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Learning Activity without Interaction, is it Possible?

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The obvious disadvantage of online education is the lack of real interaction and meaningful communication among students while solving a learning problem. We assume that under these conditions a full-fledged learning activity in its function of assimilation of theoretical concepts cannot be formed in primary school. To verify this hypothesis, we analyzed the results of meta-subject diagnostics of the fourth graders who graduated from primary school in 2015–2019 (real interaction) and graduated in 2023 (online education). 316 children in total were recruited for this study. We also used diagnostic data on meta-subject results of fifth grade students from two Moscow schools in 2019 and 2021, where “traditional” educational programs were implemented. 248 children were recruited. It is shown that the lack of conditions and opportunities for constructive interaction and meaningful communication in the process of solving learning problems complicates and slows down the development of children’s main social competencies, but also affects other important meta-subject results of primary education. Thus, the results of meta-subject diagnostics of primary school graduates in 2023 made it possible to identify the weaknesses of online learning, its disadvantages, and to assess the consequences for the mental development of children.

Keywords: elementary school, diagnostics of meta-subject results, online learning, learning ability, modeling, text comprehension, meaningful communication, interaction.

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Учебная деятельность в отсутствие взаимодействия?

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Главный дефицит онлайн-образования — отсутствие реального взаимодействия и содержательной коммуникации учащихся в процессе решения учебной задачи. Мы предположили, что в этих условиях в начальной школе не формируется полноценная учебная деятельность, обеспечивающая усвоение теоретических знаний. Для проверки предположения были проанализированы результаты метапредметной диагностики четвероклассников, учившихся по программе развивающего обучения и закончивших

начальную школу в 2015–2019 и 2023 гг. (всего 316 детей). Также использованы данные диагностики метапредметных результатов учащихся пятых классов двух московских школ 2019 и 2021 годов (всего 248 человек). Показано, что отсутствие условий и возможностей для конструктивного взаимодействия и содержательной коммуникации учащихся в процессе решения учебных задач не только затрудняет и замедляет формирование социальных компетенций, но и влияет на другие важнейшие метапредметные результаты начального образования. Таким образом, результаты метапредметной диагностики у выпускников начальной школы в 2023 г. позволили выявить слабые стороны онлайн-обучения, его дефициты и оценить их последствия для психического развития детей.

Ключевые слова: начальная школа, диагностика метапредметных результатов, онлайн-обучение, умение учиться, моделирование, понимание текста, содержательная коммуникация, взаимодействие.

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The experiment, the results of which are discussed in this article, was set by life itself. In the spring of 2020, due to the pandemic, most students were transferred to online education. Thus, children who completed primary education in 2023 found themselves on distance learning in the first grade, i.e. at the very beginning of school life. And although at present many educators and psychologists advocate the expansion of this form of educational organization [1; 10; 14; 16; 18], obviously, it imposes a number of restrictions on the organization of the educational process. The main deficit of online education for younger schoolchildren is the lack of real effective interaction and meaningful communication of students in the process of solving problems (almost all studies of the organization of online interaction of students use the already formed communicative skills of adolescents [4; 15; 17]). The impossibility of joint action contradicts the basic law of the formation of higher mental functions: "Every higher mental function in the development of a child appears on the scene twice — first as a collective, social activity, the second time as an individual activity, as an internal way of thinking of the child... This law is fully applicable to the process of children's education... An essential feature of learning is that it creates zones of proximal development, i.e. it awakens and sets in motion a number of internal development processes. At first, for a child, these processes are possible only in the sphere of relationships with others and cooperation with friends, but, prolonging the internal course of development, they become the inner property of the child himself" [2, p. 387]. "A child will be able to do something new on his own after he does it in cooperation with others. A new mental function appears as a kind of "individual continuation" of its fulfillment in collective activity, the organization of which is the content and the process of learning... It is necessary to organize learning that would be capable to create the necessary zones of proximal development, which would eventually turn into the required new abilities" [3, p. 7].

Thus, it is difficult to overestimate the importance of educational interactions and communications for the full-fledged development of learning activity. "Initially, younger students carry out learning activity together, support each other in accepting and solving problems, conduct dialogues and discussions about choosing the best search path (it is in these situations that zones of proximal development arise). In other words, at the first stages, learning activity is carried out by a collective subject [ibid., p. 9].

Theoretical, experimental, and practical development of these ideas is presented in the works of Rubtsov V.V., Zuckerman G.A., Elkonin B.D. and others. [7; 8; 11; 12; 13]. Thus, G.A.Zuckerman considers the cooperation of elementary school students with each other and with the teacher in learning activity as the most important condition for the development of a new formation of this age, "learning to learn". The author defines two main components of the "learning to learn" ability: reflexive actions necessary to identify a task as a new one, to find out what means are missing to solve it, and search actions as actions to assign missing knowledge [11]. V.V. Rubtsov substantiates a system of joint learning actions related to the coordination, planning and organization of student interactions and an adult, students among themselves when solving an educational task [7]. These actions are performed in the space of collective transformation by students of the ways of action set by adults and modeling new patterns of organizing joint educational activities to achieve a common result based on the processes of communication, reflection, and mutual understanding. V.V.Rubtsov identified and analyzed various types of interaction between schoolchildren in the process of searching and mastering a common method of action in solving an educational task. He points out that "the actual educational community appears only when the interaction between participants in a joint action is reflexive and analytical. It means that the object of their analysis is the results of reflection of a partner, understanding by another of the situation and their actions in it, discussion, and

coordination of future joint actions with another partner. It is here that the learning situation appears cognition of an object jointly and through another, the study of one's own ideas through the prism of partner's ideas and on this basis the search for common points of contact — mutual understanding" [6, p. 97].

The general principles of the organization of developmental learning (DL) and meaningful educational interactions have been introduced and implemented for many years at school No. 91 in Moscow, a basic experimental school operating according to curricula developed under the guidance of D.B.Elkonin and V.V.Davydov. In 2011, the concept of "meta-subject results of mastering the basic educational program of primary general education" was introduced into the school Standard for the first time, including, in particular, the ability to learn, the ability to plan, control and evaluate learning activity, cognitive reflection, the creation of models of the studied processes, schemes for solving educational problems, willingness to listen to the interlocutor and conduct a dialogue, the ability to identify common goals and ways to achieve them, the ability to agree on the distribution of functions and roles in joint activities, etc. A group of employees of the Psychological Institute of the Russian Academy of Education has developed a package of diagnostic techniques that allow quantitative and qualitative assessment of the development of meta-subject results of primary school [5]. Based on this toolkit, cognitive, regulatory and social meta-subject outcomes of graduates of primary School No. 91 are monitored every year. The conditions for organizing the learning activity of primary school graduates in 2023 are qualitatively different from those in previous years. They are related to the transfer of children to online education in the first grade (and it lasted almost half of the second grade) in connection with the pandemic. Through the efforts of teachers, the content of the DL programs was preserved, but there were completely no conditions for learning interaction and meaningful communication of children.

Hypothesis, Research Tasks and Methods

During online learning, it is impossible to organize collectively distributed forms of learning activity. It limits children's initiative and reduces educational motivation. Since children perform tests individually, there are no situations of meaningful contradiction or conflict, there is no need to argue and prove their thoughts, there is no need to fix actions and their results in a scheme, plan future actions and check their adequacy to the task (reflection). Lack of experience in joint learning can lead to difficulties in the development of social competencies in children. To test this hypothesis, it is necessary to compare the data of meta-subject diagnostics of gradu-

ates of the primary school of the "pre-COVID" period and graduates of 2023 who passed (due to the COVID) through the online form of education in the first grade.

Task 1 — to assess the development of the "learning to learn" ability in online and offline learning;

Task 2 — to evaluate the development of modeling actions and the use of models in solving problems in online and offline learning;

Task 3 — to assess the ability to constructively interact in the process of solving problems in students who did not have experience of joint learning activity in the first grade (graduates of primary school in 2023), and in students who fully participated in educational interactions during their studies in primary school (graduates of previous years).

To solve problem 1, we used data obtained using the "Undefined problems" method (authors G.A.Zuckerman, S.F.Gorbov, N.L.Tabachnikova, Savelyeva O.V.). It allows us to evaluate the reflexive component of the "learning to learn" ability. The reflexive component of the "learning to learn" ability makes a person able to determine what knowledge and skills he lacks to act in a new situation. The methodology is based on the material of simple textual mathematical problems. In mathematics lessons in elementary school the methods of solving these problems were carefully worked out [5].

To solve problem 2, a set of tasks from the "Mathematics test" was used (authors S.F.Gorbov, N.L.Tabachnikova and O.V.Savelyeva). The description of the technique is presented in [9].

To determine the ability to use a ready-made model as a means of solving problems, we analyzed the results of three tasks in which various aspects of using models were updated. So, in one of the tasks, part of the conditions is presented in the form of a text, and the other part is set by the actual modeling tool (diagram). Thus, to solve these tasks, it is necessary to "read" the diagram and include the information obtained with its help in the condition. In another task (shown in Figure 1), you need to solve the problem without seeing its conditions but relying only on a drawing made by "another student". Examples of such tasks are given below.

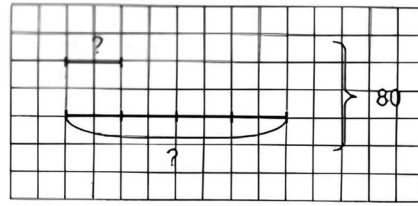
To determine the formation of the modeling action, three tasks of the "Mathematics test" were used. Figure 2 shows an example of this task.

To solve the research problem 3 the "Conflict" technique was used (authors I.M.Ulanovskaya, N.I.Polivanova, I.V.Rivina). This technique allows to compare the success of solving a problem in individual and group work. A detailed description of the "Conflict" technique is given in the publication [5].

Subjects

The experimental sample was made up of fourth grade students from Moscow school 91, where for many years

Task 1. To solve the problem, the text of which has not been preserved, Katya made the following scheme:



Solve this problem

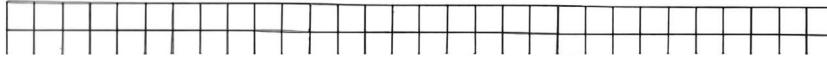


Fig. 1. Samples of tasks for determining the ability to use a ready-made model as a means of solving a problem

Task 2. Read the text of the problem. Make a scheme and solve the problem.

The 72 cm long ribbon was cut into three parts. The first was three times shorter than the second, and the third was twice as long as the first. What is the length of the longest part?



Fig. 2. A sample task for determining the development of the modeling action

primary education is based on a developmental learning program (DL). The data of primary school graduates in 2023 (48 students) and 2015–2019 (a total of 268 students) were compared. The examination was conducted at the end of the academic year.

The control sample consisted of fifth grade students from two Moscow schools (school X and school Y). In school X we used diagnostic data on the meta-subject results of fifth grade students who completed primary education in 2019 (a total of 78 people). This school implements traditional educational program "School of Russia". The survey was conducted at the beginning of the academic year. In School Y the diagnosis was carried out in 2021. Six fifth grades were examined: 3 classes were enrolled in primary school according to the "School of Russia" program (83 people), and 3 classes – according to the "Perspective" program (87 children). The survey was conducted at the beginning of the academic year.

Results

To diagnose the development of the "learning to learn" ability (research task 1), data obtained using the "Undefined problems" method were used. The students were offered 10 simple mathematical problems, some of which were composed "correctly", i.e. they could be solved, and the other part was "incorrect",

i.e. these problems could not be solved. In the case of a correct problem, students had to write its solution, and in the case of an incorrect one, indicate what must be corrected in the task. For each problem the student could receive 2 points: one for determining the possibility of solving it, the second for solving or correcting the problem. To assess the reflexive component of the ability to learn, we took into account the points for determining the "solvability" of the problem and for adequately defining the conditions in the case of an unsolvable problem. Points for solving the correct problems were not taken into account. Thus, the maximum result was 15 points.

Statistical analysis (Kolmogorov-Smirnov criterion) showed the absence of significant differences between the results of fourth graders in terms of learning ability in 2015–2019, which allowed them to be considered as a single sample. That is, the tendency of the distribution of points in the "Undefined problems" method was the same in 2015, 2016, 2017, 2018 and 2019.

Figure 3 shows the results of assessing the development of the reflexive component of the "learning to learn" ability, obtained on the basis of data from the "Undefined tasks" method in the process of monitoring meta-subject results of primary education in different years. The diagram clearly demonstrates the change in the level of development of the "learning to learn" ability in the sample of children who completed primary educa-

tion in 2023. So, for 6 consecutive years (2015–2020), the results of students in terms of the development of the reflexive component of the “learning to learn” ability showed a tendency to increase as the score increased; moreover, the proportion of students who scored the highest possible points is greater than the proportion of students who scored any other number of points. In 2023 a distribution for the studied indicator was obtained close to normal distribution with a peak at 11 and a shift of the minimum values towards a decrease in the score. The differences are significant ($p < 0.01$).

Let's consider the results of the formation of the “learning to learn” ability in schools with other educational programs of primary education (control sample).

It follows from Figures 4 and 5 that:

- In both schools of the control sample, the same trends in the distribution of results according to the indicator of the “learning to learn” ability are presented, namely, the normal distribution along the entire X axis (score for completing tasks of the “Undefined problems” method) with a peak at average values (8-9 points).

- The results of graduates of the two schools of the control sample (which implement traditional educational programs), who completed primary education before the pandemic, i.e. did not study online (Fig.4), and who went through the experience of studying online (Fig.5), do not differ qualitatively. And the results of the graduates of the DL primary school in 2023 are close to the data of the control sample, although with some bias towards higher scores (the maximum number of students received 11 points).

One of the most important means of theoretical thinking are various symbolic and sign systems (models). To diagnose the formation of the ability to build

models and use them as a means of solving problems (research task 2), data obtained using the “Mathematics test” were used. A number of tasks involve using a ready-made model to solve a problem, others – determining the correspondence / inconsistency of tasks and their model representations, and others – creating a model according to the specified conditions of the task. Above, examples of tasks were given to assess the formation of the modeling action (Figures 1 and 2). Let's consider the results obtained on two important indicators of the development of the modeling action in experimental and control samples in different years.

Comparison of the diagrams shown in Figures 6 and 7 demonstrates qualitative differences in mastering the modeling action among graduates of the DL primary school in 2015–2020 and students who completed their studies in primary school in 2023. The trend remains in the use of ready-made models: the majority of children (about 60%) received the maximum score. The trend line in terms of model creation indicates a qualitative change in the trend: the higher the score in terms of modeling, the fewer children achieve it. The differences in the data presented in Figures 6 and 7 are statistically significant at the level of $p < 0.01$.

Let's analyse how the trend lines are presented in a school implementing a traditional educational program of primary education (a control sample).

The diagrams shown in Figures 6, 7 and 8 permit us to make some conclusions:

- The DL program demonstrates obvious advantages in terms of indicators related to the modeling of educational content. Moreover, these advantages are expressed not only in the developed modeling action, but

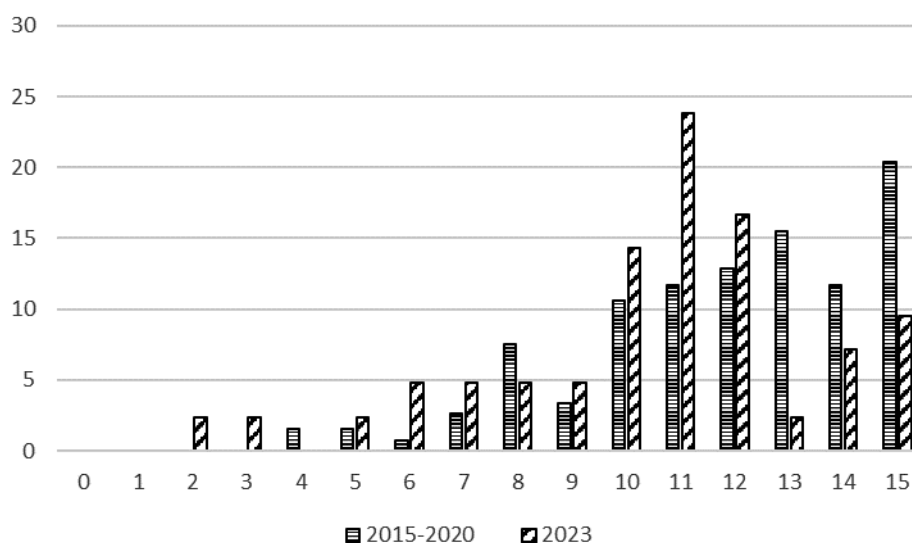


Fig. 3. The “learning to learn” ability – the results of students of the DL school in 2015-2020 and 2023

Note: On the X-axis there are points (min – 0, max – 15) for problems solving. On the Y axis, the percentage of students who demonstrated the corresponding result

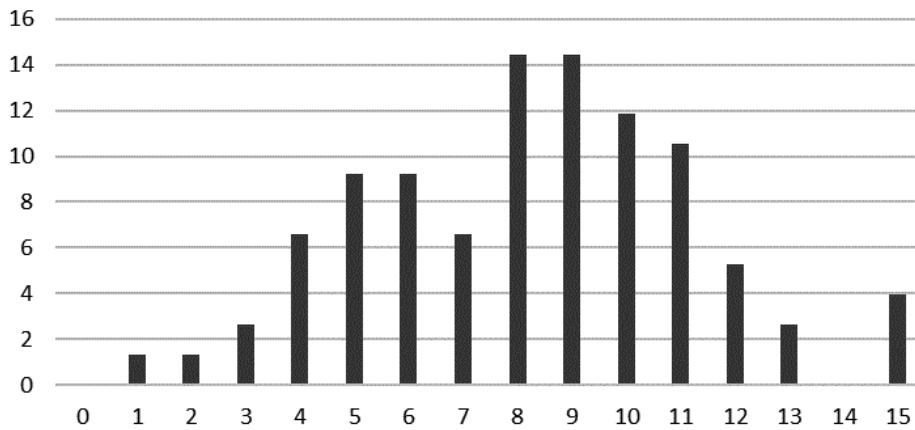


Fig. 4. The “learning to learn” ability – the results of the students of school X in 2019

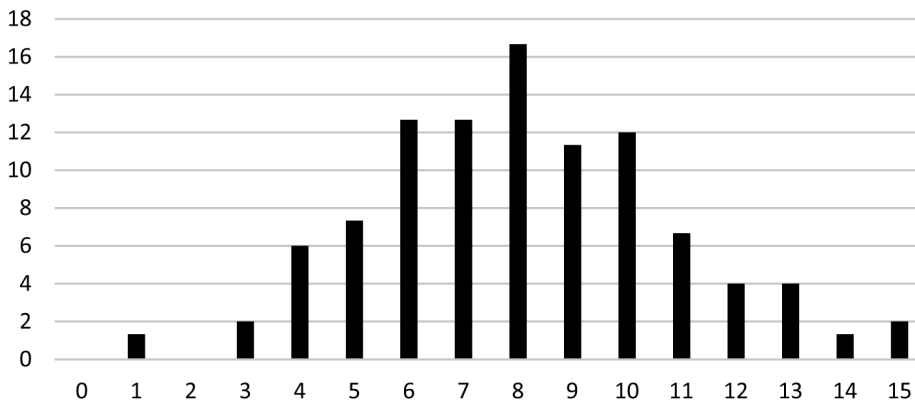


Fig. 5. The “learning to learn” ability – the results of the students of school Y in 2021

also in the ability to use a ready-made, preset model as a means of solving a problem.

- In the context of online learning, students have significant difficulties in mastering the modeling action. The use of the given models as a tool for solving the problem practically does not suffer.

To diagnose the development of the ability to in-

teract constructively in the process of solving problems (research task 3), we used data obtained in the "Conflict" method. In the "Conflict", students first solve a complex intellectual problem individually, and then in a group of four people. At the stage of individual work special conditions are created. They ensure that each participant receives a result in the decision

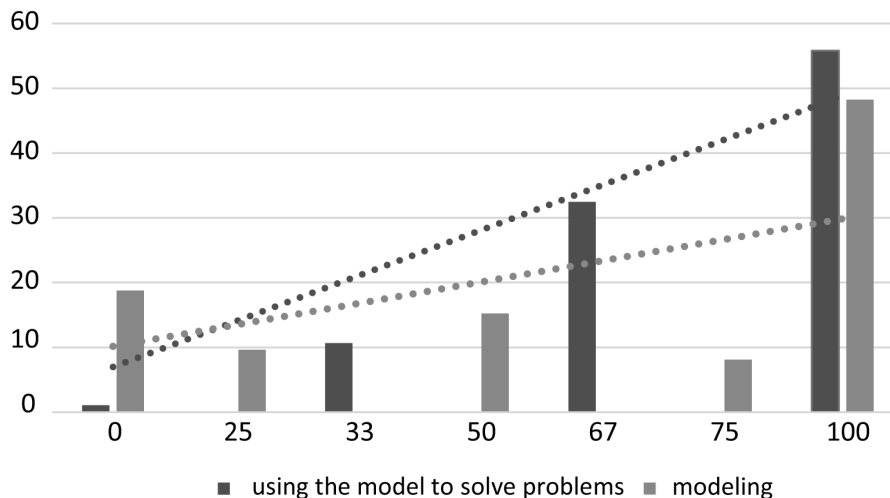


Fig. 6. Modeling and using the model to solve problems – the results of students of the DL school in 2015–2019.

Note: On the X-axis, the scores for completing tasks in %; on the Y-axis, the percentage of children who demonstrated the corresponding result. The dotted line indicates the trend line for each indicator

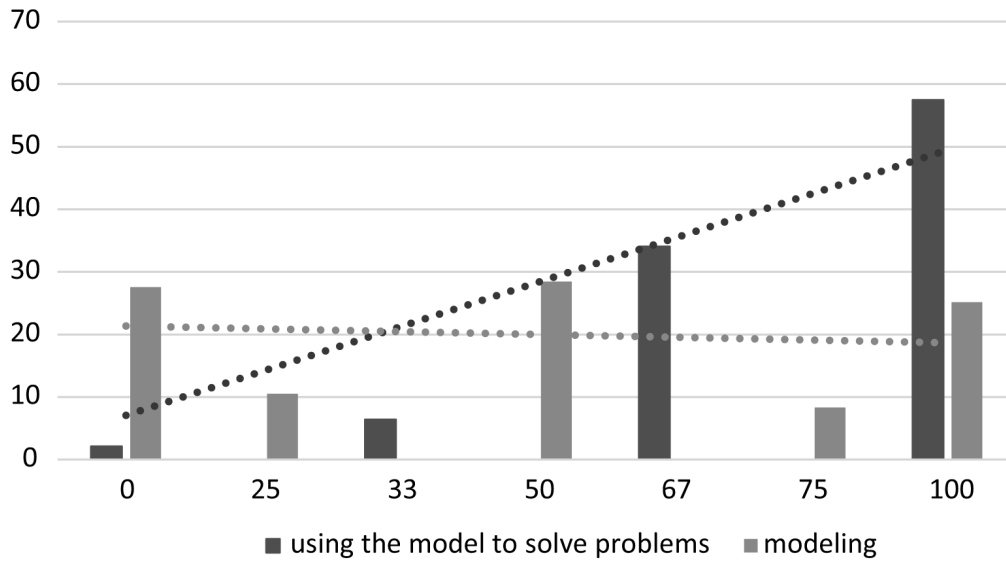


Fig. 7. Modeling and using the model to solve problems – the results of students of the DL school in 2023

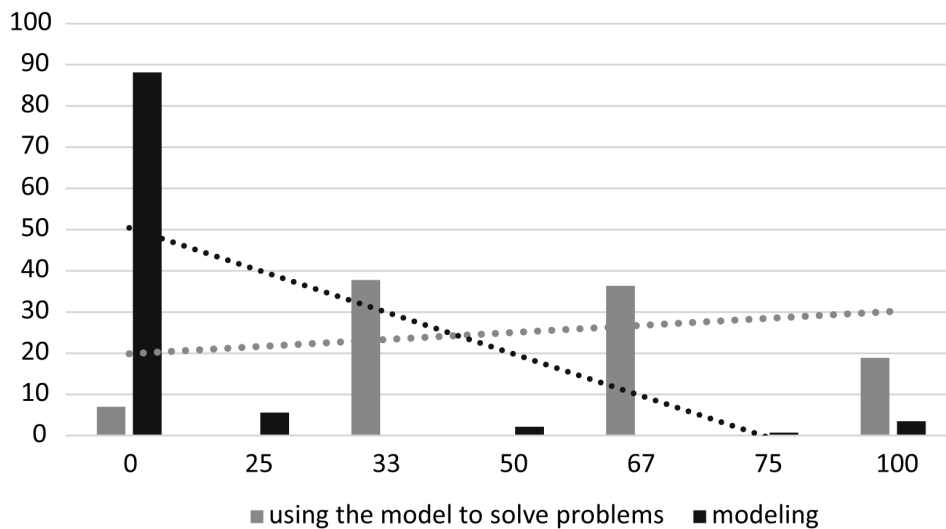


Fig. 8. Modeling and using the model to solve problems – the results of students of school Y in 2021

process that differs from the results of other members of the group. Thus, a situation of cognitive conflict is created that requires overcoming in order to obtain a common group result. Let's look at how the resource of constructive interaction and meaningful communication is presented for students who did not have experience of joint educational activities in the first grade (graduates of the primary DL school in 2023), and for students who fully participated in educational interactions during primary school (graduates of the DL school of previous years).

Figure 9 shows a qualitative change in the ratio of the results shown by graduates of the DL primary school in 2015–2019 and graduates of 2023, when solving the problem individually and in a group. In all the years before the pandemic, the resource of group interaction made it possible to improve the result, that is, on average, the group jointly achieved higher results in solving

an intellectual problem than each participant demonstrated individually (the indicator "group solutions" in 2015, 2016, 2017, 2018 and 2019 is 1.5–2 times higher than the indicator "individual solutions"). For graduates of DL primary school in 2023, combining students into a group does not improve the result. On the contrary, it destroys the decision process. Children enthusiastically engage in communication, "losing" the task assigned to them. Thus, it can be stated that the conditions of online education in primary school prevent the development of the most important social competencies.

Conclusions

Online learning in its modern form is focused on direct communication between teacher and student. In this dyad, obviously, the leading role is played by

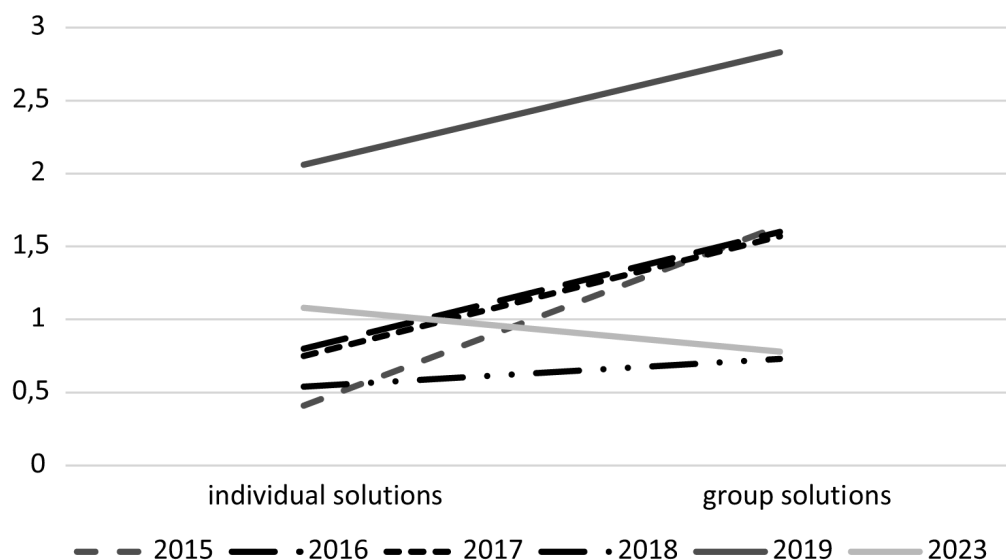


Fig. 9. The effectiveness of individual and group work – the results of students of the DL school in 2015-2019 and 2023
 Note: The X-axis shows individual and group solutions. On the Y axis – points (mjn – 0, max – 4)

an adult – a teacher. Therefore, it is much more difficult for a student to become a carrier of learning activity – its subject. The younger student becomes a subject and performs his own participation in the learning activity initially together with other children and with the help of a teacher. But the interaction of children about and in the process of performing learning activity, in principle, cannot be ensured by the conditions of modern online education. Thus, the most important development tool, joint activity, falls out of the educational process ("Person's activity always stands between learning and mental development of a person" [13]). Metasubject results of primary education prove that the lack of conditions and opportunities for constructive interaction and meaningful communication of students in the process of solving learning problems not only complicates and slows down the development of social competencies themselves, but also affects other metasubject results. The model in the DL system is built not only as a

means of fixing the studied processes and phenomena, but also as a means of planning one's future actions, as a means of proving and testing hypotheses, as a means of communication with those who enter into a dialogue and offer alternative opinions. Participation in a joint, collectively distributed or functionally divided learning activity, gradually appropriated, makes the student a carrier of educational activity – its subject. Thus, learning independence, initiative, criticality, and reflection are formed. The child learns the very way of obtaining new knowledge, "learning to learn" ability.

Thus, the results of meta-subject diagnostics of primary school graduates in 2023 made it possible to identify the weaknesses of online learning, its deficits and assess their consequences for the mental development of children. This raises crucial questions and opens up new opportunities for developers of online learning technologies. Until these issues are resolved, the effectiveness of online learning remains questionable.

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