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ON VISUALIZATION IN EDUCATION

The paper reviews new trends in contemporary information technologies, particularly those connected with visualization, and discusses their fundamental features, distinguishing characteristics, and their growing impact on communication, culture, professional activities and the human mind. Nearly revolutionary changes have taken place in recent decades in the field of the transmission of visual information: the volume and the quantity of transmitted information has increased enormously, and new kinds of visual information have developed, as well as new methods of its transmission. A comparative analysis of different methods of presenting information leads to the conclusion that visual methods are more effective, because they represent information in a more structured and systematic way. Special attention is paid to the discrepancy between the level of development of advanced technology and the quality of educational programs, which are in profound need of reform. The article discusses the possibilities for using innovative visual technologies which elevates human cognitive activities.

Key words: visualization, de-verbalization of information, mediated reality, multitasking, communication, innovations.

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Білім берудегі визуализация туралы

Мақала ақпараттық технологиялар дамуындағы жаңа тенденцияларға, әсіресе ақпараттың визуалдануына, олардың негізгі қасиеттеріне және айырмашылық сипаттамаларына байланысты, сонымен қатар олардың коммуникацияға, мәдениетке, білім беру және ойлау қызметіне кең көлемде ықпал етуіне арналған. Соңғы онжылдықтарда ақпаратты визуалды беру саласында революциялық дерлік өзгерістер пайда болды: берілетін ақпараттың көлемі мен саны аса зор өсті, визуалды ақпараттың жаңа түрлері, сонымен қатар оны жіберу әдестері пайда болды. Ақпараттарды берудің әр түрлі әдістеріне салыстырмалы талдау жасау визуалды әдістердің тиімдірек екендігі туралы қорытынды жасауға мүмкіндік береді, себебі ақпараттар көбірек құрылымдық реттелген және жүйелі түрде беріледі. Жоғары технологиялардың даму деңгейі мен білім беру бағдарламаларының сәйкессіздігі байқалады, ол бағдарламалар түбегейлі жаңалауды қажет етуде. Мақалада оқушылардың когнитивтік мүмкіндіктерін дамытатын «визуалды-бағытталған» әдістемелерді меңгерудің болашағы талқыланады.

Түйін сөздер: визуалдану, ақпараттың девербалдануы, білім беру бағдарламалары, қатар қолданылған нақтылық, «көпміндеттілік», коммуникация, инновациялар.

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О визуализации в образовании

Статья посвящена новым тенденциям в развитии информационных технологий, особенно связанных с визуализацией информации, их основным свойством и отличительным характеристикам, а также их растущему влиянию на коммуникацию, культуру, профессиональную и мыслительную деятельность. В последние десятилетия в области передачи визуальной информации произошли почти революционные изменения: колоссально возросли объем и количество передаваемой информации, сложились новые виды визуальной информации, а также способы ее передачи. Сравнительный анализ разных способов представления информации позволяет сделать вывод о том, что визуальные способы являются более эффективными, так как представляют информацию

в более структурированном и систематизированном виде. Отмечается несоответствие уровня развития высоких технологий и качества образовательных программ, которые нуждаются в принципиальном обновлении. В статье обсуждаются перспективы освоения «визуально-ориентированных» методик, развивающих когнитивные способности учащихся.

Ключевые слова: визуализация, девербализация информации, образовательные программы, совмещенная реальность, «многозадачность», коммуникация, инновации.

The 21st century is an age of technology and electronics, an age inundated with information. In this age, humans have placed enormous faith in computers, not only as a piece of metal capable of saving and spitting out information, but as a trusty assistant in the resolution of a variety of intellectual tasks (education, modeling situations, managing different processes, systems of virtual reality, and so on). It is logical to presume that a person endowed with hearing, sight and voice will not be satisfied with a silent, blind assistant and will demand a computer (in which we place such high hopes) to «understand» and synthesize speech, symbolic text, graphics, etc. Within the framework of artificial intelligence, multimedia technologies are emerging that allow the user to work with several different types of information presentations (text, audio, graphics) in real time. Visuals and sound have a very powerful impact on a person and their psyche, consciousness, and memory. It is no accident that there are a multitude of teaching methods using diagrams, graphs, and tables, and probably every person has moments when hearing a certain sound or piece of music triggers memories of related facts, events, and images.

The most prominent development in today's informational space is visualization. One of the main channels of communication in contemporary society is a visual one, and other types of communication, though continuing to play an important role in the interaction process, have faded in prominence. Visual reality is presented as an information construct, to be «read» and interpreted by the same procedures applied to verbal text. This reality is no longer perceived as a secondary or subordinate measurement. A comparative analysis of different methods of presenting information leads to the conclusion that visual methods are more effective, because they represent information in a more structured and systematic way.

Visualization is the process of presenting information in the form of an image in order to make it maximally convenient for understanding. Visualization contributes to systematization and consolidation of information; drawing out key points; rapid and effective mastery of new concepts and courses of action; the development of skills in the collection

and processing of information; and the application of theoretical information in practical work. The ability to convert oral and written information into a visual form is a professional skill of many specialists today.

Revolutionary innovations in cyber-methods of information transfer are leading to the emergence of fundamentally new trends in society. This is happening thanks not only to the development of new technologies, but also to their widespread use. The revolutionary development of digital methods of transmitting visual information, which are actively built into every possible device and gadget, has affected social interaction, and especially the principles and methods of perception of this new, integrated type of information. And so, photos and live videos are increasingly replacing text messages; electronic documents are replacing photocopies; electronic delivery of the readouts from various devices is replacing text notifications and much more (cf. photo and video recording of traffic violations).

It can be said that in modern communication there is not only a constant «hybridization» of genres of communication, but also a semiotic hybridization of visual and verbal, and the visual share of that is constantly growing. A verbal, ordinary text (especially a document) captured by a digital camera turns into an electronic object that is sent as a normal picture and at the same time turns into a visual message: an illustration, a picture or an image. The ability to instantly send and share «what is happening here and now» to anywhere else – without needing to select the exact words and expressions to describe what is happening – is fundamentally transforming information flows, and, correspondingly, thought processes, interpersonal interaction, and conditions for decision-making.

At the same time, visual perception is changing. A distinct «verbal-visual» and «visual» thinking is being formed, and there is a need for intensive intersemiotic recoding of information. In applied terms, this includes, for example, the creation of fundamentally new visually-oriented textbooks, teaching aids, simulators and others, not to mention the need for the formation of skills for making efficient on-line decisions, etc.

In addition, directly related to the visualization of communication is its growing semiotization, which is caused by the extensive use of digital means of obtaining, presenting and disseminating information of all kinds. Modern software tools for navigating the Internet and presenting information in it increasingly use a wide variety of signs, symbols, icons, labels, graphic objects, and other semiotic methods of compressing and symbolizing information. This inevitably leads to its visual, international, and semiotic nature [1].

In general, it can be said that electronic discourse is becoming less verbal, but more comprehensive in a semantic sense, due to evolving ways of visualizing information. As a result, the visualization and de-verbalization of modern communication, and even culture as a whole, that is taking place before our eyes brings with it a whole range of innovations. This applies not only to technical devices for receiving, processing and transmitting information, but also to our consciousness, thinking, behavior, education and professional activities in which the visual component is gaining greater prevalence and significance.

There has been a powerful breakthrough in the visualization of information thanks to the creation of a whole range of innovative technologies, such as touch-screen, multi-touch, and the development of a variety of professional and public mobile applications for iPhones, iPads, etc. [2]. Their remarkable convenience, comfort and accessibility make them high in demand in an increasing number of diverse spheres.

The fundamental transformation of information flow that took place at the start of the 21st century, and the beginning of the predominance of visual, non-verbal information that came with it, was primarily related to the global spread of video recording equipment – web cameras, and their installation on most state, industrial, and military institutions, among others. Their key purpose is digital processing of live visual information and, in turn, its growing intellectualization and the video informatization of professional activities.

New computer technologies are contributing to the emergence, formation and development of fundamentally new intellectual abilities, needs and skills (as well as the intellectualization of an increasing number of activities, if only because they are actively introducing a variety of digital devices for receiving, processing and transmitting information). In this regard, it is reasonable to assume that modern human thought is characterized

by a whole set of characteristics that have arisen as a result of the development of cybernetic technologies.

Some consider that the very list of digital technologies associated with the creation, transmission, reproduction and use of graphic and visual images indicates that we are witnessing the emergence of a new cognitive-visual/visual way of thinking.

So, in addition to the ability of the younger generation to multitask (cf. «Multitasking is the principle on which our brains are built» [3]), the cognitive phenomenon of «serendipity» stands out: «Digital culture is a browsing culture; For better or worse, serendipity is a fundamental feature» [4, 37].

Psychologists say that new information is better acquired and remembered when knowledge and skills are «imprinted» in our visual-spatial memory. Consequently, the presentation of educational material in a well-structured format allows us to absorb new concepts and courses of action better and more quickly [5].

Using a range of visualization technologies enables students to not simply «receive» the educational material prepared by the teacher, but actively participate in its creation, which makes the process more informative and enlightening. There are a variety of visual technologies for optimizing the learning process, which help analyze information and break it down into its components.

A *mind map* is a tool for displaying information in the form of diagrams of thoughts, plans, or actions. It allows the student to not only solidify already-available information, but also to develop their thoughts and visualize their thinking. For example, they can be used to pinpoint, understand, and remember the contents of a book or text, to generate and record ideas, to understand a new topic, or to prepare for a decision. The technique was designed by psychologist Tony Buzan. The skill of using mind maps allows for information to be more efficiently stored and processed.

Mind maps offer an alternative to text as a method of recording information, and they activate the memory. Lists, solid text, and charts are monotonous. Mind maps, in contrast, use all sorts of methods to activate perception through diversity: using lines of different thickness, branches of different colors, precisely selected keywords of personal significance, or the use of images and symbols. Mind maps not only help us organize and compartmentalize information, but also help us better perceive, understand, and remember that information. Addition-

ally, mind maps are not just a means of visualizing the thinking process, but also its diagnostics.

The *fishbone* is a tool that provides a systematic approach to determining the causes of problems. Also widely known as Ishikawa diagrams, they are the creation of Kaoru Ishikawa, a Japanese professor who invented this method of structural analysis of cause and effect relationships. The fishbone scheme is a graphic representation that visually demonstrates the causes of specific events, phenomena, or problems and the corresponding conclusions or results of the discussion. It is generally accepted that the Ishikawa diagram stimulates creative thinking; presents the relationship among the causes and compares their relative importance; and streamlines the work of the creative (educational) group.

Scribing is the creation of small, understandable drawings that make the meaning of a lecture or presentation more understandable. The success and effectiveness of scribing is explained by the fact that the human brain, inclined to draw pictures, thinks in images, and the language of drawing is a universal language.

A *reference scheme* is an approach of concentrating attention on a text or problem, and also a regulator of immersion in the material. This is an active tool for working with a text, as it helps students to unpack the content of the work. Schemes made while studying a particular work help students digest the material and prepare to write an essay.

A *word cloud* is a visual representation of a list of categories (or tags, also called labels or keywords). This tool can be used as a platform for discussion, or for practicing lexical and grammatical material. It can be used for many grammatical themes – regular and irregular verbs, gerunds and infinitives, verbs and prepositions, and verb tenses, to name a few. For example: Students must highlight or emphasize verbs that only take gerunds.

A *cluster diagram* is a graphic network of information which organizes and separates units of meaning. These units are fixed in a scheme which denotes all the links between each item. This visual tool facilitates the systematization and consolidation of educational material.

As can be seen from the above examples, there are a variety of methods by which to achieve the compression and decoding of educational information using the technology of visualization. These

techniques can be used at different stages of the lesson. It is important to remember that these techniques are not an end in themselves, but a means of achieving results. They contribute toward both the ability to work with a large amount of information and the ability to generate new visual images and their verbalization.

There are numerous possible spheres of application for the practice of visualization: medicine (e.g., computer tomography); physics (e.g., modeling fundamentally unobservable phenomena such as the expansion of the universe); the oil industry (e.g., automated electronic maps of construction), etc. However, visualization fits best in the sphere of education and advanced training using computer technology. Educational computer programs for teachers are a reliable assistant and aid, designed to facilitate and enrich the learning process. Just as the importance of books, educational films, and visual aids in the learning process cannot be overestimated, it is also impossible to overestimate the importance of visual methods using computer technology. They go beyond textbooks to engage the learner in an interesting and informative game, and this is what enables the learner to best understand and memorize the material.

Technical progress and the formation of a new visual culture is inevitably leaving its mark on the demands of teachers. There is a discrepancy between the level of development of advanced technology and the quality of educational programs, which need fundamental reforms, especially through the use of modern technology, in both general and professional education.

There are an increasing number of didactic methods involving a combination of informational influences on different human senses and on the ways of presenting educational information. However, the leading mode of perception of information when working with various teaching methods is visual, which is suggested by the development of both traditional and innovative visual methods and techniques that make it possible to activate the work of vision in the learning process. The need for innovation is becoming more and more obvious, and must be recognized early on. There is a need for new didactic principles based around information technologies, as well as new didactics based on the formation of semantics to create an «image of the world» of the student.

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