

UDK 378.091.33

Pedorych A. V.**USING OF VISUALIZATION ELEMENTS IN HIGHER EDUCATION INSTITUTIONS WITH SPECIFIC LEARNING ENVIRONMENT***The purpose of visualization is insight, not pictures.***Ben Shneiderman**

In this article are considered solutions for problems related to the need of improving the quality of explaining educational information while simultaneously increasing of training information for cadets and students of higher educational institutions with specific learning environment. The didactic and methodical features of multimedia using within the training of cadets are revealed. The experience of using multimedia and presentations in the educational process is presented. The advantages and disadvantages of visualization of educational material for higher education graduates of educational institutions with specific learning environment are studied. The potential of using these learning technologies with increasing of proportion of independent material studying is revealed.

Keywords: *cadet, visualization, visual material, multimedia, media presentation, multimedia models, interactivity, penitentiary pedagogy.*

Today in Ukraine there are innovations in the field of teaching at high school. Innovation relates to various aspects of the learning process. One of these aspects is using of new educational technologies in the educational process of higher education institutions.

This is aimed at reforming of domestic legislation in relation to the education system. In particular, Article 6 of the Law of Ukraine "On Education" dated 05.09.2017 defines the principles of state policy in the field of education and the principles of educational activity. Namely: a) man-centeredness; b) ensuring the quality of education and the quality of educational activities; c) the scientific nature of education [8]. New technologies of education are aimed at the development of higher education in Ukraine and further reformation to international standards.

At the same time, there are quite a few common possible negative aspects of the application of new educational technologies, namely, the latest information technologies in the system of open education. Among them are dispersion of attention, possible lack of feedback, duration, lack of accessibility and a number of other aspects.

The general disadvantage of most existing information training means is that after their development, the "research" of the spheres begins or continues, and all new possibilities for their practical application are thought up. It is rather rare to create information products with predetermined properties for the implementation of a specific teaching method and the solution of didactic tasks. When developing multimedia teaching aids, as a rule, the emphasis is not on

learning, not on the help for students, but on the technology of program implementation [1].

Background. There are a smart few publications and studies that addresses the issues affecting the use of information technology, including multimedia in the high school education process.

Publications on the problem of applying innovative teaching technologies in higher education institutions affirm the need to widely introducing of innovative learning technologies into the educational process, especially multimedia. The main methodological and theoretical positions of innovative pedagogical activity are defined in the studies of I. D. Bekh, Yu. Z. Hilbukh, I. M. Dychkivska, I. P. Podlasyi, S. D. Polyakov, M. M. Potashnyk, H. K. Selevko, V. A. Slaktionin and others. The questions of development and introduction of modern innovative technologies in education are presented in studies of Yu. V. Bondarchuk, G. S. Yuzbashev, V. T. Khristenko, L. M. Balabanov, A. S. Nisimchuk, V. D. Bazilevich, M. I. Ponochovny. In the studies of A. V. Brushlinsky, T.B. Habiy, O. M. Matyushkin, O. K. Tikhomirov are studied modifications in the activities and features of communication “teacher-student” with using of information technology. S. Yu. Marinchak investigated the effectiveness of innovative approaches in the system of higher education [7], [9], [11], [22].

Objective of this study is to highlight the features of multimedia using in the training of higher education graduates in higher education institutions with specific learning environment.

Presenting of main material. According to Article 3 of the Law of Ukraine “On Higher Education” [18], education at a higher school is based on the following principles: 1) promoting sustainable development of society through the training of a competitive human capital and the creation of conditions for lifelong education; 2) affordable higher education; 3) education within the framework of independent work of students; 4) education on the basis of distance learning and combinations of different forms.

“Informatization of education”, is noted in the “National report on the state and prospects of education in Ukraine” [7, p. 118], becomes a cross-cutting, comprehensive direction of innovation development of the educational system, which resources are not yet properly involved”. The rapid development of information and communication technologies and the dissemination of new educational and methodological systems create conditions for unlimited access (complete, fast, accurate, whenever and wherever, with minimal effort, etc.) of all subjects of learning to informational educational resources [7].

The principle of visuality has been and remains one of the main principles of learning. The golden rule of didactics from the time of Ya. A. Komensky has not lost its significance even today. The concept of “visualization” is interpreted in the reference materials [16, p. 6] as one way of introducing information into mass and individual consciousness. The problem of information perception by means of sight and hearing was investigated by many academic specialists. In fact, there are three types of reality perception: visual, auditory and kinesthetic.

According to the results of researching by B. G. Sledkevych, the system “ear-brain” can pass for 1sec. to 50 units of information (bits) [16, p. 11]. The capacity of the visual analyzer is 100 times greater than the auditory. In summary, 90% of the information about the surrounding world and the phenomena that occur in it, people receive with the help of sight, 9% – by ear, and only 1% – with the help of other analyzers. Also, the scientist points out that, from all kinds of memory, most students have the most advanced visual memory. A person who only listens, remembers 15% of the information that just watches 25% of the information that hears and watches up to 65% of the information. V. B. Mironov gives somewhat different figures, but this difference is not fundamental. He argues that, according to the UN data, a person remembers 10% of the read, 20% of the heard, 30% of the one they saw. If a person hears and sees, the level of memory increases to 50%, if after the heard and seen the discussion is held, then up to 70% [13].

The term “visualization” comes from the Latin *visualis* – perceived visually, clearly.

Visualization is the process of presenting data in the form of an image in order to maximize the convenience of their understanding; giving a meaningful form to any object, subject, process, etc. [19].

Visual information is better perceived and allows you to convey quickly and effectively your own thoughts and ideas to the viewer. Physiologically, the perception of visual information is fundamental to man.

In recent years, there have been tremendous changes in the field of the transmission of visual information: a) the volume, amount of information has increased; b) there are new types of visual information, as well as ways of its transmission.

Selection, structuring and design of educational material in a visual image, based on various ways of presenting information and relationships between these methods, which contribute to the active work of the cadet’s thinking when reading and understanding the content of the presented material.

When translating information into a visual image, as shown by the experience of working in higher education institutions with specific learning environment, its encoding, abbreviation, that helps to save it better in long-term memory.

Depending on the choice of one or another scheme (frame, outline, memory card, meta-plan, letter of reference signals) it is distinguished the following types of coding: 1) the organization or reorganization of various educational elements into a single whole; 2) imagery, that is, such a visual form of organization in which the verbal content becomes a virtual image; 3) clarification in which new information is expanded and added to the already known.

Also, visual models have advantages over texts. Namely: a) the definition of the structure of the phenomenon under investigation, the accentuation of significant links between its components; b) activation of thinking, promotion of a deeper digestion and understanding of educational material through its symbolic

simulation; c) formation of more rational methods of work with educational material.

Visualization of educational information can be achieved technologically by various methodological techniques and tools developed by many educators and psychologists. The methods of visualization of educational information include associative supportive signals, graphs of training information, production models, frame models, graphic circuits, circuit diagrams, memory cards, metaplanes, logical-semantic models, graphs, cluster maps, conceptual tables, and many others. Widespread using of information and communication technologies affects the creation and using of visualization tools for learning information.

Modern editors of computer graphics, interactive graphics and animation systems, programming languages and development environments, Flash technology, hypertext markup languages, presentation technology, multimedia and information technology help enhance the modeling aspect of visualization. A variety of software opens up fundamentally new possibilities for analyzing visual information by controlling their content, form of size and other parameters to achieve the greatest visibility, increase the level of understanding, and promote the development of visual thinking.

Currently, there are many graphic techniques that help to solve these problems: a) mental maps (mindmapping, mental maps – this is a convenient and efficient technique of visualization of thinking and an alternative way of fixing information); b) Fishbone from the cause-effect diagram, fishbone diagram – a graphical tool that allows for a visual and systematic analysis of the relationships between the consequences and the causes that cause these effects or affect them); c) denotational graphs (from lat. denoto – sign and greek grapho – write; – a way of emphasizing from the text the essential features of the concept); d) conceptual tables (used to systematize information, identify essential features of the phenomena studied, events); e) clusters (from the English “cluster” – swarm, bunch, lot of, crowd; with the help of clusters you can systematically present large volumes of information, keywords, ideas), etc. [5].

The principle of visibility in the context of problems related to the activation of the educational process is not given enough attention. Visibility is often considered as a factor for simplification of perception and enhancement of the memory for the learning material, that is, in its illustrative function. It is clear that the need for special preparing of training material that contribute haptical to give the students basic or necessary information, dictated by the informational saturation of the modern world.

At the same time, you need to work with active visualization means. Under the active means of visualization it is worth not only to understand the illustrative material, but the system of transmission of visual information that adequately responds to the actions of the subject in the learning process and helps him to manage the information that is transmitted on the screen.

When visualizing the educational material, it should be taken into account that visual images reduce the chain of verbal reasoning and can synthesize the

schematic image of a larger “capacity”, thereby compacting information.

Another important aspect of using visual educational materials is to determine the optimal ratio of visual images and verbal, symbolic information. Conceptual and visual thinking in practice are in constant interaction. They reveal different aspects of the investigated concept, process or phenomenon. Verbal-logical thinking shows us a more accurate and generalized reflection of reality, but this reflection is abstract. In turn, visual thinking helps to organize the images, makes them integral, generalized, and complete.

Technological techniques of visualization are aimed to provide a more imaginative, visual presentation of information. They help us: a) to support cognitive activity; b) to see previously hidden content; c) to change the perspective of the vision and to find a new point of view; d) to remember the information; e) to see and to establish new relationships between events and objects.

Graphic techniques of visualization of thinking have enormous potential in terms of creating cognitive tasks, reanimation of existing methods and means of thinking developing and memory of cadets, finding new ways of involving children in the process of active thinking activity. Since the information is a link between the teacher and the cadet, it is precisely that it structures the learning process through its components – the activities of the teacher and the activities of the cadet. Accordingly, the teacher needs to teach the students the effective ways of working with sources of information to obtain a sufficiently high level of knowledge. That is the method of teaching material to serve as the basis for choosing the technological reception of activating cognitive activity of cadets.

Thus, the visualization of educational information helps us to solve a number of pedagogical tasks:

- ensuring of training intensification;
- activation of educational and cognitive activity;
- formation and development of critical and visual thinking;
- formation of visual perception;
- formation of imaginative representation of knowledge and educational actions;
- knowledge transfer and images recognition;
- improvement of visual competence and visual culture, etc. [19].

Today, a significant number of visual means of transferring information are known: a board, posters, diagrams and a multimedia projector, prefabricated visual means (magnetic and studio boards), demonstration models, a computer screen/monitor, an interactive whiteboard, etc.

Any form of visualization of information contains elements of problemativeness. The task of the teacher is to use such forms of visibility, which not only supplemented verbal information, but also themselves were storage media. The greater the problem in visual information is, the higher the degree of mental activity of the student.

Currently, there is a fairly wide range of visualization forms for educational

material, both electronic and physical. Here is an example of just some of the electronic: computer presentations; flash animation; video/audio materials; pictures; diagrams; charts; graphs; mind maps, etc.

Today, the vector of informatization for military education should be aimed at achieving the following objectives: raising the level of professional training of military specialists with the help of information technologies in carrying out a set of procedures of organizational and methodological and informational and resource character, creating conditions for improving the quality of the educational process in higher educational institutions with specific training environment for account of the introduction of innovative methods and forms of training, based on new information technologies [8].

Along with video/audio materials, computer games and game simulators are widely used to train students from higher education institutions with specific learning environment.

“Some among the first saw the possibility of using virtual games to train military experts ... Studying computer virtual games has led to the fact that they began to be considered not only as “a game learning process”, but also a comprehensive system approach in the training of professional personnel” [15, with. 24].

So, according to scientists involved in the training of military cadets in the Republic of Belarus: “At the moment, the US Army has begun using a system of visualization of military computer games built on the basis of the graphics system SGI Onyx 3400, to create highly realistic simulators that help to prepare armed forces to make effective decisions at “hot spots” outside the USA” [21, p. 87].

The realization of the latest educational systems is supported by the latest information technologies, especially multimedia.

The word “multimedia” has become popular since the 90s of the 20th century. Multimedia (English) is multicomponent environment that allows you to use text, graphics, video and animation. “Multimedia” means the ability to work with information in different ways, and not only in digital form, as in conventional computers. Multimedia computers allow you to play sound (music, language, etc.), as well as video (video clips, animation films, etc.). Video effects can be represented by showing the variables of computer slides, cartoons, video clips, moving images and texts, changing the color and scale of the image, its flicker and gradual disappearance, etc.

Modern computers allow a new level of information to conduct the educational process, which could not be done before. So, for example, it is possible to use in one learning tool on a CD-ROM or flash-memory sound, video, graphics, animation, text, etc.

At the same time, such means are interactive, that is, they allow all participants to adjust the training process, receive additional information, choose the mode of work, and move on their individual trajectory, which is most convenient for each student. It should be pointed out, that such capabilities did not have before any training means.

Multimedia technologies have a whole arsenal of didactic capabilities, including:

- diversification of forms for information submission;
- different types of educational tasks;
- creation of educational environments that ensure the “immersion” of a cadet or a student into an imaginary world, in certain social and industrial situations;
- wide application of gaming technologies;
- realization of the possibility for reproduction of a fragment in educational activity (subject-content, subject-operational and reflexive);
- activating the training of cadets, students, strengthening their role as a subject of educational activity; enhancing motivation for learning [6].

Among the main didactic functions, realized through computer technology in the process of studying academic disciplines, scientists determine the following: a) cognitive; b) developing; c) researching; d) communicative.

K. D. Ushynsky stressed: “The teacher ... should take care that as many organs of the senses as possible: an eye, an ear, a voice, a sensation of muscular movements, and even, if possible, a sense of smell and taste took part in the act of memorizing. By such friendly assistance of all organs in the act of learning you will overcome the laziest memory” [20, p. 174].

The advantages of multimedia, in comparison with traditional, are diverse: visual representation of the material, the possibility of effective checking of knowledge, the variety of organizational forms in the work of the students and methodological techniques in the work of the teacher.

A lot of educational materials that students study in higher education institutions with specific learning environment have their own specifics and complexity. Cadets with visual thinking learn difficulty abstract generalizations, without pictures can not understand the process, to study the phenomenon. The development of their abstract thinking carries out with the help of images. Some materials become more accessible without personal contact with the object, which avoids risks. Multimedia animation models help to form an integral picture of a particular process in the minds of a cadet, interactive models give an opportunity to “construct” the process independently, to correct their mistakes, and learn themselves.

It is possible to determine the following tasks of using multimedia in the educational process: stimulating of cognitive aspects in learning, such as perception and awareness of information; motivation increasing of cadets to study; development of skills of joint work and collective experience of cadets; formation of a deeper understanding of the studied material; development of creative abilities of cadets and students, which discover their personal features.

The multimedia provides the following opportunities for effectiveness increasing of the training process for students:

- simultaneous using of several channels of perception in the learning process, which helps to integrate the information through various sensory

organs;

– simulating experiments for demonstrating a series of studies in disciplines, the implementation of which is impossible in educational settings;

– showing complex real processes on the themes that can be dangerous to the health of students;

– visualization abstract information and dynamic processes.

Multimedia helps the teacher to realize new forms and methods of training:

a) to get additional opportunities for the development of the future officer personality; b) to organize creative searching and team-working with cadets; c) to use the intellectual forms of work, teach them to make the right decisions in a limited time.

Multimedia is a useful and fruitful learning means through interactivity, flexibility and integration of different visually, as well as the ability to take into account the individual characteristics of cadets and motivate them.

Seen as a whole the problem of introducing new educational technologies into the training of students, it is necessary to take into account the management of innovative processes in the education system, as well as using of new educational technologies in the educational process.

It should be noted that the training of a future officer is significantly different from the training of a civilian specialist, since it requires: 1) a comprehensive personal training of a cadet as a future officer (citizen, defender of the Fatherland, leader, organizer, educator, public figure, carrier of ethnic values and legal norms); 2) training of a cadet as a professional, requiring a qualitative performance of tasks in conditions of certain complexity at a stable maintenance of efficiency and optimal working parameters in real extreme conditions of service; 3) upbringing of a cadet who can take an active part in the integration of the Ukrainian CES into the economic, political, legal and social system of society; 4) formation of the moral and psychological basis of law enforcement activities; 5) skill to support military discipline, teach and educate subordinates.

Speaking about the training process at the Academy of the State Penitentiary Service, the improvement of the quality of military specialists training is inextricably linked with the introduction of new educational technologies, based on the following components and measures:

– educational electronic literature, manuals and test tasks for the training of cadets and students;

– a single network of electronic libraries, banks and databases;

– computer classes that help to use the Internet and academic databases so that cadets and students can effectively upgrade their skills professionally;

– development of computer models, simulators and simulators.

Other important determinants for the future ages are improving the quality of the training of higher education institutions students with specific learning environment related to the introduction of new educational technologies, including the formation of a unified information learning environment.

In general, using of new educational technologies in the educational

process at the departments of the Academy of the State Penitentiary Service, in the training of cadets and students, allows us to solve a number of such important tasks as:

- increasing of interest in the subject under study;
- increasing the efficiency of the educational process;
- increasing the amount of information from the disciplines of professional training;
- improving the quality of the organization of the educational process;
- using of an individual learning style;
- realization of independent educational activity of cadets, which will help them in self-education;
- widening of individualization and differentiation of open and distance learning by providing a cadet of a personal teacher whose role is performed by a computer;
- development of personal qualities of cadets (ability to study, ability to self-education, self-education, self-improvement, self-development, creative abilities, ability to apply the obtained knowledge in practice, cognitive interest, attitude to work);
- to define the cadet as an active subject of knowledge, to recognize his self-worth;
- to develop communicative and social skills of cadets;
- to take into account the subjective experience of the cadet, his individual features;
- to develop skills of working with modern technologies for students, which helps to adapt them to rapidly changing social conditions for successful realization of their professional tasks [1], [2], [3], [11], [12], [13], [16].

The practical realization of a personally oriented approach by means of multimedia will require the creation and using of modern multifunctional object-oriented multimedia learning that contain large databases, knowledge learning bases, expert training systems, laboratory workshops with the ability to solve mathematical models of phenomena and processes.

Providing of interactivity is one of the most significant benefits of digital multimedia in comparison with other media, where interactivity is the process of providing information in response to user inquiries. Interactivity allows, within specified boundaries, to control the flow of information: cadets can individually modify the settings, study the results, and respond to requests for the program about the specific benefits of the user. They can also set the rate of material feed and the number of requests that satisfy their individual academic needs, which is especially important in open education.

Similar to using of textbooks, using of multimedia teaching means enriches teaching strategies only when the teacher not only delivers information, but also manages, supports and helps the student in the learning process. As a rule, presentations accompanied by beautiful images or animations are visually appealing than static text, and they can maintain an appropriate emotional level

that adds the presentation.

Multimedia media can be used in the context of a wide variety of learning styles and are perceived by people with different psycho-age features of perception and learning: some students prefer to learn through reading, others through hearing perception, and others by watching video.

Using of multimedia learning means allows you to realize new, highly effective self-learning methods, which are important in terms of open education. One of the most common approaches to self-learning, based on widespread using of multimedia means, is integrated case-technologies.

Such technologies use multimedia resources of computer networks and other similar multimedia means for conducting consultations, conferences, correspondence and providing cadets with training and other information from electronic libraries, databases and electronic administration systems of open educational institutions. An important advantage of this technology group is the possibility of more independent behavior expeditious of the cadet, his education in the process of communicating with the teacher and the group, which is an indisputable advantage over the traditional forms of day-to-day learning.

Using of “multimedia” helps the teacher to bring the effect of additional visuality into the class. According to scientists, more than 80% of the information comes to us through eyesight and hearing, which is taken into account by the teachers during the preparation and conducting of training sessions.

In addition, it should be noted that in the process of preparation for classes with using of multimedia the teacher’s professional and pedagogical qualities develop, improve, and increase his professional competence. The wish of the teacher to make the lesson interesting, accessible, and informative is an important component of pedagogy. Teachers open new ways and means of pedagogical work, while it is important to apply, use these information technologies on the professional level.

Thus, we can distinguish the following pedagogical purposes using the means of new information technologies: 1) development of thinking; 2) development of communication abilities; 3) the formation of information culture, the realization of information processing; 4) development of the personality of the student, training for work in the conditions of the information society [1], [2], [4], [7], [10], [16].

Using of visualization during lecturing of learning material is determined by the specifics of the disciplines studied by the students. In the Academy of the State Penitentiary Service, the lecture halls are equipped with multimedia projectors, there are computer classes.

Educational discipline “Penitentiary pedagogy” was studied by groups of bachelors and groups of junior specialists in the 2016–2017 academic year.

Experimental bachelors’ groups (the 131st group – 22 participants) and junior specialists (the 128st group – 28 participants) were selected. Control groups of bachelors (the 133st group – 24 participants.) and junior specialists (the 127st group – 29 participants) were selected. In experimental groups,

visualization elements were introduced through multimedia when considering the topic "The concept of subject, tasks and basic categories of penitentiary pedagogy", "Methods of studying and influencing the personality of the convict", "Basic directions and forms of individual social and educational work with convicts before imprisonment", "General and vocational training of convicts before imprisonment", "Organization of free time of convicts before imprisonment". The control groups studied the topic data in the traditional mode.

The experiment showed that for the learning the method of diagnosing the personality of the convicted person by the cadets, the process in the first stage is desirable to conduct without of the convict that will not skew cadets of junior courses.

Experiment data processing determined that using of multimedia significantly increased the effectiveness of awareness of the material and the strength of learning. On separate subjects related to the history of the penitentiary system, social and educational work among convicts, individual work with prisoners of imprisonment, examples of cultural events, the difference in knowledge acquisition in experimental and control groups was 22-31%.

During the final examination in the 141st experimental group (the 131st in the previous year), the quality ("excellent" and "good") was 95%, and in the control group 143 (133 in the previous year), the quality was 75%. The same tendency stayed by junior specialists. During the assessment of students, the quality in the experimental group 128 was 85.7%, in the control 127st group – 72.4%.

Thus, using of visualization elements through multimedia during the study of individual topics influenced the effectiveness of studying the entire training course "Penitentiary Pedagogy". Thus, the increase in the quality of knowledge acquisition was 20% for bachelors, and 13.3% for junior specialists.

But it's important to keep in mind that equipping audiences with multimedia projectors and computers does not yet guarantee computer skills for students.

Effective mastering of information technologies, a combination of pedagogical skills allow the teacher to improve the quality of the educational process, and hence the quality of knowledge of students. To train cadets and students of institutions of higher education with specific environment to work in modern working conditions it means quickly analyzing a large flow of information for the adoption of the next most correct solution.

However, it should be noted that the visual form of presentation of educational information has a number of disadvantages:

a) the first disadvantage – any schematics causes a certain simplicity of understanding something that can create an illusion to cadets that for studying the subject it is enough to have depicted material (option windows of Windows);

b) the second disadvantage – the absolutization of training manuals, built on the principle of logical-structural modeling, can negatively affect the formation of thinking and especially language. For cadets it is sometimes difficult to speak on a certain topic, there is not enough stock of words on this topic.

c) the third disadvantage – not every material can be submitted in the form

of schemes, because its individual parts are very difficult to be structured.

Modern conditions of work in the system of prison education require new approaches to the organization of vocational training in Ukraine. The purpose of multimedia using in the provision of training information for students of higher education institutions with specific learning environment is to master the methods that enable the development of the necessary professional qualities that ensure the effectiveness of their work, learn techniques of psychological contact that allows to work competent with people.

We believe that nowadays information technologies inevitably bring in the process of learning global changes that can not be underestimated or feared, you need to use them correctly and competently in order to increase the effectiveness of learning.

Conclusions and direction of further researching. Using of similar multimedia means in the education system changes the mechanism of perception and comprehension of information received by the cadet. When working with systems of “virtual reality” in education there is a qualitative change in perception of information. In this case, perception is carried out not only through sight and hearing, but also with the help of a touch and even a sense of smell.

Our studies have shown that using of visualization elements through multimedia during the study of individual topics has affected the effectiveness of learning of the entire discipline. And the increase was 20% for bachelors, and 13.3% for junior specialists. At the same time, awareness of the learning material acquisition increases.

Thus, multimedia in the training process of cadets creates prerequisites for the realization of the didactic principle of visuality in training at the principally new level. The multimedia means help the teacher to realize new forms and methods of teaching; to get additional opportunities for support and directions for development of the cadet or student personalities; to organize creative searching and team-work with cadets or students; to use intellectual forms of working.

Multimedia is a useful and fruitful learning means thanks to the interactivity, flexibility and integration of different visuality, as well as the ability to take into account the individual characteristics of cadets and encourage their motivation. In future, we plan to carry put researching on using of multimedia in all types of educational and researching work of the students.

References:

1. *Avagyan, E. S.* (2013). Osnovnyie problemyi i nedostatki ispolzovaniya multimedia v obrazovanii [The main problems and disadvantages of using multimedia in education]: Proceedings of the 13th All-Russian Scientific and Practical Conference “Information technologies in education” Retrieved from <http://ito.evnts.pw/materials/126/16036/> [in Russian] (date of referencing 08.06.2017).
2. *Belkin, E. L., Karpov, V. V. & Kharanash, P. I.* (2007). Tehnicheskie sredstva obucheniya [Technical means of teaching], Yaroslavl: [in Russian].
3. *Belokonna, N. I.* (2003). Do problemy vykorystannya informacijnyx texnologij u navchalnomu procesi [On the problem of using information technologies in the educational process] 2 rd Slavic pedagogical readings: Proceedings of the International Conference (p. 49-53). Tiraspol: [in Ukrainian].

4. *Gnatyuk, D. T.* (2003). Informacijni tehnologiyi – pereputka do majbutnogo: Informacijni tehnologiyi v shkoli [Information Technologies – Pass to Future: Information Technologies at School]. *Dyrektor shkoly*, 47, p. 15-16. [in Ukrainian].
5. Graficheskoe predstavlenie informatsii (2011). [Graphical representation of information] Retrieved from http://www.uspi.ru/study/inteach/kurs_intel/inet/predsta_vl_inf.doc [in Russian] (date of referencing 03.02.2018).
6. *Kozlov, O. A.* (2017). Informatsionnyie tehnologii v obuchenii kursantov voysk natsionalnoy gvardii Rossiyskoy Federatsii [Information technologies in the training of cadets of the troops of the National Guard of the Russian Federation]. *Izvestiya Saratovskogo universiteta. Novaya seriya. Seriya Filosofiya. Psihologiya. Pedagogika, Izv. Sarat un-that New run. Run Philosophy. Psychology Pedagogy*, V. 17, 1. p. 111-116. [in Russian].
7. *Kremen V. G.* (Ed.). (2011). Nacionalna dopovid pro stan i perspektyvy rozvytku osvity v Ukraini [National report on the state and prospects of development of education in Ukraine]. Kiev: Ped. dumka [in Ukrainian].
8. *Jock D. Mackinlay* (1999). Readings in information visualization: using vision to think. With Stuart K. Card and Ben Shneiderman (eds.), Morgan Kaufmann Publishers Inc, p. 686. [in English].
9. *Madzigon, V. M.* (2006). Problematyka ta perspektyva informatyzaciyi osvity [The Problem and Perspectives of Informatization in Education]. Kiev: [in Ukrainian].
10. *Mashbits, Yu. I.* (Ed.). (2010). Osnovy novyx informacijnyx tehnologij navchannya [Fundamentals of New Information Technologies for Learning]. Kiev: IZMN [in Ukrainian].
11. *Matiyuk, I. O.* (2000). Innovacijni modeli navchal'nogo procesu v suchasnij shkoli (na materialax riznyx typiv navchal'no-osvitnix zakladiv Ukrainy) [Innovative models of educational process in modern school (on materials of various types of educational institutions of Ukraine)] Extended abstract of candidate's thesis. Kiev: KNU [in Ukrainian].
12. *Mironov, V. B.* (1989). Industriya programmnyh sredstv [Software Industry]. Moscow: Znanie [in Russian].
13. *Mischenko, O. A.* (2006). Sutnist multymedijnyx tehnologij navchannya [The essence of multimedia learning technologies], *Pedagogika, psixologiya ta med.-biol. probl. fiz. vixovannya i sportu*, 3, p. 69-71[in Ukrainian].
14. *Molyaninova, O. G.* (2009). Multimedia v obrazovanii (teoreticheskie osnovy i metodika ispolzovaniya) [Multimedia in Education (Theoretical Foundations and Methods of Use)]. Krasnoyarsk: KrasGU [in Russian].
15. *Poznyak, S. F. & Rodionov, A. A.* (2016). Kompyuternyie igry i ee perspektivy v obrazovatelnom protsesse [Computer games and its perspectives in the educational process] : Povyishenie kachestva podgotovki voennyh spetsialistov v uchrezhdeniyah obrazovaniya [Improving the quality of training of military specialists in educational institutions]. (pp. 23-25). Minsk : BSUIR. [in Russian].
16. *Rach, V. A., Verein, L. V. & Mogilny, G. A.* (2000). Vizualizaciya informaciyi: psixologichni ta organizacijni aspekty [Visualization of information: psychological and organizational aspects]. Lugansk : Sxidoukrayinskyj nac. un-t. [in Ukrainian].
17. The Law of Ukraine on education № 2145-VIII. (2017, September 05). *Vidomosti Verkhovnoyi Rady Ukrainy*, 38-39, 380 [in Ukrainian].
18. The Law of Ukraine on higher education № 1556-VII. (2014, Juli 01). Retrieved from <http://zakon2.rada.gov.ua/laws/show/1556-18> [in Ukrainian] (date of referencing 05.03.2018).
19. *Trukhan, I. A. & Trukhan, D. A.* (2013). Vizualizatsiya uchebnoy informatsii v obuchenii matematike, ee znachenie i rol [Visualization of educational information in teaching of mathematics, its significance and role]. *Uspehi sovremennogo estestvoznaniya*, 10, p. 113-115. [in Ukrainian].
20. *Ushinsky, K. D.* (1952). 36 tvoriv u 6-ty` tomax [36 works in 6 volumes] V. 4. Kiev : Radyanska shkola. [in Ukrainian].
21. *Utin, L. L. & Dyuzhov, D. G.* (2016). Primenenie kompyuternyih tehnologiy v obuchenii voennyh spetsialistov [Application of computer technologies in the training of military specialists] : Povyishenie kachestva podgotovki voennyh spetsialistov v uchrezhdeniyah obrazovaniya [Improving the quality of training of military specialists in educational institutions]. (pp. 87-88). Minsk : BSUIR. [in Russian].
22. *Volkova, N. P.* (2001). Pedagogika [Pedagogy]. Kiev : Vydavnychyj centr Akademiya. [in Ukrainian].