USE OF INFORMATION TECHNOLOGY IN MATHEMATICS LESSONS

[a]VALENTINA MAKHATOVA, [b]BAKYT BARSAY, [c]ULDAI TULENOVA, [d]RAIGUL TULEUOVA, [e]ALMAZHAI YEGENISSOVA, [f]ZHADYRA SALYKBAYEVA, [g]TOIDYK AKHMURZINA, [h]GULDANA JANKANOVA

[a-d,f-h]*Kh. Dosmukhamedov Atyrau State University, 060011, 212 Studenchesky Ave., Atyrau, Kazakhstan*
[e]*Yessenov Caspian State University of Technology and Engineering, 130000, 32 Microdistrict, Aktau, Kazakhstan*

email: [a]*mahve@mail.ru*

Abstract: The modern social and economic environment put forward new requirements for a school graduate. To achieve them, a new quality of education is required, which is largely due to the use of information technology (hereinafter - IT). They can prepare a pupil, starting from primary school, for life in an information society and make teaching and learning more effective. The topic of this article was chosen due to the wide implementation and use of information technology in the learning process. This topic is relevant because the teaching of specific subjects is gradually computerized. New methods of learning are being introduced into the modern learning process, which revives the achievements of experimental pedagogy of the past century built on the principle of self-development and individual activeness. One of the most important methods is the implementation of information technology in the education of younger pupils and its use in such subjects as mathematics.

Keywords: information technology, mathematics lessons, primary schoolchildren's education, information society, educational and pedagogical activities.

1 Introduction

As societies become computerized and as they enter the world community, there is a growing need to teach and educate children so that they be able to live in an open society, to communicate and interact with the diversity of the real world, have a holistic view of the world and its information unity. At the same time, in the period of rapid informatization of society, the ability to collect necessary information, propose a hypothesis, draw conclusions, use new information technology to work with information acquire significance for human development. Information technology can be used when children are introduced to new material in school subjects. It can be used to consolidate and revise what they have learned. (1, 2) In mathematics lessons, in particular, information technology not only serves to diversify the lesson but also to make learning materials more visible and understandable. (3-5)

In the process of "learning and teaching", there is a constant interaction between teacher and students. Each student undergoes the learning process that has a pronounced personal connotation in different ways: one cannot demonstrate the knowledge he or she has learned, the other, on the basis of previous experience, shows phenomenal abilities, and the third has learned a certain style of attitude to the subject and persistently "does not want" to learn. One cannot deny the personal perception (or lack of perception) of the teacher by the student and vice versa that also undoubtedly has an impact on learning progress. (6, 7)

Teaching is also personal in nature. By transmitting learning information, the teacher contributes emotional and value connotation to the content of the subject. Regardless of the teacher's wishes, his/her beliefs, priorities, motivations, and life concepts are also involved in the transmission of knowledge.

Education is a future-oriented process, which is why today's schoolchildren and, above all, today's primary school children will have to manage the existing information system. In this regard, an important step towards improving primary school education will lie in computerization, or more precisely, the development of information competence among younger pupils including information culture and information literacy.

The purpose of this paper is to identify the need for the use of information technology in the teaching of mathematics to junior high school students.

The goal is realized by solving the following tasks:

- The analysis of the scientific, practical and methodological literature on the use of information technology in teaching junior high school students;
- The studies of the basis for organizing students' activities in mathematics lessons using information technology;
- The analysis of the experience of the teachers in using information technology in the teaching of mathematics to younger pupils.

The object of the paper is the use of information technology in teaching junior high school students. The subject of the study is mathematics lessons.

The implementation of students' research activity elements in pedagogical technologies allows the teacher not only and not so much to teach, but also to help pupils to study, to direct their cognitive activity. Nowadays, the project-based learning method is one of the most widespread types of schoolchildren's research work in the teaching process. (8, 9)

2 Studying the Theoretical Foundations of the Use of Information Technology in Mathematics Teaching

2.1 Concept of Information Technology

Information processes (collection, processing, and transmission of information) have always played an important role in science, technology, and society. In the course of human evolution, there is a steady trend towards the automation of these processes, although their internal content has remained essentially unchanged.

The informatization of society is a universal implementation of the complex of measures aimed at providing full and timely use of reliable information and generalized knowledge in all socially significant kinds of human activity. (10) Information technology is a wide range of disciplines and fields of activity related to data management and processing technologies such as computing etc. (10, 11)

Information technology is a set of methods, production processes; software and hardware facilities united in a technological chain that provides collection, processing, storage, distribution and display of information in order to reduce the labor intensity of using information resources and increase their reliability and efficiency. The purpose of creation and wide distribution of information technology is to solve the problem of informatization development of society and all life activities in a given country. (12, 13)

Currently, information technology is most often understood as computing. In particular, information technology deals with the use of computers and software to store, transform, protect, process, transmit, and receive information. According to the definition adopted by UNESCO, information technology is a set of interrelated scientific, technological, and engineering disciplines studying

- Methods of effective organization of work of people engaged in the processing and storage of information;
- Computing and methods of organization and interaction of people with industrial equipment, their practical applications, as well as related social, economic and cultural problems. Information technology requires complex training, high initial costs, and knowledge-intensive equipment. Their implementation should begin with the creation of mathematical support and the formation of information flows in training systems. (14)

2.2 Role of Information Technology

At present, the process of "semiotization" of society is taking place, which implies the emergence and development of numerous sign systems, through which a multi-component "information field" is formed, which is a specific information environment of man. Since the possibilities of information technology are unlimited, the problem of information (communicative) adaptation of a person in society arises. Modern society has realized that the future is unthinkable without the informatization of all areas of human activity. The flow of information that a person encounters daily and hourly becomes more and more powerful. The rapidly growing flow of information leads to the fact that every year the gap between the total amount of scientific knowledge and that part of it which is assimilated in an educational institution increases. (15-17)

The modern pupil must

▪ Be able to adapt to different life situations;
▪ Obtain a system of necessary subject knowledge for solving practical problems;
▪ Possess the skills to overcome thinking stereotypes;
▪ Develop abilities for adaptation in the changing information environment;
▪ Be flexible, mobile, perceptive, tolerant, creatively initiative, and competitive person. (12)

In this connection, priorities regarding ways and methods of training change from the presentation of ready knowledge to training in ways of search, storage, selection, qualitative processing of the information and its use.

An informatization program is a set of measures aimed at ensuring the use of operational knowledge in all types of school activities. The purpose of modern lessons is to form imaginative thinking and clear ideas about the subject. Great opportunities for its implementation are laid down in the use of computers in primary schools. The modern education system implies the use of a variety of innovative technologies. This provides two main advantages - qualitative and quantitative. Qualitatively new opportunities are evident when comparing verbal descriptions with the audiovisual presentation. Quantitative advantages are expressed in the fact that the multimedia environment is much higher in terms of information density.

The development of new information technology in education stimulates the development of software tools and applications that implement methodological ideas related to semi-automatic or automatic access to learning information, the verification of the correctness of the received results, the evaluation of initial and ongoing training, and so on. It is possible to assert that the competent use of possibilities of modern information technology in primary school promotes

1. Enhancing cognitive activities and improving the quality of learning outcomes of students;
2. Achieving the learning objectives with the use of modern e-learning materials for use in primary school lessons;
3. Enhancing the self-education and self-control skills of younger pupils; improving the comfort of learning;
4. Reducing didactic difficulties among pupils;
5. Enhancing the activism and initiative of younger schoolchildren in the lesson; development of information thinking of schoolchildren, the formation of information and communication competence;
6. Gaining computer skills in accordance with basic security rules.

A modern specialist must have fundamental information training since with the increasing volume of scientific and technical information an educational institution is unable to provide a learner with the full amount of knowledge for his or her entire conscious life. Therefore, the "core" of professional competence is not students' knowledge but the ability to use new technologies that have public value and a huge motivational

stimulating value and the ability to solve problems in different kinds of activities. (14)

Information technology is of special importance in all kinds of human activity, especially in training. Thanks to information technology and the Internet, students have the opportunity to work together on projects (partner's localization is not important), access to information sources not only at their school or university but also to other sources in the country and abroad. They can participate in teleconferences.

The specificity of competency-based learning with the use of information technology is that students do not learn the ready knowledge offered by a teacher, but the conditions of origin of this knowledge are traced. Favorable conditions are created for the formation and development of pupils' personal qualities in the course of learning activities.

In primary schools, the use of information technology helps teachers to visualize the necessary didactic units of educational information, to increase the interest of younger pupils in mathematics, and to encourage pupils to accumulate supporting facts and methods of how to act in accordance with a model. The following significant changes in the teaching process take place with the use of information technology:

▪ The reorientation towards the development of thinking and imagination as the basic cognitive processes necessary for quality learning;
▪ The effective organization of students' cognitive and independent activities;
▪ The ability to cooperate, self-improve, create, etc. is demonstrated.

When using information technology, all the main stages of the lesson are still preserved. Within the framework of a traditional lesson, electronic versions of some of the teaching materials make the process of obtaining knowledge comprehensive and effective. They make it possible to speak of the formation of key schoolchildren's competencies such as

▪ The ability to think systematically, to act independently under conditions of uncertainty and unpredictability;
▪ The readiness to take responsibility for the work being done;
▪ The ability to solve problems independently and effectively in the process of practical activity;
▪ The willingness to interact and cooperate positively with classmates;
▪ The ability to make quick and effective decisions, to actively contribute to conflict resolution in solving problems;
▪ The ability to apply their knowledge and experience quickly and flexibly to practical problems;
▪ The willingness to acquire new knowledge and to strive for self-improvement;
▪ An understanding of the importance of using information technology and its mastery in the learning process;
▪ The ability to subjective self-esteem and reflection.

It is possible to solve a problem of the lack of visual mobility in mathematics lessons using a computer when children compare geometric shapes by means of isometry and analyze relations of sets under the direction of a teacher on a monitor screen. A computer is also the most powerful stimulus for children's creativity. A screen attracts attention, which sometimes cannot be achieved using frontal instruction. On the screen, you can quickly perform transformations in a deformed text by turning scattered sentences into a coherent text. However, in order for primary school students to be able to use a computer as a teaching aid in accordance with their wishes, it is necessary to take care of the universality of their user skills. (18) Children have the right to use modern means of work already today. Modern audiovisual media and intensive teaching methods can interest pupils in the subject and make it easier to learn. (12)

Multimedia lessons help to solve the following didactic tasks:

- Mastery of basic discipline-related knowledge;
- Systematization of the gained knowledge;
- Development of self-control skills;
- Development of motivation for learning in general and mathematics in particular;
- Providing educational and methodical assistance to students to work independently on the learning material.

Information technology provides information in various forms and thus makes the learning process more effective. On average, 30 percent of the time necessary for learning a particular material is saved, and the gained knowledge is stored in memory for much longer. When information technology is used in the learning process, this process changes significantly as follows:

- The reorientation towards the development of thinking and imagination as the basic cognitive processes necessary for quality learning;
- The effective organization of students' cognitive and independent activities;
- The ability to cooperate, self-improve, create, etc. appears.

2.3 Types of Information Technology Used in Mathematics Lessons

Two types of information technologies are used in mathematics lessons: presentations and slideshows. They make it possible to explain the material to children in a clear and accessible way. The presentation is the information support for frontal instruction in a classroom and consists of slideshows. The main forms of this information are text, drawings, etc. (14)

The experience of using electronic presentations made with the Microsoft PowerPoint program showed that the quality of the lesson is improving. Computer presentations are the most modern technologies for presenting information. The forms and place of use of a presentation in a lesson depend on the content of that lesson and the goal set in the lesson. When learning new materials, the use of a presentation allows illustrating the learning materials. When conducting oral exercises, the presentation allows for submitting tasks quickly. A training presentation can be a summary of the lesson. In this case, it consists of the main components of the traditional lesson such as topic, goal, a work plan for the lesson, key concepts, and homework. For math lessons, it is important to use animated drawings, when it is necessary to organize students' work with graphs and drawings to prove theorems and problems, to make a diagram, use a table, etc.

The following different kinds of electronic applications are used in lessons:

- Illustrations and demonstrations of audio and video materials;
- Applications combining both illustrative material and introducing issues in a problematic way with the subsequent check of proposed suggestions and solutions, frontal check and self-test of knowledge in the form of quiz, crosswords, and puzzles;
- The development of a series of lessons on the topic that allows for the most complete presentation of the material by drawing a picture of the holistic perception of the world, and successfully integrating different areas of knowledge in one subject;
- The development of electronic applications to the lessons using Visual Basic programming language that provide direct communication between a student and a computer (to perform by teachers who have mastered object-oriented programming).

Kinds of information technology most commonly used in the learning process can be divided into two groups such as

1. Network technologies using local networks and the Internet (electronic versions of methodological guidelines, manuals, distance-learning servers providing interactive communication with students via the Internet including in real-time).
2. Technologies oriented to local computers (training programs, computer-made models of real processes, demonstration programs, electronic collections of mathematical problems, supervising and testing programs, and didactic materials). (14)

3 Results and Discussion

Information technology can be used

- To indicate the lesson topic. The theme of the lesson is presented with slides to summarize the key points of the issue at hand.
- As an accompaniment to the teacher's explanation. In the practice of teaching junior students, multimedia presentation notes created specifically for specific lessons can be used. They can contain brief texts, basic formulas, schemes, drawings, and the demonstration of the sequence of actions to perform the practical part of the work.
- As an information and learning tool. When teaching, special emphasis is placed on a child's own search and perception activities as well as on processing new knowledge. A teacher acts as the organizer of the teaching process, as the leader of the students' independent activities by providing the necessary help and support.
- For knowledge testing. The use of computer-based testing increases the efficiency of the educational process and activates schoolchildren's cognitive activities.

It is reasonable to apply information technology in the following cases:

- Diagnostic testing of the quality of learning material mastery;
- In a training mode to rehearse elementary skills and abilities after studying a topic;
- In a teaching mode;
- When working with slow learners;
- In a self-learning mode;
- In the mode of a graphic illustration of the learning material.

The method of the use of information technology implies

- The improvement of the learning management system at various stages of the lesson;
- The improvement of learning motivation;
- The improvement of the teaching and education quality;

Multimedia lessons help solve the following didactic tasks:

- The mastery of basic knowledge related to a given topic;
- The systematization of the mastered knowledge;
- The development of self-control skills;
- The development of the motivation for learning in general;
- Providing educational and methodical assistance to students to work independently on the learning material.

3.1 Organization of Computer-supported Lessons

Computer-supported lessons are conducted along with usual lessons where it is possible and expedient to use computers for the solution of particular tasks in a lesson so that a child could understand more deeply, perceive a lesson subject and creatively prove himself/herself. Every computer-supported lesson is, in principle, integrated. In such a lesson, besides the subject-related tasks, the tasks related to the computer science course are also solved. (19)

The main types of computer-supported lessons are as follows:

- Combined lesson;
- Testing and correction lesson;
- Knowledge improvement lesson.

When teaching children within the framework of a special course, computer-supported lessons imply the 3 following forms of teaching:

▪ Frontal instruction;
▪ Group work;
▪ Solitary work.

The following conditions should be considered for the organization of the learning process:

▪ A teacher with computer skills should conduct the lesson.
▪ Computer-based tasks should be designed in accordance with the content of the subject and the methods of teaching it.
▪ Students should be able to handle the computer at a level required for the performance of the relevant computer-based tasks.
▪ Students shall study in a special lab equipped in accordance with established standards of hygiene for primary school.

For the formation and development of key competencies in the context of information culture, a primary school teacher should develop a consistent, logically completed system of learning tasks built in accordance with the rise of the level of completeness, problem, novelty, vitality, practicality. The teacher should control students' activities regarding the selection of information and its processing.

When developing computer-supported lessons, it is necessary to determine:

▪ Which topics should be "supported" by computer-based tasks and for which didactic objectives;
▪ Which software tools should be used for creating and performing computer-based tasks;
▪ What preliminary computer skills should be developed in children;
▪ What lessons it is expedient to do with computers;
▪ How to organize computer-supported lessons.

There are the following approaches to the creation of electronic learning materials for primary schools:

▪ The structure of each thematic section should be typical for a lesson at primary schools and should include an explanation of new material, initial consolidation and development of skills, and mastery testing;
▪ The structure of each thematic section should be relevant to a primary-school lesson. This structure includes the explanation of new material, the initial consolidation of information by highlighting the main terms and concepts of each topic;
▪ The volume of learning material for practice and testing tasks is determined in view of the sanitary and hygienic norms for primary school children working at the computer;
▪ The selection of learning material is conducted in view of the basic didactic principles;
▪ The management tools for the computer-based training system for any academic subject should be as simple as possible and should not distract a pupil from performing the tasks.

Let us consider the use of information technology in the primary school maths lesson using the example of an electronic presentation made with the Microsoft PowerPoint program. The presentation is entitled "Introduction to Numerical Expressions". It has a learning function. The slides are based on the content of the "Harmony" program by N.B. Istomina. The purpose of this lesson is

▪ To evolve the perceptions of the concepts of numeric expression, mathematical expression, the meaning of the numeric expression, and relation;

▪ To enhance the ability to find the meaning of any numeric expression;
▪ To develop attention, memory, and diligence;
▪ To instill interest in mathematics using information technology.

The "Introduction to Numerical Expressions" presentation is designed to visualize the system of tasks on the topic of a given lesson and to perform them together as a team. The expected length of the work with this presentation in the lesson is 12 minutes. The presentation consists of the following elements:

▪ The first slide. The title page, on which the title of the topic and the class designation are indicated.
▪ The second slide. Pupils are asked to determine which of the figures corresponds to the expression $4 + 3$. The images of finite sets whose elements are geometrical figures are chosen as illustrations. When working with numerical expressions, pupils rely on the quantitative theory of non-negative integers, on skills to relate a set of objects to a multiplicity and to establish a relation between a given numerical expression and an illustration. As students complete the task, they move on to the more complex task shown on slide three.
▪ The third slide. The completion of the task requires students to demonstrate qualities such as the ability to see and transfer a familiar situation (slide 2) to a new problem. To complete the task a student should establish a bijection between a set of mathematical (numerical) expressions and a set of illustrations that are the objective display of relative numerical expressions.
▪ On the fourth slide, it is required to define, to what illustration numerical equality corresponds. The completion of the task requires the actualization of the mastered knowledge such as the ability to apply the earlier gained knowledge to establish the relation between a given illustration and a numerical expression. Besides, when completing the task, pupils comprehend integer composition up to ten under the assumption of the addition of parts.
▪ The fifth slide. The tasks presented on it become complicated: illustrations display the series of objects of the finite sets arranged in ascending order of the number of elements in a given set and series of numerical expressions. Students must determine the relation between a series of object sets and a series of numeric expressions by setting a rule and obtaining each subsequent object set and, respectively, a number.

The other tasks are similar to the previous ones and are aimed at the enhancement of the skills of finding the values of a numeric expression, comparing numeric expressions, and establishing the relation between the elements of the considered sets and the number of elements of the finite set.

It should be noted that the mathematical definition of a numeric expression is complex and inaccessible to younger students. Therefore, according to didactic principles of evolving the perceptions, the work with numerical expressions should be organized consistently, from stage to stage, with the observance of the logic of mathematical education continuity. (12, 20, 21) The proposed system of tasks is aimed at enhancing skills and creating conditions for the performance of learning tasks at a higher level of independence. The above-described working out can be used in a mathematics lesson in the first grade of primary school in any of the existing curricula.

The experience of working in the school shows that with the didactically thought-out application of information technology in a traditional lesson, there are unlimited opportunities for the individualization and differentiation of the educational process and the development of every student's own educational trajectory in obtaining knowledge is guaranteed. With the use of information technology, favorable conditions are created for the formation and development of students' personality-related qualities in the course of educational activity.

4 Conclusion

The objective of the study was to show how information technology could be used in the professional activities of primary school teachers. In order to achieve this objective, information technology and its role in the work of teachers and students were examined, and the literature on the use of information technology in mathematics lessons was analyzed.

The following objectives have been achieved:

▪ The analysis of the scientific, practical, and methodological literature on the use of information technology in the teaching of primary schoolchildren;
▪ The study of the basis for organizing students' activities in mathematics lessons using information technology;
▪ The analysis of teachers' experience in using information technology when teaching elementary school mathematics.
▪ The following conclusions can be drawn using information technology:
▪ No matter how complicated and boring the topic of the lesson, it will become interesting for the student if the teaching material on the screen is presented in colors, with sound and other effects.
▪ The presentation on the topic of the lesson when explaining new material allows the teacher not to make notes on the blackboard, which means that more time is saved to consolidate knowledge.

Experience shows that the use of information technology in a lesson can transform the learning process by making it more effective and attractive for students (22). Teaching with the use of information technology becomes a creative search for a child, from which one can get satisfaction and through which one can assert oneself.

The use of new information technology in traditional primary education also makes it possible to differentiate the process of teaching younger pupils in accordance with their individual characteristics, enables a creative teacher to expand the range of ways in which educational information can be presented, enables flexible management of the educational process and is socially important and relevant.

Having analyzed the experience of primary school teachers in working with information technology (23), we have drawn the following conclusions:

▪ There is a reorientation towards the development of thinking and imagination as the main cognitive processes necessary for quality learning;
▪ An effective organization of cognitive and independent activities of students is ensured;
▪ The ability to collaborate is developed.

Thus, the following conclusions can be drawn from everything written above: new methods of learning are being introduced into the modern learning process, which revives the achievements of experimental pedagogy of the past century built on the principle of self-development and individual activeness. One of the most important methods is the implementation of information technology in the education of younger pupils and its use in such subjects as mathematics.

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Primary Paper Section: A

Secondary Paper Section: AM, IN