Usage of Online Platforms in Education of Mathematics in Transcarpathia at the Beginning of Quarantine

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Abstract Distance learning and e-learning as concepts have been in our minds for a long time. In March 2020, they suddenly gained great importance due to the introduction of quarantine and were immediately put into practice. It had to be applied in the everyday lives of teachers and students with surprising speed.

The goal of this research is to assess and demonstrate how teachers overcome the difficulties of mathematics education in distance learning. For this purpose, a month later after the beginning of distance education, I conducted a questionnaire survey among 20 teachers of mathematics in Transcarpathia who teach in several educational institutions with different work experiences. They were asked how education went on during quarantine, how they chose the platforms and methods needed to hold their lessons, what the checking and testing process was, what advantages and disadvantages they faced in distance learning.

1 Introduction

Due to the quarantine introduced during the pandemic, teachers had to face a new problem. The concept and practice of e-learning and distance learning had to be incorporated into everyday life, which were far removed from the methodology learned or their lessons. In this regard, teachers had to find solutions to questions such as, *"Which platform should be used?"*, *"How can they best to solve that changes in the teaching-learning process do not reduce students' knowledge?"*. What the teachers did in the educational process with a board, booklet, or interactive aids, sometimes playfully, yet accurately, can now only be done remotely using a video connection or written instructions. Under the renewed conditions, students will have a greater role in independently processing the curriculum, possibly searching the Internet.

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According to Frederick et al. (see [4]) from more complete definition of learning can be crafted a new one: *Learning is improved capabilities in knowledge and/or behavior as a result of mediated experiences that are constrained by interactions with the situation*. With this definition of LEARNING we are half-way to our goal of defining distance learning. Now consider that there is more than one purpose for learning. Recognizing that learning is a constant process that takes place wherever and whenever the individual is receptive, there must be accommodation made for the different purposes for learning (different learning intentions). After all, learning situations may be formal (contrived) or be self-directed in everyday settings (naturalistic). Learning may occur by design, or it might occur by chance. Therefore, with these possibilities in mind, the authors propose three major subcategories of learning: (1) instruction: objectives-driven learning; (2) exploration: without objectives; and (3) serendipity: unintended learning [4].

Digital technologies have made their way not only into our everyday lives, but nowadays they are also commonly used in schools. Computers, tablets and smartphones are now part of the lives of this new generation of students [6]. All subjects are important, and it is difficult to teach all of them that you suddenly have to apply this method, yet perhaps one of the most difficult situations is for mathematics teachers. Most of the time we spend our days writing on a board, taking description the proof, solving practical examples, which now has to be solved in a completely different environment, with the help of other tools. To overcome difficulties, many platforms can be used to create groups, solve tests and tasks.

Teachers must understand how technology, pedagogy, and content interrelate, and create a form of knowledge that goes beyond the three separate knowledge bases. Teaching with technology requires a flexible framework that explains how rapidly-changing, protean technologies may be effectively integrated with a range of pedagogical approaches and content areas [6].

1.1 Distance Learning

Distance education emerged as an alternative to traditional education in the 18th century as a differently conceivable and feasible form of education, teaching, and learning. In the beginning, the main tool was the letter in which the written materials were delivered to the students. Later, also using traditional mail, image, sound and video recordings were also transmitted [3].

We can read this about distance education in the 1987 Adult Education Small Lexicon, formulated by Gyula Csoma: Distance learning is a special way of remote control; a remote control-based management and learning system, which is organized for the acquisition of defined, prescribed and precisely structured knowledge, thinking and, to a limited extent, action operations in the context of work-based learning, in order to meet specific requirements. In the didactic system of distance education, the two stages of the teaching-learning process are as far apart as possible in space and time [7].

Bušelić in [1] puts distance learning is a field of education that focuses on teaching methods and technology with the aim of delivering teaching, often on an individual basis, to students who are not physically present in a traditional educational setting such as a classroom. It has been described as a process to create and provide access to learning when the source of information and the learners are separated by time and distance, or both [1]. The United States Distance Learning Association defined distance learning in 1998 as "the acquisition of knowledge and skills through mediated information and instruction, encompassing all technologies and other forms of learning at a distance." This is a definition that does not distinguish formal and informal learning, or different types of distance (temporal and physical) [4].

Distance learning offers a myriad of advantages which can be evaluated by technical, social and economic criteria. Also, distance learning methods have their own pedagogical merit, leading to different ways of conceiving knowledge generation and acquisition [1]. By Frederick et al. definition of distance learning is this: *distance learning is improved capabilities in knowledge and/or behaviors as a result of mediated experiences that are constrained by time and/or distance such that the learner does not share the same situation with what is being learned* [4].

1.2 E-Learning

Learning has a procedural and active character, which must lead to construction of knowledge by the learner on the background of the learners individual experience and knowledge [9]. New technologies are driving necessary and inevitable change throughout the educational landscape. Effective technology use, however, is difficult, because technology introduces a new set of variables to the already complicated task of lesson planning and teaching [6].

The concept of e-learning is used in several senses. In the broadest sense, technology-supported learning, computer-assisted learning, digital learning [7]. The e-Learning system must enable the learner to create the personal information landscape while working with the provided learning materials. The means are individual compilation and topical rearrangement of learning material, creating "pools" of especially important documents as well as the possibility to annotate and cross-reference material [9]. Most of the terms have in common the ability to use a computer connected to a network, that offers the possibility to learn from anywhere, anytime, in any rhythm, with any means [2]. Students have the opportunity to proceed on their own schedule independently of the teachers. This is called asynchronous learning. This method does not preclude communication between students and teachers, as choosing an asynchronous form of communication can answer all the questions [3].

Tavangarian in [9] summarizes this as follows: We will call e-Learning all forms of electronic supported learning and teaching, which are procedural in character and aim to effect the construction of knowledge with reference to individual experience,

practice and knowledge of the learner. Information and communication systems, whether networked or not, serve as specific media (specific in the sense elaborated previously) to implement the learning process [9].

According to [2] communication is the key when it gets difficult to try reaching out to students via texts, various messaging apps, video calls, and so on-content should be such that enable students for practice and also hone their skills. The quality of the courses should be improved continuously and teachers must try to give their best [2].

1.3 Digital Technologies

During mathematics classes, pupils can make use of digital technologies in various way:

- during numerical calculations so they can concentrate on the solution of the problem itself;
- for visualisation, modelling and simulation of problems and thus to obtain such a graphical representation of the problem, which pushes them towards a solution;
- as a source of educational materials e.g. e-books or videos, interactive educational materials;
- drilling exercises, a pupil can make use of electronic working sheets or e-tests to evaluate himself [6].

Digital technologies offer teachers a possibility to make use of new educational methods, e.g. the constructivist approach, controlled search, workshop method or peer instruction method. Digital technologies are very suitable for project teaching, too. Teachers can make use of blended learning, flipped classroom method, etc. Last but not least, the computers are used for electronic testing when knowledge of the pupils is measured [6].

Dhawan says that online programs should be designed in such a way that they are creative, interactive, relevant, student-centered, and group-based. Instructors indulged them in remote teaching few flatforms such as Google Hangouts, Skype, Adobe Connect, Microsoft teams, and few more, though ZOOM emerged as a clear winner. Also, to conduct smooth teaching-learning programs, a list of online etiquettes was shared with students and proper instructions for attending classes were given to them [2]. In my opinion, platforms for editing e-tests also play a significant role in distance learning.

The classical test consists of a set of test assignments and questions from concrete subject domain, related to an assessment system and offered for solving (accomplishment of certain activities) [8].

Sokolova and Totkov explain the e-tests theory: The classical taxonomy of test questions and assignments is based on the way by which examinees give their answers. Test questions and assignments are divided into two groups: free-form responds (open type)—the examinees construct their answers themselves;

questions and assignments with constructed answer (closed type)—examinees select the correct answer from a set of alternative answers [8].

According Korenova Therefore we can define the term "e-test" dually: 1. In a narrower meaning, the e-test is an electronically controlled didactic test with an option to enrich it with multimedia elements. 2. In a wider meaning, the e-test is an electronic interactive material based on a system of questions and searching for answers created not only for measuring, but also for reaching educational goals (hence can serve as tools for innovative teaching methods). Using e-test we are able not just to determine the students' knowledge, but with these new digital tools we can increase the students' motivation, use them during repetition, exercise, controlled discovery methods. The e-test is very attractive from the students' point of view, because the digital world is very close to them [5].

Test questions and assignments, which are included in a concrete e-test can be chosen on the basis of different principles and rules. Opinions of different authors expressed in the literature, are very contradictory [8].

The question arises, what kind of digital technology do the mathematics teachers of the surrounding Hungarian-language schools use? Is it one of the above-mentioned platforms or e-tests to assess knowledge even at the beginning of distance learning? The results of this research I presented below.

2 Methods

The target group of the research were mathematics teachers teaching in Transcarpathia, in Hungarian-language primary and secondary schools, as well as in higher education. The 8-item electronic questionnaire I edited using a Google Form and then made available on the social network. I got answers to my questions that what methods are used after the introduction of distance learning, what platform they do it on, and what advantages and disadvantages they see after overcoming the initial difficulties. In addition to selecting one and multiple choice items (close type), participants had to enter their own answers to the advantages and disadvantages questions (open type). Fewer than expected, only 20 responses were received, the results of which I will presented below as pilot research.

3 Results

While editing the survey questions, I considered important the question *"How many years of mathematical pedagogical experience?"*. I was curious about the differences between the different work experiences in choosing and applying the technology and platforms required by the new situation. Figure 1 shows the distribution of respondents' work experience.

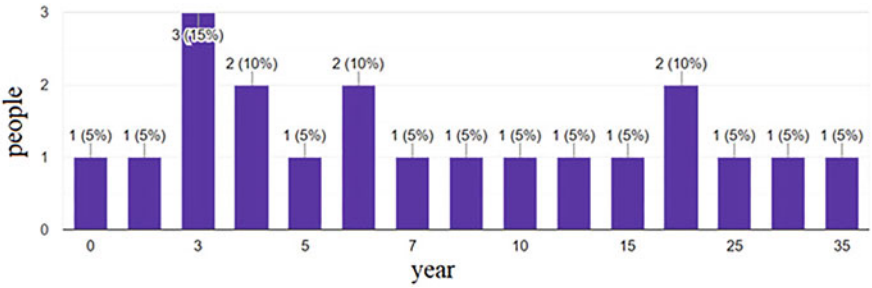

Fig. 1 Distribution of respondents' work experience

We can see that among the respondents, 8 persons have 1–5 years and another 5 persons have 6–10 years work experience. This suggests that more than half of the respondents are closer to applying the technologies due to their young age. This conclusion does not rule out the possibility that the use of technologies or learning to use the necessary new programs and platforms would be far from more experienced colleagues.

When choosing educational interfaces, in the spring of 2020, 60% of responding teachers marked Facebook Messenger, and a further 10% mentioned this application choosing the "other" answer option, thus listing more platforms. Regardless of work experience, they responded that the applied application was chosen because of its prevalence, as their students, or in the case of younger age, the parents of the students, had already used it in their daily lives. 10% used Google applications, and another 5–5% used other platforms like Geogebra groups, Microsoft Teams, EduBase and Smart Learning Suite.

55% of the responding instructors had already used video call to conduct the lesson at the time of the survey. Only 10% of respondents use the Zoom platform alone, and another 10% use other video applications in addition to Zoom. 15% also used it for measuring the level of knowledge when solving both oral and written tasks. An additional 25% created and applied e-tests using different test editing platforms, and 35% used traditional tests during the learning assessment. Other 10% was traditional and e-tests, 10% that students submit photos from their solved tasks and 5% does not use knowledge level measurement.

In Table 1, I summarized the advantages and disadvantages that respondents wrote while completing the questionnaire. During the review, I categorized and generalized the responses where the same things appeared. There were respondents who expressed several advantages and / or several disadvantages.

The table shows that the instructors in the survey see the advantage in educating students for independent, in which it helps a lot that they are separated from teachers in space and time, and that the instructional videos they can be viewed multiple times. In contrast, the disadvantages are that it is more difficult for students to learn this way, often either due to a lack of necessary tools or difficulties in mathematics. And in the case of knowledge assessment tests, it is difficult to decide whether the

Table 1 Advantages and disadvantages of distance learning according to the respondents

Advantages	Disadvantages
Students independent (4)	Harder to learn (3)
Raising awareness, interest (2)	Lack of device (electricity, internet, communication equipment) (4)
Repeatable/look back video lesson and curriculum (3)	It is difficult to accountability the students knowledges (a parent or child had answer?) (3)
Speed (3)	Lack of time (more time to prepare teacher) (3)
Different space and time (4)	No personal contact (4)
No advantage (2)	No disadvantages (1)

student solved the set task alone or with help. The lack of personal contact was also mentioned as a disadvantage.

Respondents included teachers who said there were no advantages or disadvantages to distance learning. In these cases, it can also be assumed that they did not want to answer the question.

4 Conclusion

In the spring of 2020, asynchronous learning introduced the application of new technologies in our countryside as well. The 20 mathematics teachers I interviewed jumped through this hurdle. They use multiple platforms, online materials and video calling to do their job accurately and conscientiously. To measure their students' level of knowledge, they perform classroom character lessons in a video call, or take online measurements using e-tests or correcting images submitted by students.

Examining the presented results, the possibility arises that it would be expedient to repeat the survey by looking for the same 20 respondents to compare the extent to which the technique they used has changed in the last school year of distance education. Due to anonymous responses, this would not be easy to do, but instead it would be appropriate to extend it to more respondents to I get more accurate values and a picture of the distance learning process.

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