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## **APPLICATION OF HIGH-ORDER QUESTIONS AS AN OBJECTIVE ASSESSMENT TOOL DURING DISTANCE LEARNING**

The article discusses the impact of the pandemic on the quality of knowledge and the psychological state of students studying at the CIS accredited international Nazarbayev Intellectual School in Ust-Kamenogorsk. The analysis was carried out on the example of biology, physics, and English in grade 11. It was found that in the online learning environment, the principles of academic honesty on the part of students are not fully observed. For more honest results, it is necessary to use specialized programs that block the desktop and limit time, etc. During the pandemic, the time allocated to each subject for mastering the curriculum was halved, but the program itself was not reduced. These facts led to an aggravation of the psychological state of the students. It was found that during the pandemic, referrals to a school psychologist increased by an average of 9%. The main problems on the part of the students are the lack of live communication, family conflicts, and withdrawal. Most students have a problem with time management. According to the research conducted, student activity falls from 40% to 24% during offline learning to 16% during online learning. The students' mood is also reduced by 4%.

**Key words:** pandemic, high-order questions, open-ended questions, online learning, stress resistance, academic integrity, communication skills.

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### **Қашықтықтан оқыту кезінде объективті бағалау құралы ретінде жоғары деңгейлі сұрақтарды қолдану**

Мақалада халықаралық мектептер кеңесінде аккредиттелген Өскемен қаласының Назарбаев зияткерлік мектебінде оқитын оқушылардың білім сапасы мен психологиялық жағдайына пандемияның әсері қарастырылған. Талдау 11-сынып оқушыларының мысалында биология, физика және ағылшын тілі пәндері бойынша жүргізілді. Онлайн оқыту жағдайында оқушылар тарапынан академиялық адалдық қағидалары толық сақталмайтыны анықталды. Адал нәтижеге жету үшін компьютердің жұмыс үстелін блоктайтын және уақытты шектейтін және т.б. арнайы бағдарламаларды пайдалану қажет. Пандемия кезінде мұғалімдер нәтижелерді шынайы көрсеткіштерге жақындату үшін оқушылардың білімін дәл бағалайтын барынша жоғары реттегі ашық сұрақтарды пайдалана бастады. Пандемия жағдайында оқушылардың мектеп психологіне жүгінуі орташа есеппен 9%-ке артқан. Студенттер тарапынан негізгі мәселелердің қатарына көзбе-көз өзара қарым-қатынас, отбасылық кикілжіңдер және тұйықтықты жатқызуға болады. Студенттердің көпшілігі үшін тайм-менеджмент мәселе болып табылады.

Түйін сөздер: пандемия, жоғары реттегі ашық сұрақтар, онлайн-оқыту, күйзеліске тұрақтылық, академиялық адалдық, коммуникативтік дағдылар.

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### **Применение вопросов высокого порядка как инструмент объективной оценки во время дистанционного обучения**

В статье рассматривается влияние пандемии на качество знаний-результатов обучения и психологическое состояние учащихся, обучающихся в аккредитованной в совете международных школ Назарбаев Интеллектуальной школе в г. Усть-Каменогорск. Анализ проводился на примере учащихся 11 класса по предметам биология, физика и английский язык. Выявлено, что в условиях

онлайн обучения принципы академической честности со стороны учащихся соблюдаются не в полной мере. Для более честных результатов необходимо использовать специализированные программы, которые блокируют рабочий стол компьютера и ограничивают время и т. д. Во время пандемии учебная программа осталась не измененной, но время, отведенное на совместную работу с преподавателем, сократилось вдвое. Эти факты привели к ухудшению психологического состояния студентов. Установлено, что во время пандемии учителя стали использовать вопросы более высокого порядка, такие как открытые вопросы, которые позволяют более точно оценить знания ученика и приблизить результаты к реальным показателям. Во время пандемии количество обращений к школьному психологу увеличилось в среднем на 9%. Основными проблемами со стороны студентов являются отсутствие живого общения, семейные конфликты, замкнутость. Большинство студентов имеют проблемы с тайм-менеджментом.

Ключевые слова: пандемия, вопросы высокого порядка, открытые вопросы, онлайн-обучение, стрессоустойчивость, академическая честность, коммуникативные навыки.

## Introduction

The curriculum of Nazarbayev Intellectual Schools in Kazakhstan assumes that students will develop and have high-order thinking skills as they learn. Our program, which is developed based on international standards, is based on an in-depth study of the subjects of the natural science cycle. The main focus is on subjects such as computer science, mathematics, physics, biology, chemistry. All of these subjects require a high level of thinking or skills of a high order (Development strategy until 2030) [1]. In the 21st century, in the learning process, it is not enough to simply memorize knowledge; the learning process must be accompanied by tasks to develop critical thinking and creativity, strong character, and improve the ability to use ICT (Partnership of 21st Century Skills, 2008) [2]. The educational program (NIS program) in the network of NIS schools has several advantages: it has a spiral trajectory of the content of the subject, the goals of teaching on one topic become more complicated and expands, while the integration of sections and subjects is traced. As for the analysis of the NIS program of an advanced level in subjects of the natural science cycle, the developers took into account the following points, firstly, the transition of teaching from the native language (L1) to English (L2), therefore the sections and learning objectives were lined up as the complexity increased; secondly, the number of learning objectives testing high-order skills (HOTS) was 28% and 51%, respectively, in grades 11 and 12.

In the work of Wang (Wang, 2009: 678) [3] the following conclusions were made: firstly, the traditional teaching process does not stimulate students to think more, 75% of teachers use the method when the teacher is the center of the educational process. The teacher should first monitor the pace of innovation so that students are motivated to change. Sec-

ondly, students have a very low reading culture, 83% of students prefer to open social networks and play games in their free time. This data is consistent with the findings of UNESCO (EFA Global Monitoring Report, 2012) [4]. Thirdly, the type of questions asked by the teacher does not encourage students to think deeper, 63% of teachers ask low-order questions. This claim was backed up by the monitoring and guidance provided by the Directorate for High School Development, and most high school teachers tend to measure only low-order thinking skills when writing assignments (High Order Thinking Skills Question Preparation Module, 2015) [5].

Basic competencies at the HOTS (High Order Thinking Skills) level have not been properly studied, one such example in physics is the materials of optical instruments. Optical instruments are devices that are classified as complex. This is supported by studies (Agnes, 2015: 597) [6]; (Gaili, 2000: 58) [7], (Chang, 2007: 466) [8], which claim that students still have misconceptions about the concept of shadow formation, the nature of shadows on mirrors, and how some optical instruments work. Students who do not understand how light propagates will find it difficult to describe the formation of shadows and explain the nature of shadows, for example, the difference between virtual and real shadows (Hadžibegović & Sliško, 2013: 32) [9]. Secondly, there is not enough time for material education and studying its application in life.

There are topics in biology that also cause difficulties in understanding physiological processes at the molecular level. Biology is vast and contains many abstract and microscopic scientific concepts and processes that make it difficult to learn effectively in a short time. Students also have problems with visualization and thinking at the molecular level (Friedler, Amir & Tamir, 1987: 547) [10]. As a result, students may have misconceptions if they are taught only based on information and pictures

in textbooks (Swain, 2012: 143) [11]. Therefore, to visualize processes that are not visible to the naked eye or that are difficult to explain to students in the classroom, teaching aids based on the latest technologies, such as computer animation, is needed (Barak, 2011: 842) [12].

In March 2020, strict quarantine was announced in Kazakhstan due to the pandemic. This problem has affected all spheres of human activity, including education. Despite the streamlined and standardized system of criteria-based assessment in Nazarbayev Intellectual Schools (Model of criteria-based assessment, 2019) [13], there were some difficulties in taking the summative assessment for the unit (SAU) and the term (SAT). Whereas in traditional teaching, students performed work simultaneously under the supervision of a teacher in a large hall, in compliance with the principles of academic integrity. During online learning, students have a chance to use other sources. Therefore, for NIS teachers, the priority was to preserve the quality of knowledge and adherence to the principles of academic integrity. Many foreign higher educational institutions have quite a lot of experience in writing test papers in a remote format, several rules have been developed, such as there is no way to return to the previous question, time limit, proctoring system, etc. The quality of knowledge consists of mastering the learning objectives for the sections of the quarter, and the learning objectives are worked out taking into account the development of thinking skills. Therefore, analyzing high school skills, it can be seen that most of the learning objectives are aimed at developing high-order skills according to Bloom's taxonomy (Guidelines on criteria-based assessment, 2016) [14]. Therefore, the teachers continued their work on the development of tasks or high-order questions. This practice has always been, but in the context of online learning, this approach has become more significant, since, on the one hand, it retains interest and motivation for learning, and on the other hand, it does not make it possible to refer to Internet sources while writing SAU and SAT.

The object of the research is the observance of academic integrity in the online learning environment. The subject of the research was the summative assessment for the unit and the term with the use of high-order questions.

The aim of the study is to determine the impact of high-order questions on the quality of knowledge and the preservation of the principles of academic integrity in high school students, as well as to de-

termine the psychological state of students during a pandemic.

#### Tasks

- Analyze the summative work for the unit and term;
- Include high-order questions in the summative work for the unit;
- Determine the degree of adherence to academic integrity in an online learning environment;
- Determine the level of psycho-emotional state of students during offline and online learning.

#### Methods

1 Analysis of the results of summative works for units (SAU) and a term (SAT).

2 Questionnaire "Level of depression, anxiety and stress"

3 WAM test

**Hypothesis:** The use of high-order questions affects the degree of academic integrity of students, as it forces them to think more deeply about the topic and express their own ideas and thoughts.

During the period of pandemics and quarantine, the psychological state of students is of no less importance. "Covid 19", in addition to the danger to life and health, put everyone in difficult psychological conditions. The self-isolation regime has seriously affected our everyday life. Due to a change in the usual way of life, a sharp exacerbation of psychological instability in people is noticed. The consequences of a psychological nature, have yet to be analyzed by scientists and a lot of research still has to be done.

The purpose of this article is to share observations about how high-order questions have affected the quality of knowledge and the maintenance of academic integrity in high school students and to determine the psychological state of students during a pandemic.

#### Research method

The data analysis was based on the results of summative work for units (SAU) and a term (SAT). Particular attention was paid to works written in an online learning environment. For more reliable data, we compared the work of 11th-grade students in the 2019-2020 academic year who studied in the traditional format and the 2020-2021 year – in the online format. This category of students was chosen for the following reasons, firstly, the transition to the study of specialized subjects in biology and physics into English; secondly, the content of the program increases significantly in complication in compari-

son with the 10th grade; thirdly, students studying in the specified period went through all the stages of adaptation to distance learning. The analysis of communication skills in English lessons is also important because all summative works are written exclusively in English.

To obtain more reliable data on assessing the quality of knowledge, we included high-order questions in the structure of the summative work. High-order questions were mostly open-ended questions requiring a detailed explanation or proof of the phenomenon.

The level of psycho-emotional state was investigated using the questionnaire “Level of depression, anxiety and stress”. The WAM test is a kind of state and mood questionnaire (Abramova, 1998: 142) [15]. WAM is a map (table) that contains 30 pairs of words reflecting the studied features of the psycho-emotional state (well-being, activity, mood). When developing the methodology, the authors proceeded from the fact that the three main components of the functional psycho-emotional state – well-being, activity, and mood can be characterized by polar assessments, between which there is a continual sequence of intermediate values. However, evidence has been obtained that the WAM scales are overly generalized. Factor analysis allows to reveal more differentiated scales: “feeling”, “level of tension”, “emotional background”, “motivation”. WAM is widely used in assessing the psychological state of sick and healthy individuals, psycho-emotional response to stress, to identify individual characteristics and biological rhythms of psychophysiological functions. The purpose of the WAM methodology: Express assessment of well-being, activity, and mood.

## Results and Discussions

The first 3 terms of the 2019-2020 academic year at our school were held in a standard format with full-time participation of all students and adherence to the principles of academic integrity. According to the rules of teaching in the Nazarbayev Intellectual Schools in the 11th and 12th grades, subjects of natural science direction are taught in English, therefore, in the first term of the 11th grade, there are lower grades compared to other quarters. This is since students cannot adequately express their thoughts in English due to their poor vocabulary. Also, from the 11th grade, all tasks are prepared in the format of the A level exam and the scores in the

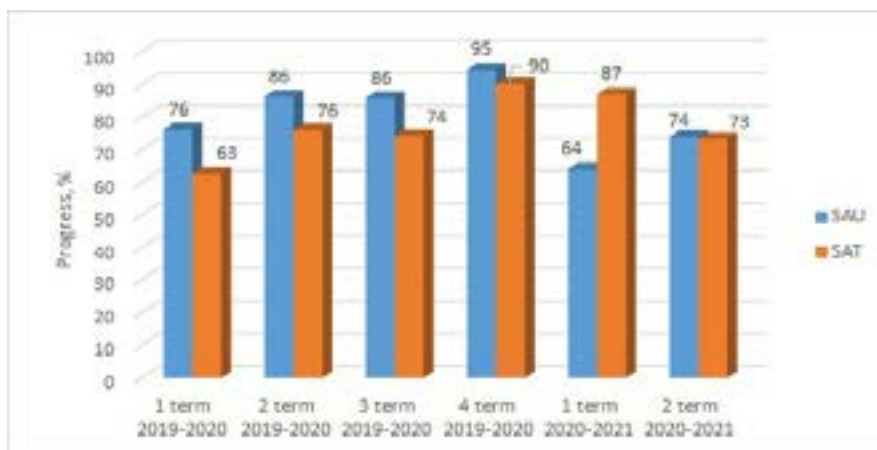
tasks increase without increasing the time interval. In the future, students adapt and write tests at their own pace and their level (Figure 1).

As can be seen from Figure 1, in the first term of the 2019-2020 academic year, 11 graders had the lowest percentage of SAU grades at 76 percent. After the adaptation of students to writing summative works in English, the average grade for SAU is growing and leveling for the second and third terms of the 2019-2020 academic year. On March 16, 2020, a state of emergency was introduced in Kazakhstan due to the spread of the coronavirus, in this regard, all classes were transferred to the online format. At first, teachers did not have the necessary skills to teach a subject in a distance format, so they had to quickly adapt to the conditions of online learning. In this regard, due to the lack of knowledge and skills in organizing SAU in an online format in compliance with all the principles of academic honesty, in the fourth term, there is a tangible increase in grades up to 95%. Approximately the same data are observed with the SAT results.

In the 2020-2021 academic year, in the 11th grade, despite online learning, the average percentage of the SAU is decreasing to 64%, but the SAT shows an increase to 87%. In our opinion, this is since during the SAT the students did not follow the academic integrity rules, and the assignments themselves could be done at a slightly easier level. In the second term of the 2020-2021 academic year, it can be seen that both students and teachers have adapted to the conditions of online learning, and the average grade for SAU and SAT show approximately the same level (Figure 1).

When compiling summative assessment assignments for the unit and the term, teachers are guided by the learning objectives and skills tested. Biology teachers practice the introduction of high-order assignments in SAU and SAT. According to observations over this period, it can be noted that students are accustomed to such questions (Figure 2).

Analyzing the results obtained, it can be noted that the students of the last academic year show a higher percentage of completion than the current ones. This is because the proportion of students 2019-2020 academic year claiming A \* is 4.3% higher. It can also be seen that the principle of academic honesty is maintained at the expense of extended-type assignments that assess high-order skills. The general downward trend in the SAT results is observed over the entire period of the study, which ranges from 2-20%.

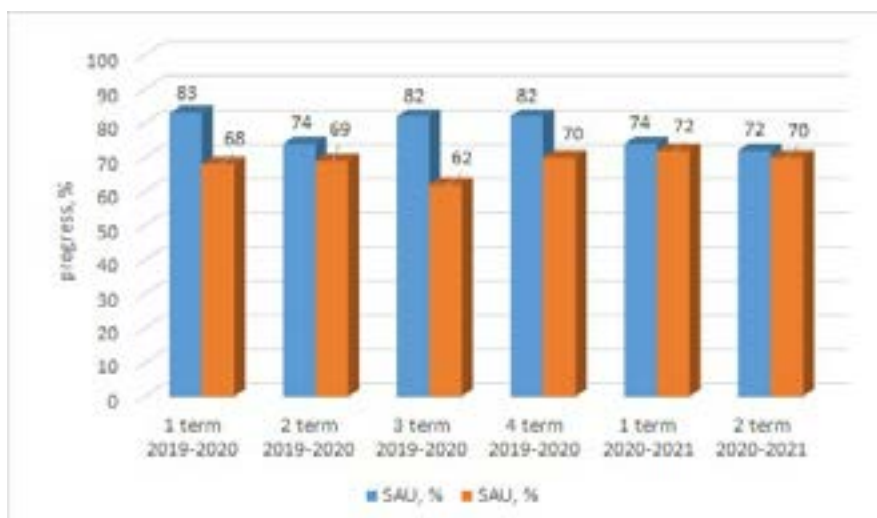


**Figure 1** – the quality of students’ knowledge for the summative assessment for the unit and the term in physics

When comparing the 1<sup>st</sup> term, which took place offline and online, a difference of 9% is noticeable. This decrease is due to the fact that students did not receive the full amount of support from the teacher to overcome the language barrier (transition from L1 to L2). In traditional teaching, grade 11 students took an additional 3 hours a week with an international and local teacher, practicing the subject academic language.

With distance learning, the number of hours decreased, but the volume of the material studied by the learning objectives remained the same. As mentioned above, the percentage of learning objectives focused on testing higher-order skills increases with every term, which is reflected in the second term.

Sections such as “Molecular Biology”, “Cellular Respiration” and “Excretion” are the most difficult. In this case, the decrease in the assimilation of material online occurred for three reasons: the lack of the opportunity to carry out practical work, the integration of sections, subjects of chemistry and biology, and the reduction in hours during distance learning. The biggest difference between SAU and SAT results was in term 3, which was 20%. This term is the longest of the four terms. Most students have a predominant short-term memory, therefore, the topics studied at the beginning of the term are forgotten by the end of the term, and learning goals focused on high-order skills are 3 terms more than in all the others (Figure 2).



**Figure 2** – the quality of students’ knowledge for the summative assessment for the unit and the term in biology

With the transition to the online learning format in the 4<sup>th</sup> term, there was no significant jump in the results for both the SAU and SAT. When comparing the results of physics and biology in the 4<sup>th</sup> term of the 2019-2020 academic year, a significant difference is seen by an increase of 13% (SAU) and 20% (SAT) in physics. This difference is explained by the fact that in physics formulas are used that do not require written explanation, while in biology evolutionary processes were solved and proved. Therefore, in biology, the results of SAU and SAT are approximately the same (Figures 1, 2).

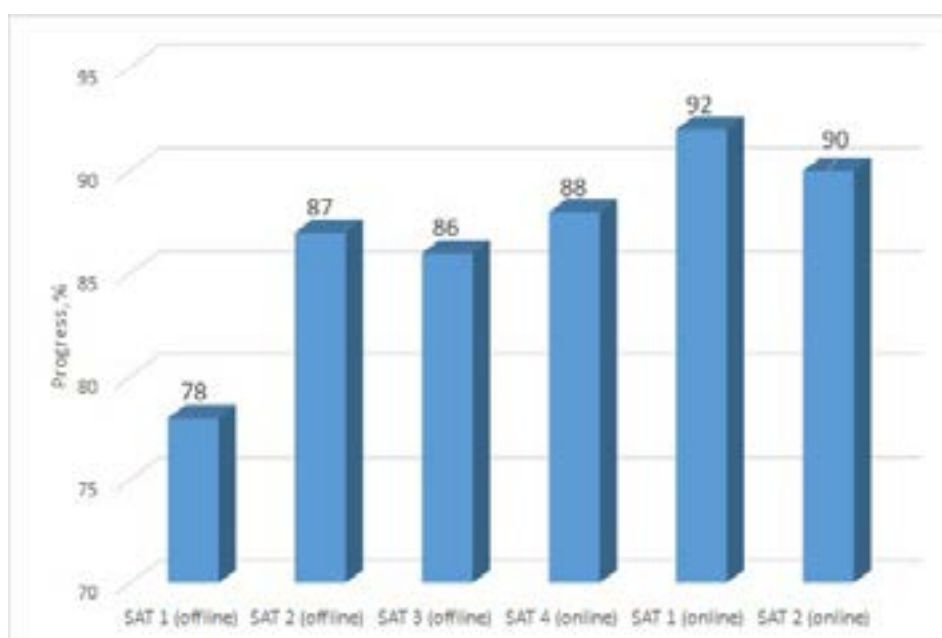
As for the 2020-2021 academic year, the teachers, having adapted to the online format, assessed SAU and SAT more rigorously. More emphasis was placed on the logic of presentation, the correctness of the use of specific verbs and concepts when checking works. This procedure has shown significant results since learners began to take into account errors in SAU, which showed a decrease in the results of SAT by only 2%.

Having made a full analysis of learning objectives and percentage of achievement per unit and term, it can be said that the more learning objectives that focus on testing high-order skills, the fewer stu-

dents demonstrate a high percentage of absorption. The standardized SAU verification system allowed students to be motivated to prepare more thoroughly for the SAT. These approaches to assessment allowed minimizing false increases in the quality of knowledge and preserving the principles of academic integrity.

The situation with academic integrity in English was also dissatisfying. Students want good grades without any effort. And it was possible in distance learning, as it was easy to google the texts for reading or listening tapescript which is being used in summative assessment tests. Cheating was possible with productive skills as well. There are plenty of sites that provide ready written assignments or even check the written assignment for grammar and spelling mistakes. (<https://www.grammarly.com>) Teachers have been searching for ways to reduce cheating.

For an accurate picture, the teachers decided to analyze the percentage of academic performance for the last 2019-2020 and 2020-2021 academic years to see the difference in students' progress. We could observe the difference between the percentage of academic performance in the face-to-face traditional offline period and online training. (Figure 3)



**Figure 3** – the quality of students' knowledge for SAT in the English language

A study indicated that the performance on open-ended questions was correlated with the quality of self-explanations, but performance on multiple-

choice questions was correlated with the level of prior knowledge related to the text (Ozuru, 2013: 215) [16]. Answering the open-ended questions re-

quires a deeper understanding of the text and just copying exactly the same answers of classmates is not the solution like it is in multiple-choice questions. Teachers decided to use open-ended questions in summative assessment. The results were as follows:

the diagram (Figure 4) shows the percentage of average students' performance in reading skills. On the 8<sup>th</sup> of October, students passed the summative assessment, where the skills to be assessed were reading with closed questions. On the 26<sup>th</sup> of November, they passed the other summative assessment with the same skill, but with open-ended questions for reading.

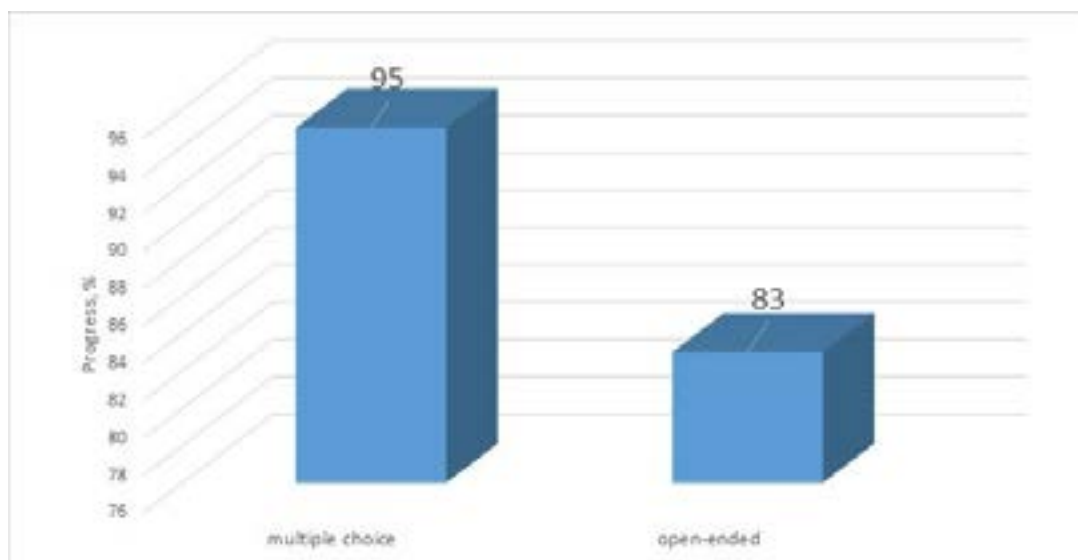
As can be seen from the graph, the difference in students' summative assessment results was 12%. Using two types of questions showed different results in students' academic performance. It could be difficult for students to copy classmates' answers, as open-ended questions require more details and explanation.

According to our observation, the inclusion of open-ended questions on the subject of English, it also directly influenced the structure of writing expanded-type answers in the SAU and SAT in phys-

ics and biology, because students began to use a more academic presentation speech.

The educational process includes not only training, assessment, but also, as a result, the psychological response of students (stress, depression, fear, etc.).

During distance learning, the number of calls to a school psychologist has increased. One of the frequently encountered phrases is "I'm afraid of getting sick," "I can't do anything," "I have low self-esteem," "Uncertainty and low motivation to study," etc. The dynamics show that visits to a psychologist increased by 9% during self-isolation compared to previous years. It turned out that students often have problems and difficult situations during individual and group remote consultations, which can serve as a direct reason for a decrease in the percentage of mastering the material in the subjects. The main problems on the part of the students were: lack of real communication, family conflicts, "withdrawal", violations of time management. These factors negatively impacted student achievement and self-regulation. It turned out to be difficult to trace the relationship between psychological state and academic performance, but this provides prerequisites for further study.



**Figure 4** – the quality of students' knowledge for SAU with different types of questions on the reading skill (subject English)

In the 2019-2020 academic year (before the COVID 19 pandemic), the psycho-emotional state of students was investigated. In the course of the study, through the questionnaire "Level of depression, anxiety,

and stress", we learned that certain emotional states arise. They determine both the level of information and energy exchange of a person and the direction of their behavior. In adolescence, it is very



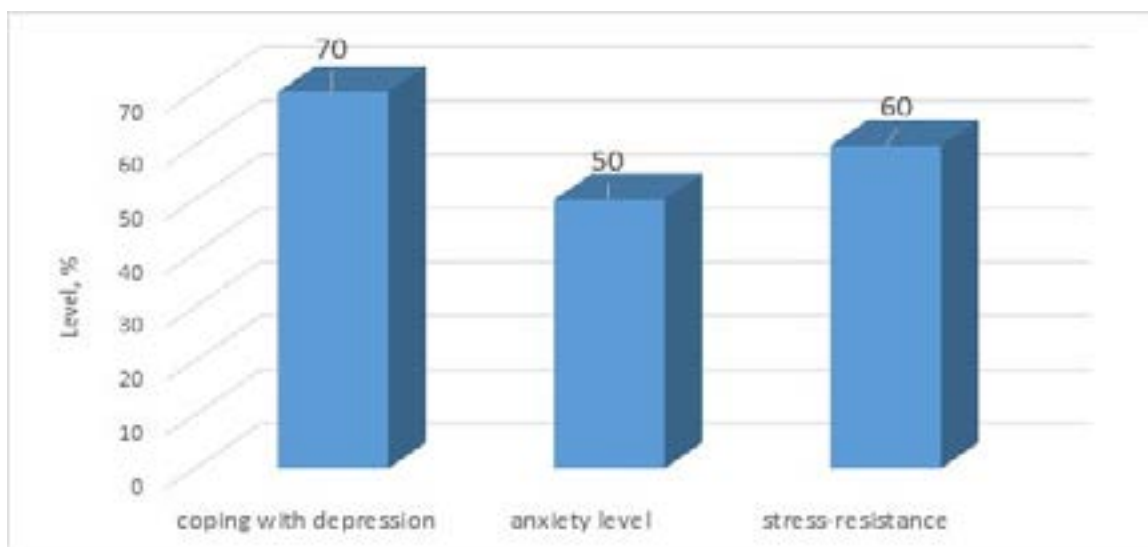
difficult to keep track of your psycho-emotional state. After all, this is such an emotional state that allows you to describe human behavior as special. Thus, a positive level of psycho-emotional state strongly affects the level of mental development. Perception, thinking, our psychological health, and mental health are closely related to the psychological state. They affect both the processes of cognition and personal development and the quality of life in general.

The level of each scale makes it possible to see the dynamics of changes and the impact of depression, anxiety, and stress. The scale of the stress level shows us the level of the stress state of students, if we notice a high level of this state, then the scales of anxiety and depression will be high. The foundation

of the anxiety state is laid down in the stress scale, if students have developed the skill to get out of a high-stress state on time, then obviously the scale of depression will show us a low indicator. Being flexible allows us to improve our academic performance in subjects.

As a result, dividing it into three scales, we note the stability of the students. Figure 5 helps to visualize some statistical data, as well as assess the psycho-emotional state of students.

The stress scale shows that 70% of students are stress-resistant, daily stress strongly affects performance, thinking, and solving difficulties in learning. Analyzing the scale of anxiety, we see that students have moderate anxiety, which is 50%.



**Figure 5** – Assessment of the level of depression, anxiety, and stress before the pandemic

The average level of anxiety is very useful during the SAU and SAT. This condition encourages performance. At such a moment, the student is strongly motivated to succeed and at the same time does not yet think that he may not be able to cope with the task. Analyzing the scale of depression, it can be noted that 60% of students do not become depressed.

Stress is a stressful psychological state that occurs in a person with a strong emotional shock (Isaev, 2005) [17]. Teens are also often stressed. There is such a term as “stress resistance”. Stress resistance is a person’s ability to withstand stressful loads without negative consequences for his body. The psychological service of the Nazarbayev Intel-

lectual School annually approves and implements programs and plans to maintain the psychological health of the teaching staff and students. The most important point is to adequately adapt to the educational process and maintain psycho-emotional balance, be resistant to difficulties, and find solutions. Adolescence is a crisis period, during which there is a significant psychological restructuring, and the formation of adolescent anxiety can be one of the consequences of such a crisis. It is noted that adolescents with an increased level of anxiety often find it difficult to assess the attitude of their parents towards them and determine this attitude depending on the situation. At the same time, anxiety makes them fixate more on negative manifestations, while



such adolescents practically do not experience a sense of security. The research results show that the students of the Nazarbayev Intellectual School have developed the skill of tracking the psycho-emotional state.

Accordingly, we get the result that the majority of students do not become depressed. Mental health is a state of well-being in which a person realizes their abilities can withstand the stress of everyday life, be productive, and contribute to their community. In this positive sense, mental health is the foundation of an individual's well-being and the effective functioning of a community. However, our mental health; this adequate thinking, perception, clear orientation strongly affects the successful educational activity. To obtain reliable results in the 2019-2020 academic year (before quarantine) for

additional materials, the psycho-emotional state of students was studied using the "WAM" method.

In the 2020-2021 academic year (during the COVID 19 pandemic), a second study of the psychological state was carried out using the WAM method. As a result, we can see the real bottom line, the difference is that isolation greatly affects the learning motivation of students. Lack of physical activity, verbal communication, and proper regimen had a profound effect on every student. A high rate of the well-being of 50% during self-isolation motivates for a fast and medium rate of performance. This process is strongly interconnected with activity, which shows us 16% in the time of, and 40% before self-isolation. A decrease in activity leads to the fact that the students' mood deteriorates to 34%, before self-isolation, the students' mood was at 38%.

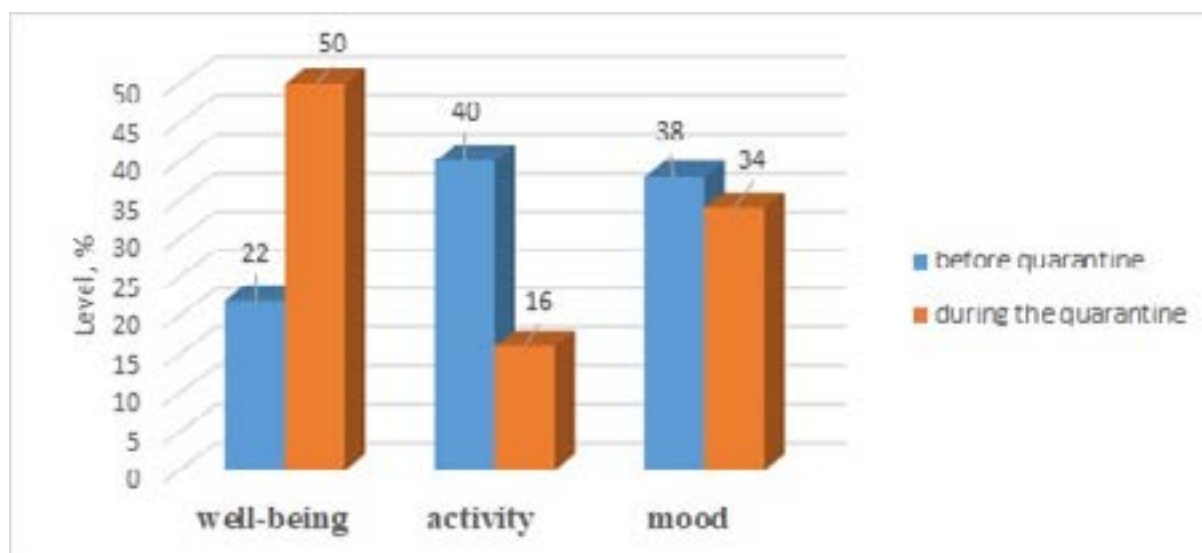


Figure 6 – Methodology «Well-being, activity, mood» of pupils in time and before isolation

A sedentary lifestyle has greatly affected mental and mental health. According to the results of the methodology, aggressive behavior, frequent stressful situations are revealed. For each student, individual route maps have been developed to increase motivation to study and track the psycho-emotional state. Based on the results of tests to assess the well-being of students and individual meetings with them, psychological tools and techniques were recommended for solving problems and tasks, algorithms and solutions were developed together with students.

## Conclusion

- It was found that during distance learning there is an increase in the quality of education by an average of 10% in physics and English. The increase in quality is due to the lack of adherence to the principles of academic integrity on the part of students and a lack of IT skills on the part of teachers.
- During the long period of isolation, teachers actively improved their IT skills and mastered programs and applications that help limit the use of cheat sheets during online SAU and SAT.

- During the pandemic, teachers began to use more high-order questions such as open-ended questions, which allow them to more accurately assess the student's knowledge and bring the results closer to real indicators.
- The specifics of the subject of biology, as well as the quality of education during the pandemic. In comparison with physics and English, during the period of online training in biology, there was a decrease in the percentage of material acquisition by an average of 2%. This causes students to work hard to expose and argue processes in Molecular Biology, Inspiration, and Evolution.
- There is a direct relationship between communication skills like writing between science subjects and English.
- It was found that during the pandemic, referrals to a school psychologist increased by an average of 9%. The main problems on the part of the students are the lack of live communication, family conflicts, and withdrawal. Most students have a problem with time management.
- According to the research conducted, student activity falls from 40% to 24% during offline learning to 16% during online learning. The students' mood is also reduced by 4%.

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