that a larger class size is optimal for the implementation of the educational process, worked mainly with classes the sizes of which exceeded, in their opinion, the permissible limits. At the same time, the teachers' beliefs about the optimal class size differ depending on the type of settlement. It is obvious that the search for a compromise between the best conditions for a child's development and a teacher's physical capabilities must continue.*



Photo of the Press Service of the Ministry of Education and Science of Ukraine

METHODS OF ANALYSIS OF STUDENT AND TEACHER SURVEY DATA USED IN THE PREPARATION OF THE REPORT ON THE RESULTS OF MONITORING STUDY

In addition to typical methods of analysis (construction of frequency distributions, calculating the measures of central tendency, calculating indicators of variation, measuring the correlation between different variables, comparison of averages, etc.), methods of measuring latent variables within the framework of the modern Item Response Theory were used within the monitoring study to analyze the data of student and teacher questionnaires. They were used when a group of student or teacher questionnaire questions related to the same latent variable that allowed generalization and measurement on a continuous scale. For this purpose, a one-dimensional model of partial credits (the Partial Credit Model) was used.

The result of measuring this variable (index) was presented in a scale with an average value of 10 and a standard deviation of 2. The process of constructing the scale and its validation for each index is described in detail in Appendix A of Part II of the Report¹. To give the points of the scale a specific meaning after its construction, benchmark values were determined to divide the scale into three intervals, characterized by high, medium and low manifestation of the variable measured by the corresponding index. A total of 14 indices were constructed in this monitoring cycle.

The following indices were constructed based on students' answers to the questions in the questionnaire:

- index of students' household resources,
- index of students' bullying,
- indices of students' self-confidence in learning subjects (these and the following indices were constructed separately for Mathematics and Reading),
- indices of students' attitude to the subject,
- indices of students' family support.

The following indices were constructed based on teachers' answers:

- index of teachers' work challenges,
- index of school focus on students' success,
- index of teachers' job satisfaction,
- index of teachers' collaboration,
- index of poor working conditions for teachers,
- index of pedagogical approaches to engage students in Mathematics (when constructing the latter, only the answers of the teachers whose students took the Mathematics test were used).

In the case when the group of questions related to a variable the measurement of which on a continuous scale did not make sense, or when it was necessary to explore the hidden structure of the data in depth, reduce the number of features without losing information

¹ Report on the results of the second cycle of the National External Monitoring Study of the Quality of Primary Education *The State of Development of Reading and Mathematical Competencies of Primary School Graduates*, in 2021: in 2 parts. Part II. Learning Prerequisites and Outcomes / T. Lisova (main author), H. Bychko, M. Mazorchuk, T. Vakulenko, V. Tereshchenko, V. Horoh; edited by O. Osadcha and V. Tereshchenko; The Ukrainian Center for Educational Quality Assessment. Kyiv, 2022. 272 p.

about the studied variable, factor analysis methods were used. When conducting this analysis, the main method was a principal components method using a method of varimax (orthogonal) rotation, which facilitates the interpretation of the principal components and allows them to be meaningfully interpreted and named.

In the context of NEMSQPE, the factor analysis made it possible to identify the structural components of the methods and techniques that teachers use in Mathematics and Reading lessons, and to investigate the impact of these practices on students' performance. Certain regularities were also revealed in the structure of the data regarding the difficulties experienced by teachers in working with the class, regarding teachers' collaboration, and teachers' beliefs about how much their work is valued by various participants of social relationships.

The influence of various contextual factors (institutional, material and cultural, demographic, motivational, social and family, methodological and didactic, etc.) on the level of development of Mathematical and Reading competencies in primary school graduates was researched mainly with the help of two-level linear regression models. The use of mixed regression models is due to the nature of the sample, since all students of a certain class from a randomly selected school were included in the study. To account for this clustering of the data and to avoid Type 1 error (reporting an effect that does not actually exist), all main effects were examined with random effects due to between-school differences.

The choice of the model (with a variable intercept or with a variable intercept and angle of inclination) was made on the basis of information criteria AIC and BIC. In the case when a school-level predictor was considered (for example, a variable of teachers' collaboration obtained on the basis of their answers to questionnaire questions), models with only a variable intercept were built.

The models with both continuous and discrete predictors were used to test each effect associated with the indices. In the first case, the predictor is the index itself, and we end the conclusion about the effect with the words 'when the index increases by one unit'. In the second case, the predictors are the index benchmark values, which are transformed into dichotomous 'dummy variables'. The effect is observed in comparison with the values calculated for the base category, which usually corresponded to a low level of the index.

Figure 12 summarizes the information on the influence of all constructed indices on students' performance in Mathematics and Reading, obtained from separate regression models for each index. A significant (at the significance level of 0.01) change in the number of points from the subject when the corresponding index increases by one unit is marked in a darker color. For example, the results in Mathematics and Reading increase by more than 5 score points when the index of students' confidence about the subject increases by one unit.

Changes in the number of score points in a subject, if the corresponding index increases by one unit

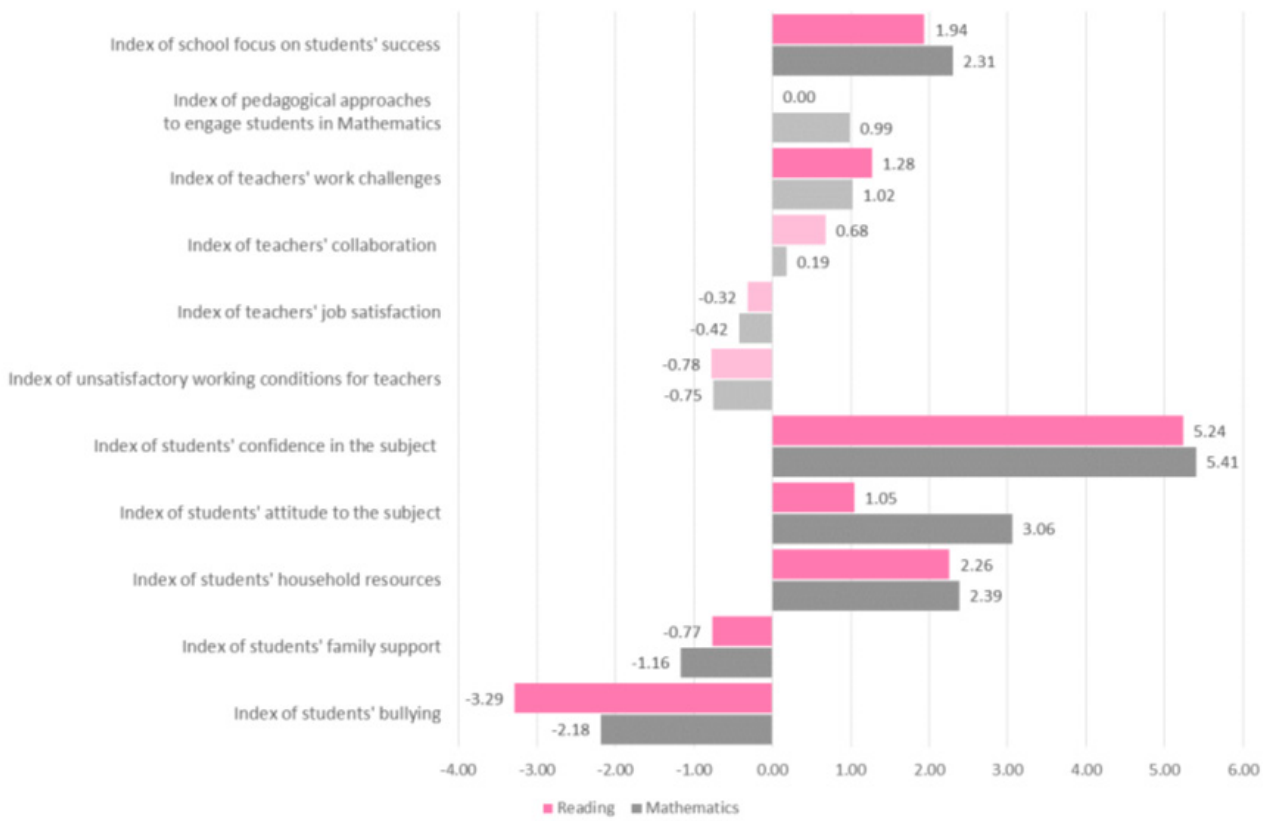


Figure 12 – Changes in the number of score points in a subject, if the corresponding index increases by one unit

You can read more about the results of the main stage of the second cycle of NEMSQPE 2021 in the full report on the website of The Ukrainian Center for Educational Quality Assessment.

ЗВІТ

2021

ПРО РЕЗУЛЬТАТИ
ДРУГОГО ЦИКЛУ
ЗАГАЛЬНОДЕРЖАВНОГО
ЗОВНІШНЬОГО МОНІТОРИНГУ
ЯКОСТІ ПОЧАТКОВОЇ ОСВІТИ

ЧАСТИНА II



Що і як впливає на успішність
випускників початкової школи
в читанні й математиці



Київ 2022