

## Assessment of anxiety markers in schoolchildren in a distance learning environment

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### Article Info

#### Article history:

Received Apr 13, 2022

Revised Feb 7, 2023

Accepted Feb 25, 2023

#### Keywords:

Anxiety

Anxiety markers

Anxiety research

Distance learning

Domestic experience

Educational experiment

### ABSTRACT

This study outlines the theoretical foundations of diagnosing and dealing with children's anxiety in a school setting. Based on these observations, the study proposes and tests practical anxiety management techniques. The study introduces a new term - school isolation anxiety - which is given an original definition. A total of 1,892 secondary school students (grades 4 to 9) in various regions of the Republic of Kazakhstan participated in the study. The sample encompasses 60 classes divided equally into 30 experimental groups and 30 control groups. Preliminary observation and interviews with participants allowed to identify 10 markers of school isolation anxiety, enabling its diagnosis. The next phase of the study suggested the development of anxiety management techniques. The use of the identified anxiety markers and the parallel application of techniques resulted in a significant reduction of anxiety levels in the experimental groups.

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## 1. INTRODUCTION

Distance education is a form of learning where participants of the education process study remotely. The recent pandemic has brought the problems associated with this modern format of learning to the forefront [1]–[3]. One challenge faced by parents and the teaching community today is the psychological state of children who are forced into isolation. Most researchers agree on the list of factors that cause anxiety in school students studying online [4]–[6]. The first factor affecting students' psychological well-being is the lack of social and emotional contact between a teacher and a student.

The transition to distance learning has prompted the pedagogical community to search for optimal educational platforms and teaching methods. Educators across the world are inexperienced with remote work. This uncertainty and lack of a systemic approach negatively affect the psychological atmosphere of distance learning. In Kazakhstan, schools switched to a distance learning mode at the end of March 2020. The main platform chosen by teachers at that time was WhatsApp messenger. During the 2020-2021 academic year, many schools expanded the digital capabilities of distance education and switched to organizing communication through Microsoft Teams and Zoom. A distance learning platform developed in Kazakhstan, Bilim Land - was also launched at the time. Despite the efforts of the pedagogical and parents' community aimed at overcoming the problems of distance learning, they continue to affect the quality of education and the psychological state of schoolchildren.

Based on the findings of this pre-study, the main research was focused on the concept of anxiety. In psychology, anxiety refers to the feeling of apprehension without the presence of the object of fear. Psychologists distinguish the following symptoms of anxiety: worry, anticipation, depression, and other nervous system disorders, such as sleep problems, and tearfulness [6]. On a somatic level, anxiety can manifest itself in a range of symptoms not associated with any particular illness. These are rapid heart rate, labored breathing, shortness of breath, claustrophobia. In cases where symptoms are present, the diagnosis is decided at the medical-psychological level [7].

Anxiety may be latent and may not manifest itself explicitly, which does not exclude serious consequences threatening psychological or even physical health. Therefore, the role of teachers and school psychologists in the diagnosis and treatment of anxiety in children at the initial, pre-medical stages is crucial. This requires the coordinated work of homeroom teachers and school psychologists to ensure the prevention and early detection of anxiety.

Anxiety has a negative impact on the individual's success, leads to lower learning performance, disrupts learning communication, and negatively impacts the quality of pedagogical cooperation [8], [9]. Anxiety is a stable personality attribute, which manifests itself already in the early preschool age [10]. This trait has major importance in school for providing effective psychological and pedagogical support of the child's education process. Anxiety, as a key stable personality characteristic, is essential for the modern personality-oriented education paradigm [11].

This paper makes a significant contribution to solving the problem of anxiety in distance learning. Until now, there has been no substantiated theoretical outline and practical solution to school isolation anxiety. This is a completely new phenomenon in psychology and pedagogy, so the solution to the problem is urgent. Amid the global pandemic, the results of the study are very important and relevant to the entire pedagogical community, as well as those who are in one way or another interact with the education system. The paramount importance of education and the upbringing of the younger generation in any country determines the scientific value of the study.

## 2. LITERATURE REVIEW

The most important aspect in the study of anxiety as a phenomenon is psychometric analysis (i.e., determining the presence of anxiety and measuring its level). The most widely used tests to assess anxiety in Kazakhstan include Luscher and Cattell color tests, individual-type questionnaires (for both adults and children), emotional stability tests by Ryan Hollins, Raymond Cattell, Scheyer, Marvin Zuckerman, Bass, Hogt, Charles Spielberger, Buck, Bellak, and Spielberger's State-Trait Anxiety Inventory [12]–[15]. Researchers took advantage of the complete transition to online learning during quarantine in all countries to create more sophisticated and multifactorial methods for measuring anxiety [16], [17]. These methods are of practical importance because they initially focus on identifying significant anxiety factors in high school and college students, as well as adolescents and young adults in general. Targeting these factors can help overcome the problem of anxiety in schoolchildren.

Research literature agrees on the manifestations of anxiety by which it can be diagnosed [2], [14]. The most important manifestations include indecisiveness, high commitment, pedantry, conscientiousness, and the need to conform to external evaluation [16]. The latter is revealed through diligence, painful experience of failure, fear of getting a low grade, and nervousness at end-of-year assessments [18], [19]. Hands-on research with wearable sensors and information processing with Big Data tools has demonstrated that typical anxiety in high-school, college, and university students has well-defined physiological traits by which it can be diagnosed [7]. However, technical and medical diagnostic methods can hardly be used at scale or in developing countries. Usually, high academic performance in anxious children is not the result of high creativity, but a consequence of diligence and perfectionism [20]. Children with high anxiety are characterized by stereotypical thinking, a tendency to adhere to traditional forms of behavior learned in the family or the nearest social environment [2], [21]. Some children with anxiety exhibit the exact opposite attitude, displaying deviant patterns of behavior that cause various serious medical, psychological, and social problems [22]. This raises the question of how anxiety can and should be diagnosed, particularly in distance learning settings; How to assess the level of anxiety to direct the efforts of teachers and psychologists to overcome it? This and other questions today require an immediate solution.

The overview of the international experience in coping with school students' anxiety in distance learning leads to the conclusion that the subject remains understudied. The sources available in the public domain mostly concern the study, diagnosis, and prevention of anxiety outside distance learning environments. Some studies loosely link anxiety and distance learning issues [2], [11], [23]. Researchers note that one way of coping with anxiety may be to increase the quantitative proportion of creative learning assignments [3], [9], [19]. Others draw attention to the fact that the pragmatic learning tasks cause an

emotional response, increasing motivation and reducing anxiety [21]. Empirical research shows that efforts aimed at reducing anxiety should consider the characteristics of the nervous system of the learner, cognitive style of behavior, extrovert or introvert personality type, as well as the way the learner processes information [14]. Comparing the characteristics of students with different types of nervous system organization ultimately determines the specifics of individualized approaches to overcoming anxiety [17], [21], [23].

Western researchers offer numerous approaches to studying anxiety in a distance learning environment [24]. These works emphasize that anxiety in online learning has its unique features associated with several common fears: i) Technology fear (worry about hardware malfunction, connection breakdown, or software disruption); ii) Uncertainty about one's digital literacy and related competencies; iii) Lack of personal connection with other students and with the teacher; and iv) Distractions by electronic entertainment. A few researchers had suggested using gaming content and learning approaches to engage student attention in remote learning environments, which proved to be successful [23], [25].

Some studies of online learning during lockdown link anxiety to a sensory expression of disadvantage and connect increased anxiety to the social environment, not the learning factors [26]. Several researchers associate school anxiety with students' personality traits and experiences with intermediate learning goals, which are not always emphasized by teachers, creating feelings of frustration in students [5]. Russian researchers focus more on the impact, role, and place of anxiety in students' personality development. For example, Prediger and Piliugina [27] look at school anxiety, which, in their opinion, is an extremely important indicator of personal development, as it leads to maladaptation, decreased motivation, and emotional disturbances. Savina and Polyashova [19] define anxiety as the state of worrying caused by negative expectations. Peñate *et al.* [28] associate anxiety with the experience of emotional discomfort, the expectation of distress, and the anticipation of impending danger. On the one hand, anxiety is understood as an emotional state, on the other hand, it is a personality trait. Researchers make the distinction between anxiety as an emotional state, or psychic tension, and anxiety as a personality trait. This study follows the state-trait differentiation of anxiety aspects.

Some studies distinguish cognitive, emotional, and operational components of anxiety [29]. Several psychologists, following Freud's theory of repression, say that anxiety is a result of an intrapersonal conflict, a consequence of 'scissors' between the needs of the 'I' and social demands [30]. On the contrary, author does not see a connection between anxiety and the conflict between biological needs and social norms and defines it as a complex of 'neurotic needs' [31]. Fromm connects anxiety and the historical development of society [32]. Approaches to the study of the anxiety phenomenon in the academic research literature are summarized and schematically shown in Figure 1.

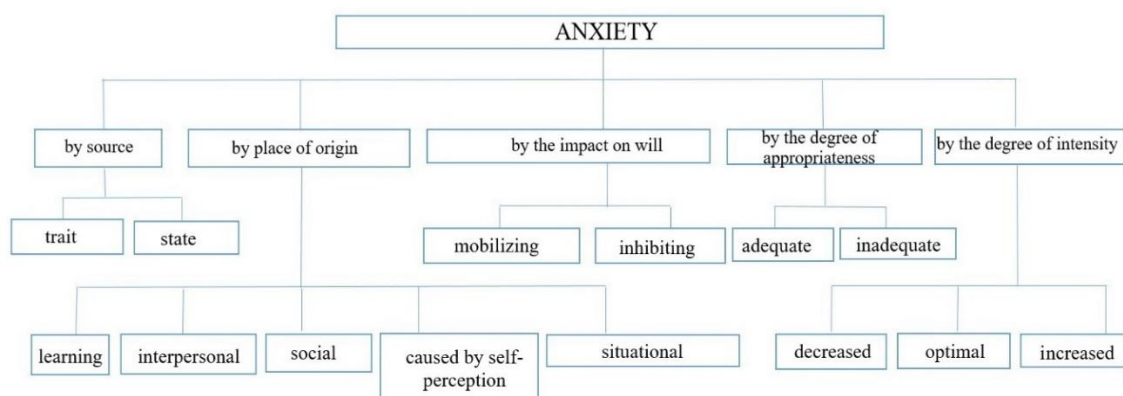


Figure 1. Types of anxiety

The significance of this study is connected to the current situation in the school education system in many developing countries, including Kazakhstan, which was forced to switch to a distance learning format because of the coronavirus pandemic. As a result, the educational environment experienced negative consequences, which affected both the pedagogical process and the psychological state of the students. This problem is one of the most pressing issues in contemporary pedagogical discourse throughout the world.

The research on anxiety offers very rich academic material regarding its measurement techniques, manifestations in different age groups, and other aspects. Because of the universal nature of the problems related to distance learning transition and mass anxiety in students in different countries, the development of

techniques for supporting students, reducing, and preventing anxiety is of the greatest importance. Addressing the problem of anxiety should enhance academic performance and improve the system of distance learning.

The aim of the study was to develop a system of psychological and pedagogical support aimed at reducing the level of anxiety among distance learners. The objectives of the research project included the following: i) To study foreign and domestic experience in handling school students' anxiety; ii) To introduce the term 'school isolation anxiety' into scientific circulation and provide definition; iii) To determine the markers of school isolation anxiety in schoolchildren; iv) To develop a diagnostic online toolkit for assessing the level of school isolation anxiety; v) To develop principles of psychological and pedagogical support for students aimed at reducing the level of anxiety in distance learning environments; vi) To determine and classify the methods of coping with schoolchildren's anxiety; vii) To conduct a pedagogical experiment to confirm the effectiveness of psychological and pedagogical support measures aimed at reducing the level of anxiety in students studying remotely; viii) To establish a connection between the reduction of anxiety and the improvement of education quality. The research hypothesis is that the organization of the pedagogical process aimed at coping with anxiety should improve the psychological setting and students' performance. The final stage of research included a pedagogical experiment to confirm the research hypothesis.

The study was based on factors identified by the researchers through observation and empirical study of participants' experiences. Therefore, some factors, not typical for this sample or determined by its specifics, could be unaccounted for. Results obtained using different psychometric instruments may deviate from those obtained in this study. The study did not differentiate results by gender, age, or other factors that should not be critical in such a large sample.

### **3. RESEARCH METHOD**

#### **3.1. Sample**

The subjects of the study were secondary school students from grades 4 to 9 enrolled in Kazakh- and Russian-language schools in the Republic of Kazakhstan. In total, the experiment involved 30 experimental and 30 control groups from schools across the Republic. A total of 1,892 students, including 987 females and 905 males, participated in the study. The age of the children ranged from 10 to 15 years. The sample of children-participants was evenly distributed by age: each grade was represented by six experimental and six control classes. Both classes and participants were selected randomly. The choice of these years of education was due to the rather high developmental level of the participants. The 9th grade is the last year of basic education for many students. Children in grades 1 to 3 belong to an age group whose age features are significantly different from middle and high school students [24]. The possible statistical error of the sample does not exceed  $p=.45$  when the general population is the number of students in corresponding classes enrolled into secondary schools across the Republic of Kazakhstan. Thus, the sample can be considered statistically representative for Kazakhstan. The pedagogical experiment to identify anxiety markers was conducted by practice teachers of the following majors: i) Russian language and literature; ii) Russian language and literature at schools with the non-Russian language of instruction (Abai Kazakh National Pedagogic University); and iii) Psychology (Caspian University).

#### **3.2. Research design**

At the initial stage, the researchers observed behavioral manifestations of anxiety in school students. Preliminary anxiety markers suggested in a pre-study were specified during the experiment. These activities were carried out in the first and second quarters. In the third quarter, the study formed the precise markers of children's anxiety, determined their manifestations, and outlined the correction methods for school isolation anxiety. At the beginning of the third quarter and the end of the fourth quarter, the authors conducted control snapshots to assess the effectiveness of measures aimed at reducing students' anxiety during distance learning.

At the initial stage, the study used online diagnostic tools available on a psychological platform <https://psyttests.org/> (tests to identify the anxiety in adolescents). However, such tests do not always give objective results, because they are based on the respondents' answers, which does not ensure objectivity. In addition, these tools are not always applicable to distance learning conditions. Therefore, at the later stages, the paper relied on tools and methods of psychological and pedagogical diagnostics developed by the authors.

The practical objective of the study was to identify signs of anxiety that could be measured. Such signs are called anxiety markers. The observation of Kazakhstani students during the first half of the academic year 2020-2021 revealed 10 anxiety markers as presented in Table 1. The markers were developed during the pedagogical experiment conducted during the Russian language and literature course in the distance and blended learning settings. Each manifestation was recorded by the working group. The

percentage of manifestations was calculated using the ratio of manifestations to the total number of learning contacts (according to the teaching schedule). For example, if the length of the Russian language course for fifth-grade students in one quarter was 24 hours, it was counted as 24 contacts or 100%. The percentage was calculated based on the following ratio: the number of marker manifestations/number of learning contacts.

Table 1. Anxiety markers, their manifestations, and coping techniques

No	Marker	Manifestation	Coping techniques
1	Painful attitude toward the received grade	Asking for additional assignments in messengers, resentment	Conversation, control over the consistency of requests for additional assignments, students' reflection on the results of learning activities
2	Inadequate assessment of the results of learning activities	Dissatisfaction with the evaluation, unfounded accusations of bias, negative emotional state	Conversation, elaboration of precise evaluation criteria, the announcement of evaluation details at the beginning, reflection on the results of learning activities, self-assessment, mutual evaluation
3	Failure to complete class assignments	One-off or systematic neglect of homework while doing/not doing classwork	Working with family, talking to family, finding reasons for lack of feedback, differentiating assignments, redistributing assignments with a prevalence of class assignments over homework, simplified presentation of material
4	Low activity in the class	Reduction of the educational activity (in varying degrees), one-off or systemic withdrawal from the learning process	Differentiation of learning tasks systematic introduction of gamification elements into the lesson, creative tasks, pair or group work
5	Emotional disturbances	Mood swings	General positive emotional background, individual approach, using game forms of education, individual and group creative tasks
6	Detachment from the education process	Absence of audio and video feedback combined with missing classwork and/or homework	Individual approach in designing an education trajectory, conversations, consultations with a psychologist
7	Lack of confidence and low self-esteem in a particular discipline	Absence of audio and video feedback combined with missing classwork and/or homework, secrecy, quietness	Conversations, individual creative tasks that consider psychological features of an individual, placing students in different groups, according to their level on WhatsApp and Zoom session halls
8	Increased activity	Permanent communication outside of scheduled time, constant sending of messages to a personal chat bypassing the collective one, clarifications, requests, questions, excessive perfectionism	Reduction of hyperactivity through the allocation of additional individual assignments, gentle psychological support, preventive attitude, objective evaluation to satisfy possible learning ambitions
9	Concerns due to unequal access to technology	Not completing homework or not doing it on time, absences due to technical reasons that lead to stress manifestations expressed in messenger texts with explanations of technical problems, requests for additional homework	Selection of individual assignments, setting an individual schedule for accepting assignments, assigning individual consultations, changing the schedule for accepting assignments
10	Bodily manifestations	Facial expressions (with video monitoring), stereotypical movements (with home parental supervision)	Comprehensive measures to reduce anxiety, conversations with a psychologist, increased physical activity, organization of leisure time, optimization of work and rest, limitation of time spent in front of a computer screen

### 3.3. Data analysis

Psychology uses a variety of methods to study anxiety. For example, Phillips school anxiety test [24], Spielberger and Hanin [33] state-trait anxiety inventory. However, many of the techniques are difficult to apply in a distancing learning environment. In addition, the goal of the project was not to develop a purely psychological framework of anxiety but to diagnose its presence and identify ways to address it as part of comprehensive psychological and pedagogical support. The techniques should be used not so much by expert psychologists but by teachers of any specialization. Besides traditional methods of theoretical research (analysis, synthesis, generalization, modeling), the paper uses observation and natural experiment methods.

To determine the comparability of differences in the control and experimental groups, average data on the Russian language for all classes was used. For ease of comparison, the 10-point grade system, common in school practice in Kazakhstan, was converted to a percentage scale (the mark was multiplied by 10). The project developed principles of psychological and pedagogical support for students aimed at reducing the level of anxiety in distance learning environments. They include: i) Psychological comfort and friendliness; ii) Adaptivity; iii) Taking into account the emotional state of an individual; iv) Protection of the interests of the child; v) Dialogic communication; vi) Individual approach, variability, and flexibility; vii) Continuity, consistency, and coherence; viii) Personalization of learning; ix) Interaction between the participants of the psychological and pedagogical support; and x) A reflexive and analytical approach to the process and result.

### 3.4. Ethical issues

All participants in the pedagogical experiment gave their consent. Parents and the administration of the schools involved in the experiment also gave their permission. The study did not disrupt the order or organization of the learning process. The experiment did not affect the evaluation of participants in any way. No personal data of participants were collected, analyzed, or stored.

## 4. RESULTS

The type of anxiety studied in this paper is associated with distance learning, which was not consciously chosen by children, but enforced by compulsory isolation. Therefore, the working term used in the study is ‘school isolation anxiety’, which, in the authors’ opinion, most accurately reflects the essence of the phenomenon under study. School isolation anxiety is a psychological reaction to isolation, manifested in a tendency to excessive worry. Predisposing factors, such as heredity, family environment, negative experiences, and low self-esteem are a basis for isolation anxiety manifestations. Teachers and psychologists face the task of diagnosing school isolation anxiety (SIA) and developing a set of measures to cope with or reduce it, regardless of the presence/absence of psychological or physiological factors associated with the detection of a particular level of anxiety. The groups that were introduced to anxiety-reducing strategies showed positive dynamics. A decrease in anxiety was detected with respect to all 10 markers: marker 1 - by 20%; marker 2 - by 17%; marker 3 - by 9%; marker 4 - by 14%; marker 5 - by 15%; marker 6 - by 11%; marker 7 - by 9%; marker 8 - by 19%; marker 9 - by 9%; marker 10 - by 12% as shown in Figure 2. At the same time, the participants subjectively note a decrease in interpersonal conflicts and insecurity, more pronounced leadership and activity in the classroom, and improved emotional state.

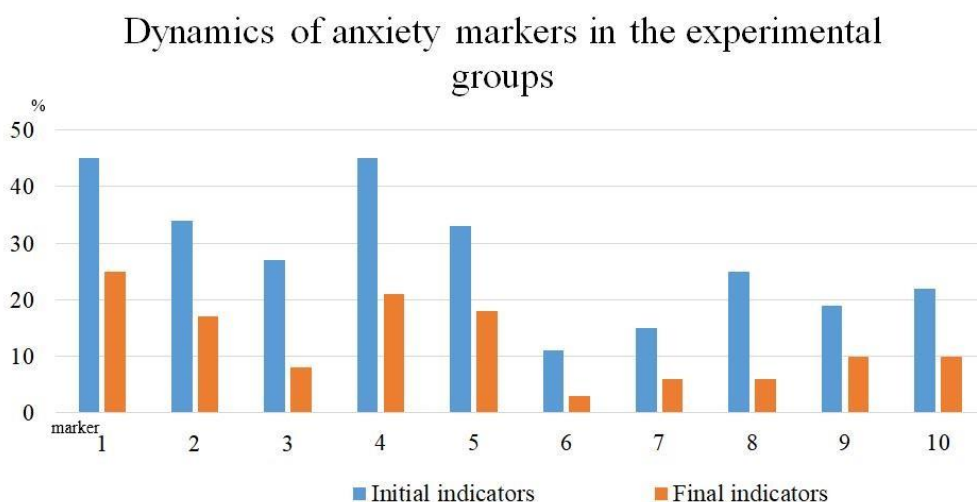


Figure 2. Cumulative data on the level of anxiety in the experimental groups

One of the research tasks of the project was to establish a connection between the level of anxiety and the academic performance of students. For this purpose, the ascertaining, forming, and final experiments were conducted. The authors measure student performance before and after the implementation of anxiety-reducing techniques. The Russian language proficiency was assessed on a 10-point scale and cumulative average score for all experimental groups was calculated as presented in Table 2.

Table 2. The academic progress in the experimental groups (January-May 2021)

	January	February	March	April	May
Cumulative average score	5.3	5.9	6.2	6.7	7.2

By converting the point system to a 100-point scale, the authors obtained a measure of the academic performance dynamics. The average academic performance in the experimental groups increased by 19% after the introduction of anxiety-reducing measures. The control group had the following results: MT1–35/41, MT2–30/26, MT3–27/24, MT4–40/34, MT5–33/36, MT6–9/12, MT7–14/16, MT8–24/21, MT9–19/17, MT10–20/25. In other words, a slight decrease in anxiety (in markers 2, 3, 8, and 9) was observed in the control groups. Other markers of the control groups showed negative dynamics as shown in Figure 3. The indicators of academic achievement in the control groups are opposite to the ones observed in the experimental groups as presented in Table 3. By converting points to percentage, one obtains a cumulative 26% decrease in academic achievement in the control groups.

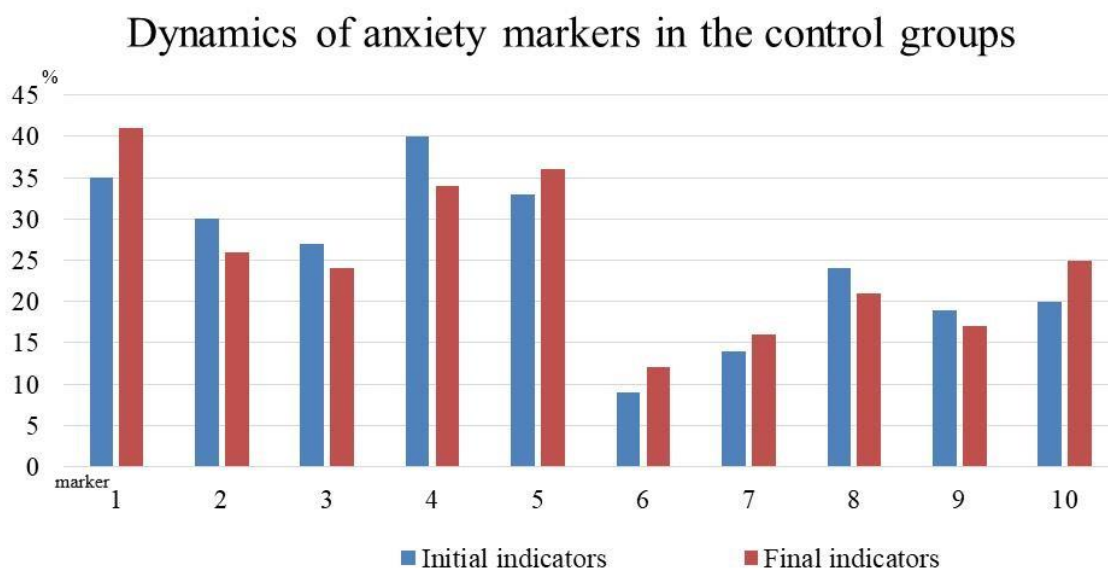


Figure 3. Cumulative data on the level of anxiety in the control groups

Table 3. The academic progress in the control groups (January-May 2021)

	January	February	March	April	May
Average score	6.5	6.0	4.5	3.9	3.9

## 5. DISCUSSION

The distance learning format is associated with diagnostic difficulties [16]. Many existing methods are inapplicable because of the lack of face-to-face communication, tactile contact, or even external observation. For instance, a teacher or a psychologist is unable to register facial expressions, changes in body movements. Therefore, anxiety assessment is only possible through proficiency testing and psychometric methods [28].

The debated issues in anxiety studies concern mainly the psychological nature of the phenomenon. In this project, the goal was not to exhaustively define the basics of anxiety but to focus on the nature of school isolation anxiety and techniques for managing it. The results showing a significant increase in average academic performance and a decrease in anxiety for students of most age categories in the experimental group compared to the control group prove that it is possible. Other coping techniques also demonstrate significant results [23], [28].

Studies have shown the importance of extracurricular factors such as physical activity and active social interaction (even online) in overcoming anxiety [2], [14]. This research also highlighted the importance of participants' interaction and activity among the pedagogical factors of anxiety management [34]. The questions may arise about certain markers, their manifestations, and intervention methods. In this regard, it is necessary to mention that the study focuses on anxiety in connection with academic performance. The experiment showed that it was found that the proposed anxiety coping strategies, such as differentiating, proficiency level, and individualized approaches to learning, lead to a decrease in anxiety and an increase in academic performance.

The relationship between decreased anxiety and increased achievement found during the experiment echoes the findings of other empirical studies [6], [11], [25]. The researchers established a link between task simplification and high verbal association learning outcomes in anxious children. A distinctive feature of the research presented here was a thorough development of the anxiety theory. The study presented in this paper defined school isolation anxiety, which appeared as a reactive phenomenon in response to forced social distancing in the pandemic. It also identified anxiety markers and selected a set of methods to reduce anxiety manifestations in each of the markers.

Many works devoted to the problem of anxiety are very limited in their scope. They focus mainly on the diagnostic problems, rather than define the physiological and psychological essence of anxiety and its management [7], [16], [17]. The study presented in this paper compensates for the disadvantages of such an approach that arise in the context of the complete global transition of education to distance learning. All the theoretical developments and experimental work carried out within the grant of the Ministry of Education and Science of the Republic of Kazakhstan (MESRK) are directly related to the problem of distance learning. The research has attempted to find a correlation between the specifics of distance learning, school anxiety, and better education quality.

## 6. CONCLUSION

The review of foreign and Kazakh experiences identified the anxiety manifestations characteristic of distance learning. The working term ‘school isolation anxiety’ was put forward and the meaning of this phenomenon was defined, which is a contribution to the academic study of anxiety. Through preliminary observation and testing over the course of one school year, the project developers identified ten markers of school isolation anxiety and manifestations of each, allowing them to diagnose anxiety and measure its level. Based on the observations and the world research practice, optimal methods of reducing anxiety were suggested: increasing the share of creative assignments, individualized approach to the design of academic assignments, a level-based approach to assessing student achievement, personalization, and using the capabilities of digital educational platforms to intensify group work. The follow-up testing involved 1,892 secondary school students (grades 4 to 9) in the Republic of Kazakhstan with 30 experimental groups and 30 control groups. The study findings prove the working hypothesis and confirm the effectiveness of the proposed method of psychological and pedagogical support during distance learning in reducing anxiety. The results can be used in anxiety management of middle and high school students during distance learning. These methods can be useful in most developing countries with similar pedagogical practices.

## ACKNOWLEDGEMENTS

This research was carried out by the Academy of Pedagogical Sciences with the aid of the grant of the Ministry of Education and Science of the Republic of Kazakhstan (MESRK) allocated for the project “Psychological and pedagogical support of schoolchildren in the context of distance learning to reduce the level of increased anxiety” in response to an urgent need for reducing the anxiety levels of Kazakh students engaged in distance learning. This research was funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan (Grant No. AP09562184).

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