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## **USE OF MOBILE TECHNOLOGIES AND LEARNING TOOLS IN METHODOLOGICAL TRAINING OF THE FUTURE MATHEMATICS TEACHERS**

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When preparing a lesson with the use of mobile technologies, the teacher must organize it based on the goals and adhere to the main didactic principles (systematicity and consistency, accessibility, differentiated approach, scientific and others). The use of mobile phones is an addition to the lesson, not a substitute for the teacher, so the use of smartphones and other devices should not occupy more than half of the lesson.

Let's consider which mobile applications can be used in a mathematics lesson, for example, when studying the topic "Linear function, its graph and properties" in general secondary education institutions in Ukraine. The linear function is the simplest and, one might say, the most important among all functions. Many physical laws are expressed using a linear function. For example, a path traveled at a constant speed. Therefore, it is important that students understand and remember this educational material well.

The first stage is motivational, which includes the teacher's introductory speech, updating the students' knowledge and skills, setting the task, and motivating the educational activity. In this part of the lesson, it is advisable to discuss the purpose and tasks of the lesson with the participants of the educational process, using a presentation developed in PowerPoint. And also with the help of the mobile application ClassDojo [2]. Its application helps teachers to increase the motivation of students' cognitive activity and interest in learning, to stimulate their learning activities, work in groups and pairs, to monitor and create data on the behavior and types of student activities, to establish feedback and control their activities during the lesson. And parents will be able to check their child's progress at school.

Checking homework and updating available and required learning experience can be done with the help of mobile phones. To update knowledge, you can use the LearningApps application [3], which allows students to solve some types of tasks together. There is an opportunity to create accounts for your students and use your resources to test their knowledge right on the site. If you register on the website as a teacher, an additional tab appears – "My classes". In this section you can create student accounts. Each of the students will be automatically assigned a login and password, under which they will enter the site and perform exercises. The teacher can monitor the process of their work, write their comments by clicking on the envelope icon opposite the student's name. If there is an interactive board, exercises can be performed on it, this will make children even more interested in the educational material. With the help of a smartphone, you can read a QR code that contains a link to an exercise, download it as a graphic file and insert it into a presentation. If the children do not have the ability to quickly read the QR code, then the link to the exercise should be sent to the shared chat of any instant messaging system (Viber, Telegram, etc.).

It is also possible to use different survey platforms to quickly and efficiently update background knowledge, for example, use the site "On Lesson" [1]. Its advantages are that this educational project has ready-made

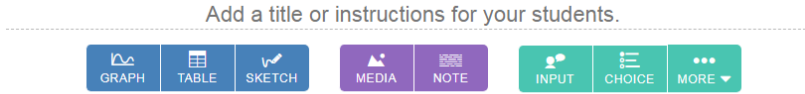
tests created by other users and the ability to create your own. In order for the child to pass the test, it is enough to throw the link [join.naurok.ua](http://join.naurok.ua) and the code. You can work with the test in real-time mode or as a homework assignment, specifying deadlines. With the help of the "Testing results" tab, the results of students' passing the test are viewed.

The second stage is a practical part of the lesson, which also involves working with mobile technologies and performing various types of tasks on the topic "Functions". The most popular mathematical program MS Excel is available as a mobile application. The program has a convenient interface, allows you to easily operate with numbers, quickly perform the necessary calculations, for example, build a table of function values, graphs. That is why its application in mathematics is very effective and gives great opportunities to the teacher of mathematics. In the process of teaching mathematics, MS Excel can be used in the study of the following topics: solving equations of the  $n$ th degree, solving systems of linear equations, constructing graphs of functions, graphically solving equations and their equations, etc.

It also nicely enhances the visualization of studying the functions of GeoGebra applications [4]. With its help, you can analyze functions, build graphs, solve problems, work with functions, etc. Using the GeoGebra program speeds up the learning process, allows you to accurately and visually depict the transformation of graphs of various functions and enables students to participate in the learning process, while saving time for unnecessary constructions.

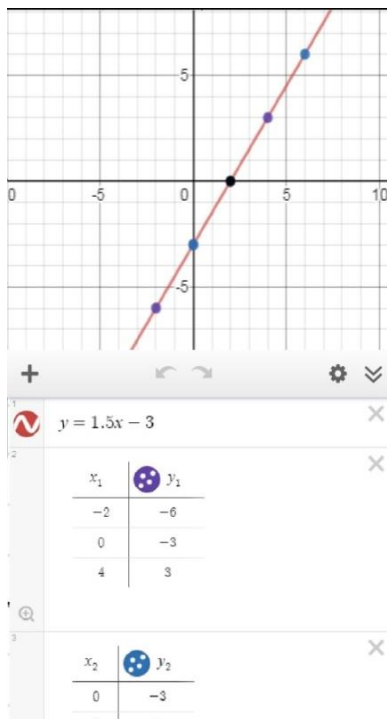
When studying the topic "Functions", it is convenient to use Desmos [5] – a graphic calculator implemented as an online calculator and a mobile application. Making the connection between graphical and algebraic representations provides a visual that can reinforce understanding and the dynamic aspect of seeing how both representations change helps teachers describe mathematical relationships. With the app, students can build and explore dynamic objects that help them better understand mathematical relationships and develop visual vision. In addition to a number of useful tools for learning functions, it also allows you to organize a class using a special tool for teachers at [teacher.desmos.com](http://teacher.desmos.com). You can use already existing courses on studying functions (linear, quadratic, exponential and others, on the graphical solution of linear equations and systems of linear equations, as well as on modeling) or try to create your own course. To create your own exercises in Teacher Desmos, you need to go to the "activitybuilder" tab and click on the "Start Building an Activity" button, and enter the name of the topic of the

task. Next, you need to choose the elements that will be included in the question, such as a graph, image, table, text, etc. (Fig. 1).



**Fig. 1. Toolbar for creating an assignment in Teacher Desmos**

You can make a graph and ask students to analyze it, find a solution to the corresponding equation. You can also build a table of function values and analyze the table, add pictures, and create an interactive exercise where



**Fig. 2. Tasks in the Desmos mobile application**

students have to match the correct answers and add pictures to the graph itself. The student needs to log in to the course with a valid Google account by following the link to the course, that is, the student can log in to the system under his/her name, only on the student's page and only for his/her assignments. The student does not see the work of other participants, except for those cases when the teacher took care of this possibility in tasks with entering the answer. He observes what is happening in the students, in all of them at once and in each of them separately, entering a specific task of the student, where he sees the degree of its completion.

Desmos is best used at the beginning of learning a topic, as it is more instrumental than controlling in nature, and therefore most effective when familiarizing with new material, checking homework, and solving problems of a research nature (Fig. 2).

The use of modern programs of dynamic geometry in the teaching of mathematics gives students motivation to study and learn new things not in a ready-made form, but by independent search. Schoolchildren analyze the resulting visualization models, learn to distinguish important and minor features of mathematical objects, generalize and structure the material.

The availability of mobile technologies and means of teaching mathematics allows the implementation of the "bring your own devices" technology, in which students' smartphones and tablets, which were brought from home, are actively used for classes. The advantage of such an organization of the educational process is that teachers and school administrations do not forbid, but allow and in every possible way motivate students to bring their own devices to school and learn with their help.

The profession of a future teacher requires constant improvement of the level of professional skill. There is a task to update and improve the educational process with modern and accessible technologies. The use of dynamic mathematics environments, such as Desmos, in the classroom changes traditional teaching methods, allowing to increase the interest of students in the subject. And such a combination of programs such as ClassDojo, LearningApps and "On lesson" contributes to better assimilation of educational material.

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