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TUKHTAMURODOV A.A. ERGONOMIC PRINCIPLES OF TEACHING PEDAGOGICAL SCIENCES WITH THE HELP OF COMPUTER PROGRAMS FOR FUTURE IT TEACHERS

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Abstract
The use of ergonomic studies and the training of future teachers of computer science, the factors for the effective use of computer programs in the study of pedagogy with the aim of convenient presentation of information using information technologies are highlighted. The issues of ensuring the work of a computer and its users with high motivation and minimal fatigue, the creation of optimal working conditions in terms of ergonomic design of human-computer interaction are considered.

Keywords: information technology, ergonomics, computer programs, ergonomic design, optimal working conditions, ergonomic educational environment.

Introduction

In the early stages of the development of computer technology, articles on ergonomic research, that is, human-computer interaction, began to appear in foreign countries in 1959. As a result of the boom in information technologies, the first step in the development of ergonomics of human-computer interaction occurred in the 80s of the last century. By this time, the number of conferences, symposia, meetings of working groups, various publications dedicated to research in this direction has increased dramatically (in particular: Behavior and information technologies, artificial intelligence, computer science, information technologies, etc.). Much attention has been paid to finding ways to present complex information in a way that is convenient for the non-IT user. Most ergonomic research has focused on information use and evaluation processes in the management of military and industrial facilities. Applied research has focused on establishing optimal relationships between humans and machines to ensure that humans work with high motivation and minimal fatigue. A new phase in the development of human-computer interaction ergonomics began in the 1990s. B. New directions such as the psychology of programming and ergodesign, associated with the name of Schneiderman, appeared.

Relevance of the topic

Improvement of the ergonomic competence of students of the pedagogic field regarding digital technologies has been insufficiently studied, the need for an interface for the operator's activities in the educational environment, the need to form a mental model, the development of the culture of using a simple direct manipulation interface has been determined by the insufficient study.

The purpose of the study. It consists in developing proposals and recommendations for the formation of knowledge, skills and competencies on the ergonomic basics of using computer programs and organizing practical use for the purpose of teaching pedagogy with the help of computer programs to future informatics teachers.

A brief analysis of scientific research on the topic. Foreign researchers K. Bikshe, Ya. Gedrovitss, R. Smith, L. Sidorchuk analyzed the ergonomic competence of the teacher and showed the feasibility of improving professional activity based on the responsibility of pedagogical activities and the ergonomic environment of the educational process in modern educational conditions of schools.

Russian Scientists:

A.A. Belova, E.V. Voroninoy, R.S. Gershunskoy, A.A. Kriulinoi, L.P. Okulova, N.A. Pugal, E.S. Rapatsevich, E.V. Ryabovoy , R.S.Safina, S.F.Sergeeva, etc., studied the problems of ergonomics in education in detail.

We can find ideas about the formation of ergonomic competence of young people in Uzbekistan in the spiritual and cultural heritage of our nation, "Avesta", as well as in the works of Abu Nasir Farabi, Abu Rayhan Beruni, and Abu Ali Ibn Sina. Researchers S.Kh.Abdullaev and N.A.Abdullaeva also proved that the human, his attitude to the environment, spiritual, moral, ergonomic qualities are of decisive importance in the development of society. However, in their scientific studies, the current aspects of the problem of ergonomic competence of future informatics teachers have not been investigated.

The scientific essence of the article is that our scientists have not sufficiently studied the impact of the ergonomic approach to the educational process and the improvement of the ergonomic competence of the Pedagogical students regarding digital technologies on the educational process.

The object of the study was the process of preparing future informatics teachers for professional pedagogical activity in higher education institutions.

Methods used in the Research:

Systematic, comparative-logical analysis, empirical observation and the results of questionnaires were used.

The Main Part

Computer technologies are important in shaping the future. There are concerns that the use of computers will cause people to lose skills and abilities on their own. B. According to Schneiderman, the reason for the loss of skills is the wrong design theories combined with the wrong general approaches. Efforts should be made to ensure that users of computer systems experience a sense of competence, accuracy, predictability, control, and comfort in working with them.

Research on fatigue and comfort at work, design of equipment and environments, software based on the study of human behavior (strategies of user participation in the creation of systems), analysis of human judgments and perceptions, development of methods for the correct evaluation of information by a person, working with a computer system User support, development of international labor safety standards using computer technologies are given great attention in foreign publications.

According to V. D. Magazannik, in recent years in developed countries, attention has been paid to the following main areas of ergonomic research: methods of formation, specific examples and software interfaces; ergonomics of local and global computer networks (language inconsistencies, intercultural differences); structure and design of interfaces (Web design, universalization of requests to various databases, etc.); organization of workplaces (geometry of the workplace, parameters of chairs, footrests, keyboard, mouse, trackballs, shape of joysticks, characteristics of video terminals, various optical filters, etc.).

In our country, interest in the problem of human-computer interaction has been noted since the 80s. Issues of human-computer interaction design are studied. In particular, the issues of ergonomic provision of software design, the activities of operators behind the alphabetic display, the design of human-computer dialogue, the problems of experimental ergonomic evaluation of dialogue support software tools, and some features of information displayed on a color display are analyzed. The ergonomic principles of organizing the graphic representation of data, the issues of psychological rationalization of information interaction between the operator and the computer are considered.

S.Yu. Reshetina conducted research on experimental ergonomic evaluation of communication support software. The research paper describes three main groups of ergonomic characteristics of communication systems: characteristics describing the reception of information from the system; features related to inputting information into the system and features other than the problem solving process (the ability to increase or decrease the number of communication steps at will, use non-fatiguing methods of selecting information on the screen, etc.). An analysis of software solution options for each group of features was carried out, and ergonomic principles of intelligent communication, as well as some ergonomic requirements and recommendations for the construction of interaction procedures, were developed. In the studies of V. E. Evstigneeva and G. Ya. Smolyana, ergonomic recommendations for determining the screen area occupied by specific graphic information, construction of graphics and diagrams related to the colors used, information on the organization of communication for the construction of such

images are presented. Yu.P. Chuchina's research describes the method of experimental assessment of perception of various types of information displayed on a color display (letters of the alphabet, conventional graphic symbols, line segments in sixteen directions, groups of words with semantic content). The main factors affecting the discrimination of information are identified, the possible color combinations of symbols and backgrounds are evaluated, and recommendations for their practical use are given**.** T.V. Tsyguro considers the following parameters of the main areas of improvement of data models on the display screen: expansion of the standardized alphanumeric alphabet, implementation of the improved configuration of the used characters, improvement of lighting characteristics, expansion of information systematization tools, provision of ergonomically correct color coding and speed of data change. . Also, T.V. Tsygurlo focused on the biomedical aspects of ensuring the operation of the operators behind the display. GM In their research, Zarakovskii et al. present experimental data on the effectiveness of operators in reading messages in text and tabular forms, which concluded that the widespread use of reduced language symbols in the mode of communication between the operator and the computer is allowed.

The growth of research in the field of human-computer interaction can be judged by the increase in the number of publications in the proceedings of various conferences.

Visual programming of the environment - systems using visual images (two-dimensional, three-dimensional, etc.), design of programs and software systems, their assembly and correction, development of query language in databases, organization of interfaces, etc. Various types of image classifications used in visual programming environments are given. It is noted that in creating such environments, it is necessary to strive to use more natural images.

According to V. M. Krol, the visual user interface should be based on deep knowledge of psychophysical, psychophysiological and neurophysiological patterns of information reception and processing. He emphasizes the need to expand the methods of presenting information, to move from a mostly textual image of information on the display screen to a figurative image. Representation of scientific knowledge in figurative form is used as material for creating expert and others, uses textual and tabular display forms, which greatly complicates the user's work with such programs. Thinking that any abstraction can be expressed in the image, V.P. Zinchenko and A.I. Nazarov concludes that it is necessary to overcome the traditional postulate that the image is connected only with emotional knowledge. V.P. In the research of Zinchenko and G.Y. Uzilevsky, some problems of user interface research were considered from the perspective of ergosemiotics. Based on the pragmatic and semantic aspects of semiotics, the requirements for user interface creation and evaluation are highlighted. In addition to the above two types of requirements, the used interaction languages are filled with requirements from a syntactic point of view. A classification of human-computer interaction languages is given. According to the four principles of direct manipulation interface proposed by B. Schneiderman, the implementation possibilities of the fourth principle of direct manipulation interface, which

is the most difficult to implement, are analyzed. E. B. Morgunov believes that existing difficulties can be solved with the help of the activity theory developed within the framework of local psychology.

The principles of direct manipulation interface were used by I.V. Burmistrov to create a new form of human-computer communication - a flexible script interface based on the ideas of the script approach to describe the structure of the task. The proposed interface envisages the use of a representation of the scenario in the form of an interactive graphic that supports the process of solving the problem by the user. An intelligent component of the interface - the system guide - uses dynamic changes of the scenario graph to guide the user to the world of the problem being solved. V.A. Berezhnoy and his co-authors describe user interface management systems (UIMS - User Interface Management Systems). UIMS is a software element that manages all communication between the user and the application. It takes experience and expertise to develop a single, consistent strategy for UIMS design.

In 1993, dedicated to the results of the international scientific conference, "Ergonomist Library. The collection "Concept of creating highly ergonomic human-machine complexes" was published, a number of topics of the collection are devoted to the organization of interaction between operators and computers, the project of user interface. In particular, V. M. Lvov and co-authors explained the conditions for the formation of such qualities as ergofunctionality and ergocomfort of complex man-machine complexes. Computer ergonomics, including the development of effective and user-friendly interfaces, and the creation of practical programs, tools for solving a complex of problems related to the visualization of information on the display screen, as well as various aspects of user interface design are reflected in the collection on artificial intelligence.

Results and practical examples. In general, foreign countries, including our country, are paying great attention to the issue of safety of the interaction of human and computer technologies. The problem of working safely with a computer is so serious that it was reflected in the work of the World Health Organization at the United Nations. In addition, a number of countries are developing and publishing legislation regulating the use of displays. Sweden can be recognized as a recognized world leader in this field. This country was the first to develop computer security standards in the public interest. For example: Sweden standards: MPR-ll, TSO-92, 95,99, 2002.

In addition to the above, widely used: international standard ISO 9241 (based on national regulations of the European Union), Blue Angel (German analogue of TCO-95), FCC Class B (USA).

Strict standards for radiation from computer monitors and equipment, the Swedish TsO standards for office use are the most important for manufacturers around the world. These standards are updated approximately every three years. The TsO-92 standard was developed only for monitors.

To obtain the TsO-92 certificate, the monitor must meet Low radiation standards, that is, have a low level of electromagnetic field, ensure automatic reduction of power

consumption when not in use for a long time, and meet European fire and electrical safety standards. TsO-95 standard is an extension of TsO-92.

All changes in the standards are related to environmental protection, radiation and safety standards remain the same. In addition, the TsO-95 standard applies to a complete computer set, including a monitor, a system unit and a keyboard. TsO-99 imposes stricter requirements than TsO-95 in the following areas: ergonomics (physical, visual and ease of use), energy, radiation (electric and magnetic fields), environment and ecology, as well as fire and electrical safety. Currently, TsO-99 is one of the strictest standards in the world.

The Ministry of Public Education of the Republic of Uzbekistan, the Ministry of Higher and Secondary Special Education, the Ministry of Culture and Sports Affairs of the Republic of Uzbekistan in the instruction on the effective use and storage of furniture, educational and laboratory equipment, computer equipment, sports equipment and other inventories in educational institutions (Tashkent-2010) "Rules of safety techniques in the educational computer classroom" are as follows:

The educational computer class is an educational department of the school equipped with computing equipment. The equipment of the educational computer class consists of up to 10-15 personal computers (student's workplace) and one personal computer intended for the teacher (teacher's workplace). The room is used for theoretical and practical classes, extracurricular and optional activities. All students and teachers, club members and other users must familiarize themselves with the rules of safety equipment before working on a personal computer, and this information must be recorded in the safety equipment log.

The following are prohibited in the educational computer classroom:

• entering the room in outerwear;
• connecting the computer and its devices to the electrical network without permission or turning them off without permission;
• walking and talking in the room without the teacher's permission;
• to turn the light, volume and other functions of the computer and open the protective covers;
• touching the computer screen with hands and other objects, touching the connection points of devices and power sources.
• using heating devices and lighting fire near the computer;
• open and use containers with flammable substances near devices;
• bringing into the room acidic, chlorine-containing substances and substances that have a negative effect on the work of the internal elements of the device in general;
• putting various items and clothes on the computer and other devices;
• touching devices with wet hands and connecting them;
• inserting a pen, ruler and other objects into the holes of the devices;
• using force when pressing the keys;
• leaving the working device unattended;
• cleaning while the computers are working.

Sanitary and hygiene requirements in the educational computer class:

1. The natural and artificial lighting of the educational computer class should be in accordance with sanitary and hygienic requirements.
2. The main stream of natural light should fall on the computer monitor from the left. The windows of the room should be on the north or northeast side of the room. The main stream of natural light cannot be directed from the back and front of the computer worker. In two-way lighting of rooms with a width of more than 6 meters, there must be a light source whose height does not exceed 2.2-2.9 meters.
3. In the artificial lighting of the blackboard of the educational computer class, a general lighting system based on fluorescent lamps placed on both sides at the same distance and on the same plane, fixed or suspended from the ceiling should be used. Lights and windows cannot be reflected on the computer screen.
4. In artificial lighting, the level of illumination of the student's desk should be in the range of 300-500 lk. Luminaires should have a coating that diffuses light.
5. As light sources, it is recommended to use 40 W - 58 W fluorescent lamps or 36 W LB, LXB with low energy consumption that meet sanitary requirements (SanPiN – 0101-0001 6.12.2000) in terms of efficiency and spectral composition.
6. It is recommended to use lamps of the LP036 series in computer study rooms.
7. Computer classrooms are recommended to have air-driven ventilation that can ensure optimal temperature and humidity in any weather conditions due to air pollution with organic anthropogenic substances and carbon dioxide.
8. If there is no air drive ventilation, household air conditioners can be used to clean the air. The number of air conditioners is determined by the engineer based on its efficiency, the amount of heat separation of computers, people, solar radiation, heat and artificial lighting sources.
9. The power supply of the educational computer class must be based on the requirements of the State electrotechnical safety.
10. The power supply to student and teacher's desks should not be activated or visible.
11. The location of the power source connection and protective shutdown device should allow the teacher to immediately turn off the power supply. It is recommended to install it on the left or right side of the classroom board.
12. In order to ensure fire safety in the educational computer classroom, there should be 1 fire extinguisher (ignition extinguisher) with the expiration date indicated and filled (such as OU-5).
13. Light (r=0.5-0.6) colored paints should be used when painting walls. The composition of the paint should be selected so that lime powder does not form.
14. The level of the blackboard, desks and shelves in the educational computer classroom should be non-reflective.
15. The floor surface should be flat, non-slip, easy to clean and wet, and have antistatic properties.

16. The amount of harmful chemicals in the air in the room should not exceed the daily concentration of the air atmosphere.

Summary. It was found that the effect of radiation on physiology is mainly considered, and the field of psychophysiology is little studied. Radiation has been shown to affect the human psyche, but the extent of this effect is difficult to estimate. People who work for a long time in radiation conditions, especially at the computer, report headaches, irritability and depression. In general, the issue of radiation measurement from various sources, in particular from computers, is not sufficiently developed.

Ergodesign (ergonomics included in design) is one of the fields that includes the use of computer technologies (a new field of project activity related to the improvement of the organization of workplaces related to the processing, storage, transmission of information in text and graphic forms). One of the directions of Ergodesign development is to increase the functionality of the interface. Educational programs in the field of pedagogy require a screen that provides use in mono-screen dialogue mode, high-quality ergonomic solutions for methods of presenting educational information, careful planning of the compositional spatial arrangement and its review trajectory.

The design of teacher programs for the science of pedagogy means that it is necessary to carry out research work on the development of ergonomic principles, and this is one of the urgent problems. In recent years, the following research works have appeared in the preschool, secondary, higher education system, where the issues of ensuring optimal working conditions in the ergonomic design of human-computer interaction have been considered: protection from electromagnetic radiation; correct work order; microclimate conditions; reduced visual load; correct posture at work; workplace organization and others.

Based on the conclusions, we present practical suggestions:

1. There are no specific features of works studying the ergonomic features of teacher programs for teaching pedagogy.
2. Pedagogical sciences are characterized by a high level of abstraction of educational material. A significant increase in the effectiveness of computer training with a high ability to imagine complex subjective relationships, to simulate various pedagogical processes can be achieved by using high-quality computer training programs built taking into account psychological, pedagogical and ergonomic requirements.
3. Existing ergonomic standards and design guidelines for the user interface, including ergonomic requirements, recommendations, as a rule, apply to information processing systems: databases, expert systems, websites, graphics, text editors. In order to develop an ergonomic basis for designing computer-based educational programs in pedagogic sciences, it is necessary to critically analyze the models of perception of information previously defined in the framework of ergonomics during the interaction of a person with a computer.

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