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TRENDS IN DISTANCE LEARNING IN AN ELECTRONIC ENVIRONMENT

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ABSTRACT

This paper introduces an analysis in the forms of education and learning in the past and nowadays and especially the tendencies in distance learning in an electronic environment in COVID-19 pandemic conditions. After the brief introduction of the types of training before and during the pandemic, a comparative analysis of the problems related to the distance learning in an electronic environment identified by Institute for Educational Research /IER/ in 2021 and our private surveys in 2020 and 2023 has been done. The results in both researches show many common tendencies commented in the following parts of the paper.

Keywords: DLEE, Programmed Learning, Types of Training, E-learning.

INTRODUCTION

With the growing role of computers and electronic devices in all areas of our lives, new approaches and methods began to be imposed in the education of children and adults. Augmented virtual reality devices, 3D images, and virtual labs have begun to be developed and implemented. STEM training has been talked about and implemented worldwide. It is an abbreviation of Science, Technology, Engineering and Mathematics /STEM/ and its common interpretation is training, which makes a connection between the different disciplines. Theoretical knowledge and conclusions are applied in almost real situations and influence thinking when solving cases. It is assumed that students with STEM literacy will quickly adapt to a real enterprise, community or activity and the learning-realization transition is faster and hassle-free. The term is flexible and can be used to define both the preparation of pupils and students to respond adequately to reality, the current situation, and in the sense of training using tools for the actual application of taught knowledge.

Unlike the terms day and evening forms of learning, which are the two main types of learning used in education, all other forms are unclear to the general public and are sometimes misused.

According to the current legislation in Bulgaria, the types of training are: full-time; evening; extramural; individual; self-learning; remote; combined; on-the-job training (dual training system).

- Evening education is conducted according to school curriculum developed on the basis of the relevant framework curriculum for evening education.
- Part-time form of education includes school hours, independent preparation and taking exams to determine the annual grade for the subjects of the school curriculum.
- The self-learning form includes individual lessons and ongoing assessment or examinations to determine a term or annual assessment.
- The independent form includes independent preparation and exams for determining annual grades in the subjects of the school curriculum.
- The distance form of education is carried out through the means of modern information and communication technologies and includes distance learning classes, self-preparation, current feedback on learning outcomes and face-to-face exams to determine

term or annual grades in school curricula.

• Combined form of education includes training under the terms and conditions of the daily form and individual training in one or more subjects of the school or individual curriculum.

• Training through work (dual system of training) is a specific form of training in which professional qualification is acquired through: practical training in a real work environment and training at school" [1].

Following the sudden declaration of a state of emergency in Bulgaria on March 13, 2020, the education system was forced to rapidly transition from the standard daily form to distance learning through information technologies [2]. This form of instruction essentially replicates daily classroom training, but without direct contact between students and teachers. Distance learning can be implemented in two modes: synchronous learning, where students observe a lesson in real time and interact with the teacher, and asynchronous learning, where students observe the lesson without real-time interaction. The critical situation necessitated the urgent adoption of this approach.

EXPERIMENTAL

The use of machines in training is not new. The term „Programmed Learning" has existed and been used since the middle of the last century. The emergence of programmed learning is considered a necessary stage in the development of pedagogical thought, the foundations of which are in the previous development of pedagogy and psychology, although it is closely related to a number of new scientific fields such as cybernetics, information theory, electronics etc. It should be noted that as early as the 19th century, there were suggestions that it was possible to create devices that could perform certain useful functions in the learning process and could automate some of its operations. In 1926 S. Pressey, looking for opportunities to reduce the time spent checking and evaluating the results of students tests, succeeded in constructing an apparatus that recorded the correct answers using a special counter [3]. He perfected this control machine and noticed that the students who used it increased their success. This automated control device is a training device in the true sense of the word. The industry of that time did not show interest in the various variants of S. Pressey's devices and he gradually gave up working on them. Even then, however, it became clear that mechanical devices achieved: (1) time savings; (2) efficient testing and evaluation; (3) increasing the level of motivation to learn; (4) opportunity for exercise in the acquisition of knowledge and skills. From the beginning of the 1930s to the beginning of the 1950s there was almost no interest in automated learning devices.

Computer technology has already become widespread in education. It is used both to present a lesson and to control knowledge and skills in the form of tests and tasks. Today, the issues related to the argumentation of practical ways to build successful integration between programmed and traditional forms of educational work come to the fore. A number of authors consider the programmed texts and the learning machines as a means to diversify the independent work of the learners within the lesson. It is recommended that these forms be assigned from 15 to 30 min. within the lesson, without following a strictly defined type of programming. Successful attempts have been made to formulate a system of lessons using classical methods and programmed learning. The following types of lessons are distinguished on the basis of the integration of programmed and traditional learning, each of which has its own specific structure:

• a lesson to get acquainted with the work on programmed text;

• a lesson for introducing new concepts, in which the work on programmed text takes only a part of the time;

• a lesson for acquiring new knowledge exclusively with programmed material;

• a lesson for consolidating knowledge with the help of programmed material;

• negotiation lesson with the help of programmed material;

• a lesson in systematization [3].

The computer can assume examination functions such as testing, evaluating, and partially replacing the teacher-examiner. As a cybernetic system, it supports the teacher in managing the learning process by maintaining continuous interaction (feedback) with the student during learning. The computer is particularly important for the exercise system, for asking questions and getting answers, for solving problems and searching for information [4].

In 2020, the COVID-19 pandemic prompted a

major shift in the methods and technical means used in education and training. Many countries, including Bulgaria, adopted online learning as the preferred alternative to conventional face-to-face instruction [2].

Distance learning in the electronic environment (DLEE), conducted in 2020 in Bulgaria and re-implemented in 2021, has led to the emergence of hitherto unknown problems and situations. It is important to note that prolonged standing in front of the screen reduces physical activity and the lack of social contacts has an adverse effect on teachers and students. There was a risk of „hiding behind-the-scenes" uninvolved students. Increased the time for preparing teachers' lessons, transforming it into an electronic version and searching for suitable materials for illustration and exercises. The need for electronic versions of tests has also increased dramatically. In order to identify problems and prepare normative documents for such, the Ministry of Education and Science commissioned from the Institute for Educational Research /IER/, a study on the topic: „Assessment of the impact of learning in the electronic environment or other absent forms of school performance education" [5]. The conclusions and recommendations in the analysis are based on information from 3 750 teachers teaching students from grades I to XII and 16,480 students from grades V to XII from 200 schools across the country, selected by sample at the school system level. The survey was conducted in June 2021. Our private survey has been done in July 2020 and included interviews with 70 students from V to VII grade and 185 teachers and included similar to the IER survey questions [2].

RESULTS AND DISCUSSION

Teachers have wide access to online platforms for distance learning in e-environments, and most of them use different combinations in their work. There is a more structured use of available platforms compared to the period of distance learning in an electronic environment in the previous school year. The most widely used platform for teaching in the electronic environment is MS Teams, as it is mentioned by 69.3 % of the surveyed teachers. The next widely used platform is Google Classroom, which is used by 27 % of teachers. Social networks continue to be widely used to serve the distance learning process. 23.1 % of teachers indicated that they used Facebook Messenger alone or in combination with other platforms in their work from distance with students, and another 19.1 % used Viber. It should be noted that the most active use of Facebook Messenger and Viber is observed among primary school teachers (28 % and 26.5 %, respectively), which is probably explained by the adopted model of communication with parents. One in ten teachers used Zoom or the Shkolo virtual classroom to conduct DLEE (Fig. 1). Similar results (Fig. 2) we obtained from the students. They ranked MS Teams with 54 %, Viber with 52 %, Google Classroom with 45 %, Zoom with 43 % and Shkolo with 24 %.

The amount is over 100 % because the respondents gave more than one answer. It should be noted here that the Microsoft Teams platform was purchased by the Ministry of Education and Science. All teachers and students were given official accounts, with which they received Office 365, e-mail in a special domain created by the Ministry of education and science of Bulgaria and access to educational resources of individual publishers, some of which required registration and payment and his service was provided free of charge to the education system.

The other platforms used by the teachers are free, except for the virtual room in Shkolo. It was accessed after a fee was paid by the school that wished to use it. According to teachers, the most serious challenges for the distance learning process in the electronic environment are related to students' access to quality Internet and electronic devices, their motivation and commitment to learning, ensuring regular attendance of some students in online classes and their lack of digital skills. To identify the main difficulties

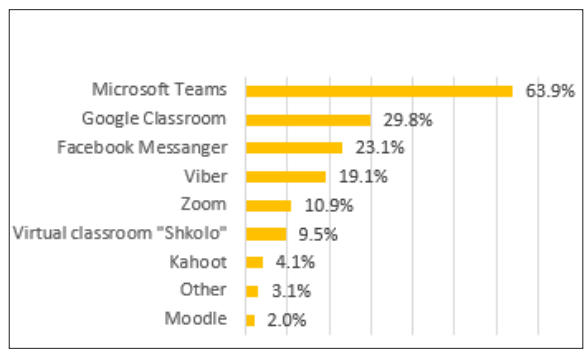

Fig. 1. Distribution of teachers according to used online platforms [5].

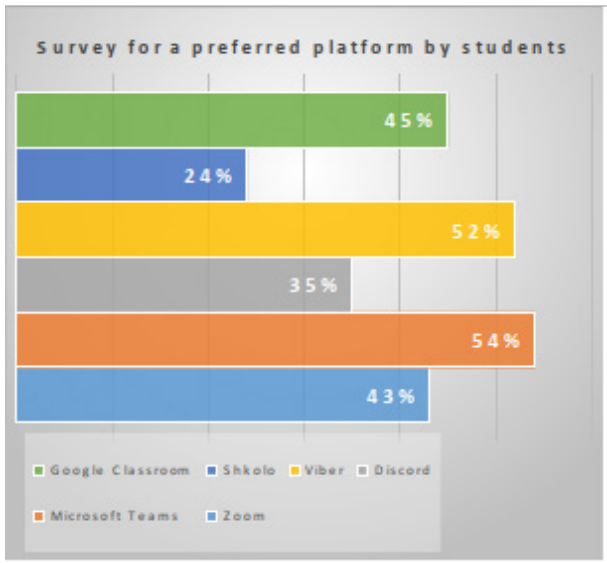

Fig. 2. Survey for a preferred platform by students [1].

in conducting effective distance learning in the e-environment, teachers were asked to identify up to five challenges that they felt had the strongest impact on the distance learning process in the e-environment in the 2020/2021 school year. The access of students to a quality internet connection is cited as the most serious challenge for the DLEE /Distance Learning in an Electronic Environment/ of 57 % of teachers, and every second teacher cites as a major difficulty maintaining the motivation and commitment of students. Among the five main challenges, teachers also mention students' access to electronic learning devices (38 % of respondents), ensuring regular attendance at classes of disengaged students (29 %) and insufficient digital skills of students (28 %). For 27 % of teachers, increased stress from work at home is a significant obstacle to the effectiveness of distance learning and learning, and one in four teachers report difficulties in including students from vulnerable families in the learning process. Comprehensive interaction with students is proving to be a significant challenge for every fifth teacher. A relatively low proportion of teachers (12 %) indicate challenges related to the inclusion of students with special educational needs in the learning process, but this result may be due to the smaller number of teachers who generally work with such students. Teachers report the least problems with their digital skills, as well as with access to digital tools and learning resources (Fig. 3).

The amount is over 100 % because the respondents gave more than one answer. Students' access to a quality internet connection and electronic devices are identified as two of the most serious challenges in all three educational stages, but in addition, the individual stages identify specific challenges that should be addressed by teachers and schools in an appropriate way. Interaction with students is emerging as a serious specific problem for high school teachers. Insufficient digital skills of students are identified as a key challenge for e-learning by many primary school teachers. In all three stages, maintaining the motivation and commitment of students is identified as a significant challenge, but it is significantly more pronounced in high school and junior high school than in primary school. Similarly, the regular absences of students from classes (which are largely a consequence of low motivation and commitment) are a significant problem in high school and junior high school and relatively limited in primary school.

The results of our study revealed the same problems observed in the student survey. A major issue identified was the weak or absent Internet connection [2]. Improving wireless connectivity could be achieved through the proper distribution of routers, as described by Panov et al. [6] and Filipov et al. [7]. Another significant problem noted was the lack of direct interaction between teachers and students.

The inclusion of students from vulnerable groups seems to be a more serious problem in primary and lower junior high school than in junior high school. The lack of support for learning on the part of parents proves to be a critical obstacle to the learning process in the junior high school stage. Increased levels of stress from distance work are registered in primary and junior high school teachers, and the reasons are probably related to some extent to the other specific problems observed in these two stages (Fig. 4).

Findings indicate an alarmingly high level of professional stress and emotional exhaustion among educators engaged in distance learning within a digital environment. Half of the surveyed teachers exhibit pronounced symptoms of burnout. Approximately 70 % report feeling consistently overworked during this period, with an equal proportion indicating they felt overwhelmed at the end of each school day. Moreover,

two-thirds experienced significant emotional fatigue as a result of remote instruction, and nearly 60 % expressed an overarching sense of burnout from the demands of daily online teaching and student interaction (Fig. 5) [5].

The duration of a teacher's professional experience is positively correlated with increased levels of burnout associated with distance learning in digital environments. Notably, a sharp increase in burnout symptoms is also observed among young teachers at the beginning of their careers, indicating that the stress of online learning encompasses all educators [5].

The research was conducted among students and the issues are related to the provision of electronic devices, the availability of a suitable place for learning at home, commitment and self-esteem of students in learning in an electronic environment.

The study reveals that nearly all students (98.9 %) have access to an electronic device at home that they can use for distance learning (Fig. 6) [5].

There is no doubt that using a smartphone for digital learning is a compromise solution in the absence of more suitable devices. It falls short in delivering the efficiency and quality required for effective information processing, particularly in an educational context. The size and quality of the display, on which students read instructional content, play a critical role in facilitating comprehension and deeper understanding [5].

The data indicate that a relatively large proportion of students have an appropriate, quiet, and peaceful space at home for independent study, although significant differences exist depending on the language spoken in the household (Fig. 7) [5].

A concerning decline has been observed in students' emotional, behavioral, cognitive, and metacognitive engagement between 2020 and 2021. This includes a deterioration in their learning approaches, self-regulation skills within academic contexts, and their confidence in their own learning capabilities. Additionally, there has been a marked increase in the proportion of students exhibiting low levels of engagement and self-assessed learning competence (Fig. 8) [5].

Approximately one in four students - 25 % report significant difficulty adapting to distance learning in a digital format and feel they have not performed well. In contrast, 15 % believe they have achieved a strong grasp of the material across all subjects, while 30 %

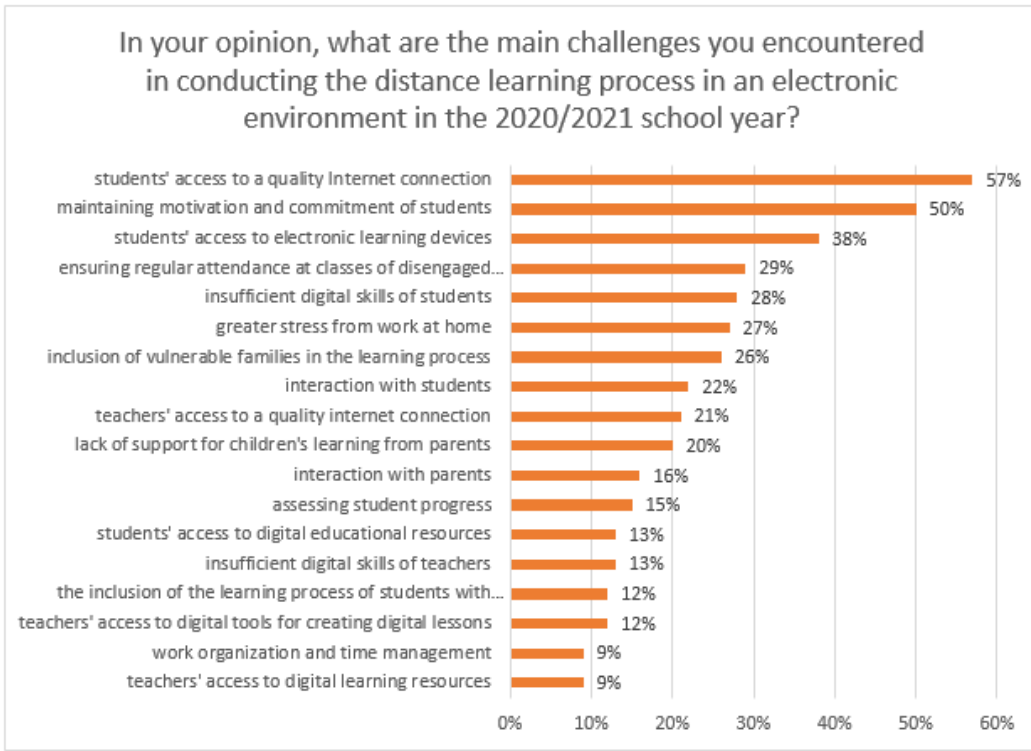

Fig. 3. Main challenges in DLEE [5].

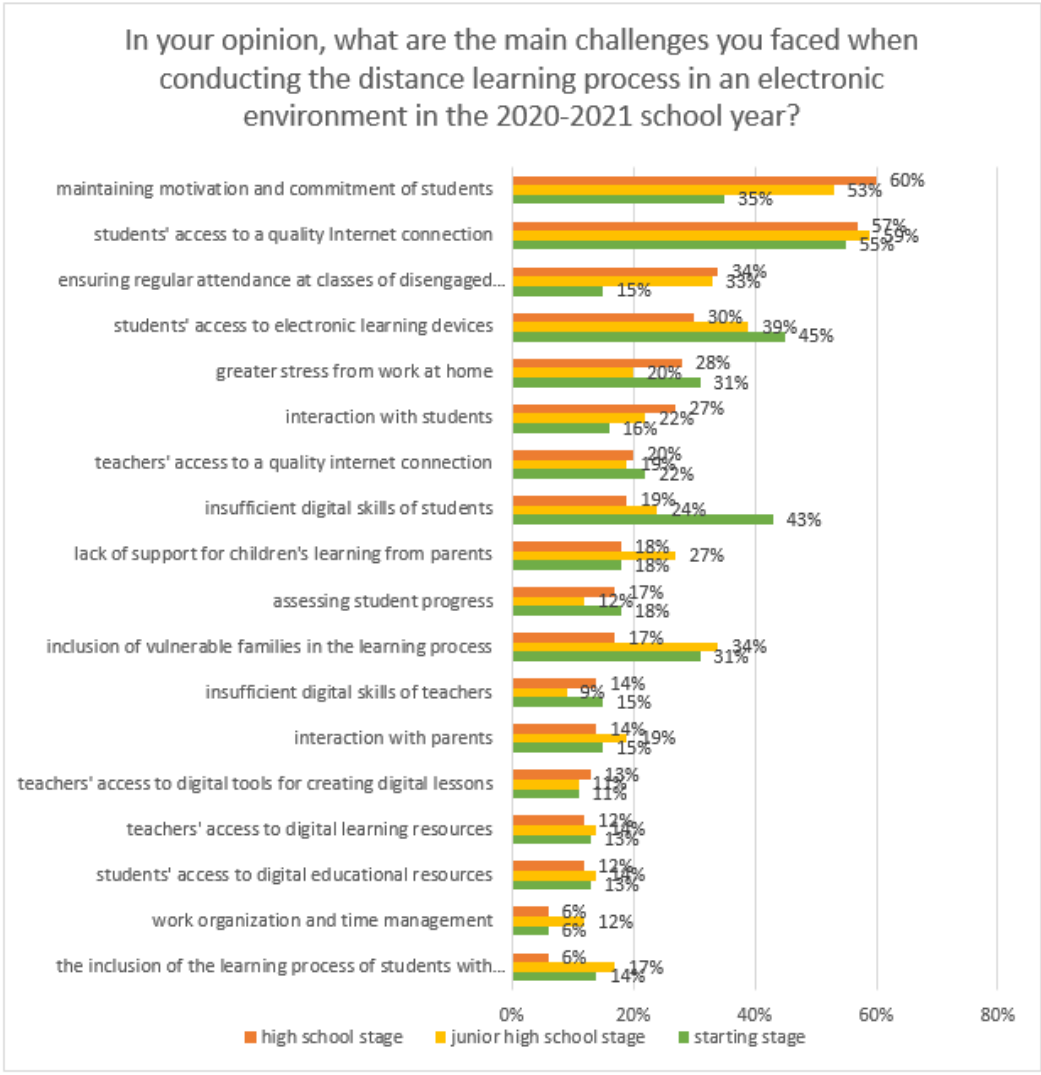

Fig. 4. Main challenges to the learning process from a distance in an electronic environment according to the educational stage [5].

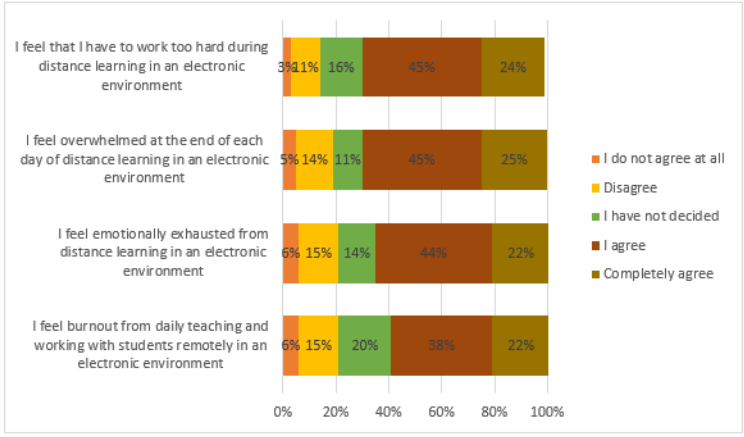

Fig. 5. Distrbution of teachers according their self-assessment of professional stress from DLEE.

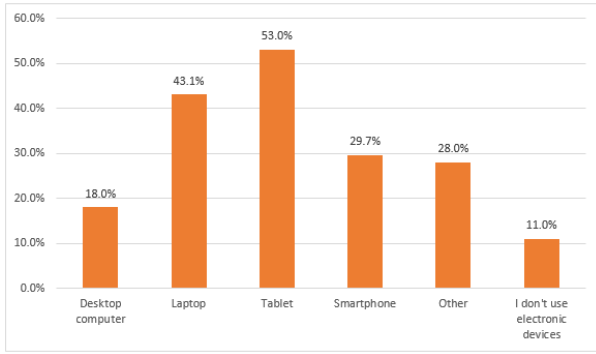

Fig. 6. Access to an electronic device in students home.

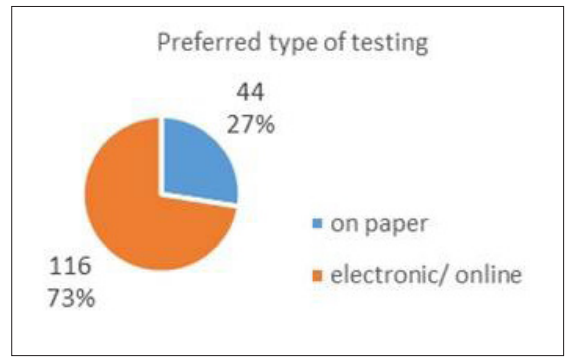

Fig. 7. Availability of a suitable, quiet and peaceful place in the students' home where they can study alone.

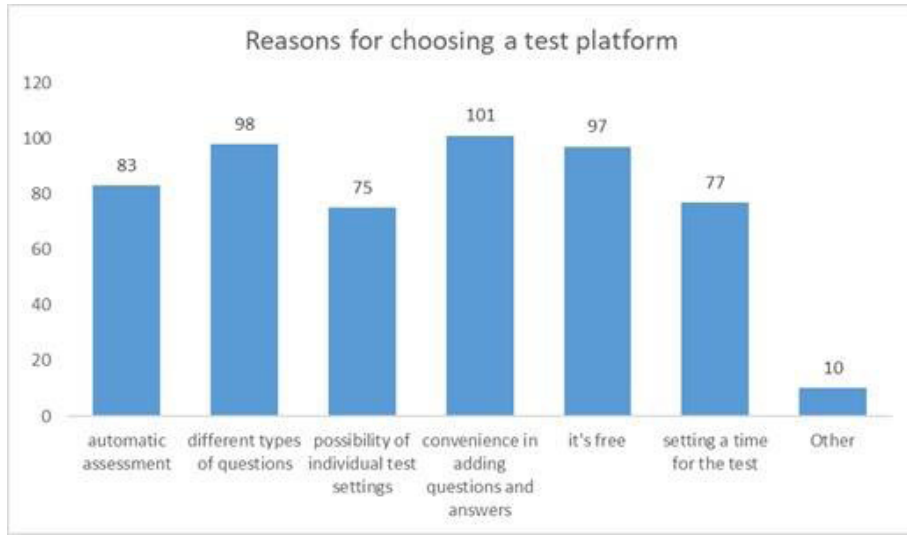

Fig. 8. Emotioal, behavioral, cognitive and metacognitive engagement of students.

report success in most subjects. Meanwhile, around 17 % acknowledge struggling to master the content effectively. Notably, only 23.8 % of students perceive online learning as more comprehensible than traditional in-person instruction [5].

„The lowest level of satisfaction with the distance learning process in the electronic environment is among students in the 12th grade, and the highest - among students in the 5th and 11th grade" [5].

Similar problems were identified in a survey conducted among students from a metropolitan school. The majority of student responses highlight issues related to internet connectivity and the absence of social interaction with peers as primary concerns. In the „other" category, responses reflect a wide range of sentiments, including general dissatisfaction („many problems", „there is nothing I like"), positive feedback („I like everything"), and remarks on workload and screen time („I am sitting in front of the computer all the time", „they assign more homework and conduct more tests") [2].

The most recent study conducted in May 2023 reveals an interesting trend: the preferred method of assessment for teachers is through the use of online platforms. Here are the results of the survey conducted among 161 teachers. In Fig.6 is the distribution of the test group, according to the educational stage in which they teach.

The total number of responses exceeds the number of respondents since some teachers teach simultaneously in more than one educational stage.

Regarding the question „If you could choose, what type of test would you use?", over 70 % of the respondents indicated the electronic option (Fig. 7).

The advantages are primarily related to the ability to ask different types of questions (including video, music, graphics, etc), convenience in creating the test, and automatic grading. It is notable that many teachers have given more than one answer, which indicates the convenience of this type of testing (Fig. 8).

The most widely used platforms continue to be those provided by the largest digital service providers, namely Microsoft and Google. A relatively large share is also occupied by the Bulgarian platform SmarTest. Surprising, a considerable number of teachers use the heavy, but free platform Moodle for installation and operation. The high number of „Other" responses is related to the fact that many publishers now offer electronic tests on their own platforms. Some examples include Anubis-Bulvest, publishers of foreign language textbooks, Prosveta, etc. We should also mention the free platform mozaWeb, which is available for teachers during this academic year (2022 - 2023).

Here is the distribution of the most commonly used platforms for electronic testing (Fig. 9).

The following analysis shows the preferred platforms by school level in which the teachers teach. A preferred platform for high school teachers is Google Forms, followed by Microsoft Forms, SmarTest, and Moodle. The Shkolo platform is only used by schools where principals have paid a subscription. Therefore, the number is relatively small. The use of other platforms is negligible.

The situation related to the platforms used by teachers in junior high school is similar. SmarTest, although it is a paid platform, is also widely used in this stage of education. The remaining significant platforms were used at rates similar to high school education. Preferred online testing platform by junior high school teachers.

There is also no difference in preferred online test platform by primary education teachers. Here we have to take into account that a part of the respondents (24.38 %) teach both high school and junior high school. 6.25 % of the respondents noted that they work in elementary and junior high schools. A deeper analysis of the platforms used shows that teachers prefer familiar, easy-to-use platforms. SmarTest preferences are significant, although payment is required for school use. The platform is very similar to Kahoot, with the difference that it immediately calculates a score (rather than a percentage of correct answers).

Here is an analysis of the answers to the question „Why did you choose this platform?" (Fig. 10).

The possibility of different types of questions is placed in the first place, when choosing online tests by all teachers. This allows for more accurate assessment of older students. When the questions are multiple-choice or free-response, with the possibility of uploading symbols, a file and even a clip, the teacher gets a more complete picture of the extent to which the material has

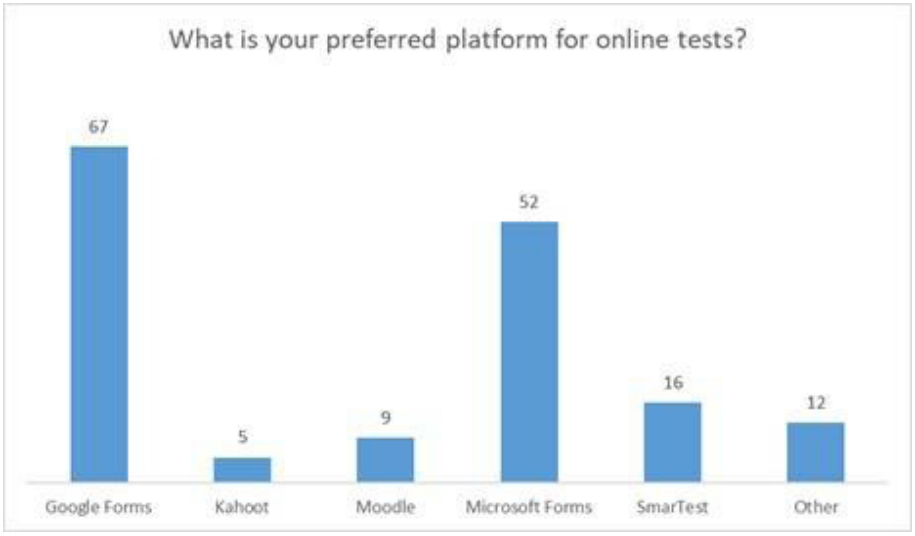

Fig. 9. Satisfaction with the distance learning process in electronic environment [5].

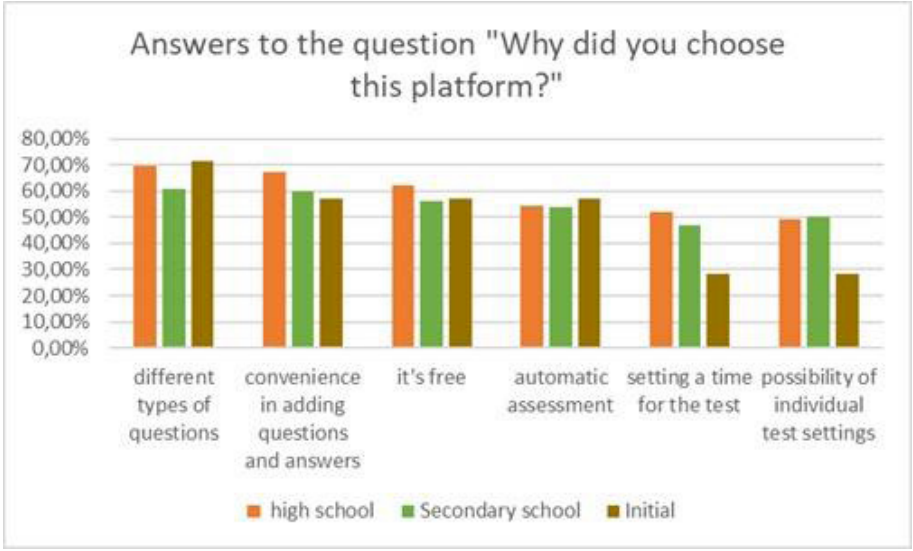

Fig. 10. Distribution of the test group by the educational stage in which they teach.

been mastered by a particular student, group, class and graduating class. The ability to upload images is most important to elementary teachers where students cannot yet read and write well. Automatic checking is also preferred by all teachers, but slightly more so by early-stage teachers. All teachers also prefer the platform to be free and intuitive. The ability to set a time to complete the test is preferred by teachers in junior high school and high school. The reason is that older students can quickly find the information on the Internet or get the answer online from another student or relative. Setting a response time limits the possibility of fraud. Another preferred option for online tests is setting individual test settings. This is also more important for junior high and high school teachers. The reasons for this requirement are many: in almost every class there are students who, for medical or other reasons, work more slowly and need more time to respond; it is good that the questions are different for each student at the same time of the test; sometimes it is necessary to start part of the test because the remaining material is not yet taken or solidified, etc.

CONCLUSIONS

The large-scale study of the IRE, commissioned by the Ministry of Education and Science, shows the structured advantages and disadvantages of learning in an electronic environment. The motivation of teachers and students to seek and use more electronic resources has increased, the need to increase computer skills and work with electronic devices has led to the rapid acquisition and application of such skills [8].

It has become clear that having a high-speed, uninterrupted internet connection is a big problem when conducting distance learning, as well as maintaining the motivation and real presence of students in the classroom. This is the reason why some teachers prefer atypical learning platforms such as Facebook Messenger, Viber and others. At the same time, during DLEE, the problems of working with students who are from vulnerable social groups or need special treatment and support are exacerbated. A very large percentage of teachers say they have been overworked and overwhelmed during this non-specific teaching. The methods and tools that every teacher uses during face-to-face training are largely inapplicable in e-learning. Literally, for each lesson it is necessary to look for techniques that will stimulate students and make each new concept and knowledge more understandable and easier to learn. A special challenge is to create appropriate tasks for exercises and consolidate knowledge [9].

The study shows that a large percentage of students have electronic devices and a place in their home where they can study independently. However, using a smartphone or tablet with a smaller screen should be an alternative, not a device for homework and

learning. Although behavioral, emotional, and cognitive engagement increased in 2021 compared to 2020, the proportion of students who think they are doing well in electronic environment remains low. Less than 1/3 of the students are of the opinion that they have studied fully during the distance learning in an electronic environment. The lack of live contact with classmates and the teacher is also part of the low motivation of students. The specific emotional climate in the classroom is a strong motivating factor that cannot be transferred to an electronic environment [10].

These analyzes and conclusions show that distance learning in the electronic environment in the ordinary school system is permissible only for a short period of time, in danger to human life and health. Some of its elements could also be used during standard training, such as: examples from the web, materials developed by other teachers or platforms for sharing educational resources, platforms for creating tests. Given the high percentage of students with electronic devices, the ubiquitous use of electronic textbooks would save a lot of headaches and paper [11]. Last but not least, electronic tests could be used both for control and for tracking and consolidating knowledge.

Acknowledgements

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Authors' contributions

All authors participated in drafting and revising the manuscript, as well as in the analysis, design, and interpretation of data.

M.P. was responsible for the study's conceptualization, data analysis, and the creation of all graphics. A.A. contributed to the initial idea, provided guidance on the structure and overall shaping of the manuscript, and assisted in drawing conclusions. D.P. coordinated the journal submission process and guided the necessary revisions to comply with the journal's requirements. All authors have reviewed and approved the final version of the manuscript.

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