

HYGIENIC FOUNDATIONS OF MODERN COMPUTERIZATION IN TEACHING THE SUBJECT “LIFE SAFETY”

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Annotation. Nowadays modern computer technologies are used in every sphere of our life. Telecommunication technologies have opened up new possibilities, especially in teaching the subject of “Life Safety”. According to researches of specialists it is stated that usage of computer networks gives student the need to become a member of the social community. Telecommunications improve students' reading and speaking skills, increase their interest in learning, and, as a result, improve their overall level of learning. However, not marking the situation from one hand, it is important to keep in mind the hygienic requirement during the operation with computers.

Key words: computer, hypertext text, multimedia, electromagnetic radiation, asthenopia, accommodation, illumination, microclimate.

Multimedia technologies transform the computer not only into a full-fledged interlocutor but also allow students, without leaving their classroom or home, to attend lectures by prominent scientists and educators. They also provide the opportunity to witness historical events of both the past and the present, visit the most important museums and cultural centers of the world, and explore the most remote and fascinating corners of the Earth from a geographical perspective.

Especially for students and teachers in the field of the subject “**Life Safety**,” telecommunication technologies open up new opportunities. Observations by specialists have shown that working in computer networks enhances students' need to become members of the social community. Through telecommunication communication, improvements in students' literacy and speech development are observed. Their interest in learning also increases, which consequently leads to an overall improvement in academic performance.

According to Russian experts, the use of **new information technologies in education (NITE)** in educational institutions makes it possible to increase the effectiveness of practical and laboratory classes in natural sciences by at least **30%**, and to improve the objectivity of assessing students' knowledge by **20–25%**. As a rule, the level of academic performance in control groups studying with the use of NITE is on average **0.5 points higher** (on a five-point grading scale). When computers are used in learning foreign languages, the rate of vocabulary acquisition increases **two to three times**. [1]

Materials and Methods

Modern information technologies, operating on the basis of microprocessors, computing equipment, and modern systems and tools for information exchange, provide operations for the collection, generation, accumulation, storage, processing, and transmission of information. Currently, the **QWERTY keyboard**, used in personal electronic computers (PECs) and named after the sequence of the first six letters in the top row, was developed at the end of the 19th century without empirical research. Its key arrangement is imperfect, requiring disproportionate movements of the weakest fingers of each hand, which has been repeatedly criticized by specialists.

The main physical factors affecting students in computer classrooms include:

- electrostatic fields;
- electromagnetic fields at 50 Hz;
- radiofrequency electromagnetic fields.

Computers installed in informatics classrooms are not a source of hazardous X-ray radiation for students' health. However, even low-intensity electromagnetic fields of radio frequencies can ionize the air, and in computer classrooms with video display terminals (VDTs), the number of ions may increase significantly. An excess of **positive ions** is considered harmful to humans, and their concentration should not exceed **5000 per cubic centimeter**.

Data from domestic research correspond with assessments by foreign specialists.

The operation of PECs is accompanied by **noise generation**. According to hygienic regulations, when the permissible level is **50 dBA**, actual levels may reach **60–65 dBA**. [2]

Many locally produced computers are ergonomically inconvenient. In classrooms of informatics and computer technology, specific environmental conditions arise, such as poor air quality, unfavorable microclimate, and inadequate lighting. Almost all computer classrooms show deficiencies in lighting systems for work surfaces. According to standards, artificial illumination is reduced at the keyboard and workstations for theoretical lessons (**130–200 lux**) and increased on monitor screens (**200–250 lux**).

Irregular operation of air-conditioning systems and lack of ventilation can significantly worsen microclimate parameters. Analysis of informatics classroom microclimate shows that air temperature **exceeds optimal levels in 70% of cases**, ranging from **22–23°C**, and in classrooms with southern orientation, the temperature can rise sharply in spring up to **25°C**. The relative humidity in 60% of classrooms is at the lower limit of the norm (**around 30%**). Excessively dry air is a significant drawback of computer classrooms. Low humidity increases the risk of accumulation of highly electrostatically charged microparticles that can adsorb dust and exhibit allergenic properties. [3,4,5]

Informatics and computer technology classrooms often contain polymer, synthetic, and lacquer-paint materials. Floors are frequently covered with linoleum or synthetic coatings. When computers operate and temperature rises or humidity changes, additional contamination of the indoor air with harmful chemical substances can occur.

Studies of the external environment in computer classrooms show that by the end of lessons, **carbon dioxide concentration may be twice the maximum permissible level**. Ammonia levels also increase, exceeding the permissible limit by 1.5–2 times in 37% of samples. Oxygen concentration may decrease by 1.5–2 times. Sanitary-chemical assessment of classroom air allows identification of several chemical compounds.

The operation of video terminals can lead to the formation of **ozone**. Its concentration generally does not exceed the maximum allowable concentration for the working area (**0.1 mg/m³**).

However, in children's institutions (often in school computer classrooms), ozone levels can reach or even exceed the **0.03 mg/m³** permissible limit for residential air.

Students are exposed to the **combined effect of low-intensity factors**, which individually may seem insignificant. [6,7] The influence of electromagnetic radiation across a wide spectrum is of particular importance.

The most important characteristics of video terminal devices include:

- levels of electromagnetic radiation in the infrared, microwave, ultraviolet, and X-ray ranges;
- overall screen illumination;
- brightness and contrast characteristics of the image, including depth of brightness pulsation;
- clarity and stability of the image;
- character size. [2]

Results and Discussion

The use of computers in the educational process increases the volume of information available to students during lessons and activates their learning activity compared to traditional lessons. At the same time, working near a display differs fundamentally from conventional classroom tasks: attention shifts frequently from the keyboard to the screen, results displayed on the screen require analysis and correction, etc. Lessons with computer use can create visual strain consistent with hygienic standards when applied to traditional types of academic workload of similar duration and intensity. [8]

Working with VDTs (Video Display Terminals) imposes significant visual strain, as it is more demanding than reading from paper. When information is presented on paper, it is reflected light that reaches the eyes, whereas VDTs emit self-illuminating points. In addition, images on a VDT are discrete, with frequencies of **50–70 Hz** or higher. These nearly unavoidable factors significantly complicate visual perception and are often compounded by the quality of the devices used.

VDT work leads to visual function strain due to several factors:

- unusual contrast between background and characters on the screen;
- characters on the screen lack the clarity of printed text;
- the distance between eyes and the screen and the direction of gaze cannot be freely adjusted, unlike reading printed text;
- focusing the horizontal gaze is more difficult than a downward gaze;
- flickering and trembling of the image, whether perceived or not;
- reflections on the screen, especially if the monitor is improperly positioned or lacks an anti-glare coating;
- fixation of characters on the screen occurs on a plane different from the screen surface and requires mental effort.

Physiological studies indicate that movement speed increases with age. Children reach peak development of this ability at ages 14–15. At 16–18 years, movement speed is slightly higher than at 14–15 years. This is especially relevant when working with computer keyboards, where small resistance is encountered during finger movement. The speed of movement reactions depends on the functional development of central and peripheral nerves, which determine the transmission rate of nerve impulses. In children, the maximal conduction speed of impulses in peripheral motor nerves reaches adult levels by age six.

A major issue with VDT work is its impact on visual function. VDT users experience **asthenopia**, characterized by discomfort in the eye area. This term primarily refers to visual symptoms, such as blurred vision or objects appearing unclear. The second component includes eye-specific symptoms, such as eye fatigue, discomfort, or pain. The frequency of asthenopia among VDT users varies between **40–92%**, with daily occurrences ranging from **10–40%**.

Significant loads are observed in the musculoskeletal system: when working with PECs, the trapezius and spinal muscles experience **9–14% of their maximal voluntary strength**, corresponding to noticeable strain. Prolonged typing may lead to fatigue, extreme exhaustion, and occupational diseases. These effects result from insufficient recovery between VDT work periods. The speed of recovery and the alternation of recovery phases depend on the intensity of prior work: more intense, shorter work leads to faster recovery, whereas slow fatigue leads to slower recovery. Repetitive hand movements with moderate intensity but long duration also slow recovery. Cumulative negative effects can lead to extreme fatigue, approaching pre-pathological conditions of the hands' neuromuscular apparatus (NMA).

The nature and degree of positive or negative effects of PEC work are determined by a combination of internal and external factors. External factors primarily include computer- and pedagogy-related parameters:

- duration of work in front of the display;
- image quality (particularly “display-related” factors);
- ergonomics of the workplace;
- environmental conditions (lighting, microclimate);
- the content and volume of work determined by the complexity of educational materials;
- teaching style and lesson structure.

External factors such as workplace ergonomics, environmental conditions (lighting, microclimate), teaching style, and lesson structure can be monitored and regulated.

More than half of students (55%) report general fatigue or discomfort in the eye area (fatigue, flickering, etc.) after working with PECs. About one-third of them report both symptoms. These effects are caused by continuous adaptation of the eye to unclear images on the VDT screen, resulting in eye muscle fatigue and subsequent reduction in visual acuity.

Evaluation of the functional state of the visual analyzer during PEC work shows that **45 minutes of work** leads to a significant decrease in accommodation stability. Prolonged work exacerbates this process, leading to residual tension in the ciliary muscles or accommodation spasm.

According to hygienic standards, after **30 minutes of VDT work**, **21–26% of students** report asthenopic complaints. During unsatisfactory VDT conditions, this number can reach **40%**. A similar pattern is observed with reduced visual acuity: the proportion of students with decreased acuity is **10–20%** and **25–30%**, respectively. By the end of the lesson, 35% of students experience decreased visual acuity. Normally, visual acuity recovers **15 minutes** after class, and complaints of visual fatigue disappear **25 minutes** after the lesson. The speed of recovery also depends on VDT quality. [2]

Conclusion and Recommendations

Thus, after **30 minutes of continuous work** in front of a display, significant fatigue develops in older students. Therefore, the duration of uninterrupted work at an individual pace in front of a display should **not exceed 30–40 minutes**, depending on the type of VDT.



After mixed-type lessons, the frequency of negative effects in school-age students is lower. The intermediate form of activity includes exercises conducted in a **dialogue mode**, with **free-paced tasks**, such as programming lessons, which helps reduce visual and physical strain.

References

1. G.I. Shaykhova, *Hygiene of Children and Adolescents*, Textbook, Tashkent, 2004. – 438 p.
2. Sanitary Rules and Norms for Work on Personal Computers, Video Display Terminals, and Office Equipment. SanPiN 0224-07. – 15 p.
3. S.M. Narziev, *Theoretical Analysis of the Causes of Injury in Sports Activities and Their Reduction Measures*, Journal of Advanced Research in Dynamical and Control Systems, 2020, Vol. 12, No. S2, pp. 166–170.
4. S.S. Sulaymonov, S.M. Narziev, *Methods of Forecasting and Occurrence of Traumatic Damages in Sport*, International Journal of Innovative Technology and Exploring Engineering, 2019, Vol. 8, No. 9 S2, pp. 223–225.
5. S.S. Sulaimanov, S.M. Narziev, *Causes and Prevention of Athlete Injuries During Training Sessions and Competitions*, JournalNX, pp. 325–329.
6. Sh.M. Narziev, A. Rakhimova, *Application and Analysis of Pedagogical Methods in the Educational Process*, Tekhnika, 2021, No. 1 (5).
7. Sh.M. Narziev, A.B. Botirov, *Human Activity Safety: Methods of Studying and Analyzing Risks in the Work Process*, Tekhnika, 2021, No. 1 (5).
8. S. Narziev, J. Asqarov, A. Khokimiyatov, *Methodology of Organization of the Labor Process and Preservation of Employees' Health*, The American Journal of Engineering and Technology, 2021, Vol. 3, No. 04, pp. 79–84.
9. Саидова Г. Т. Современные сведения об этиологии и патогенезе менопаузы у женщин //Медицинский журнал молодых ученых. – 2025. – №. 15 (09). – С. 174-177.
10. Г.Т. Саидова. "Рациональное и фактическое питание женщин в климактерическом периоде." *Advanced methods of ensuring the quality of education: problems and solutions* 3.1 (2026): 62-65.
11. Шайхова, Гули Исламовна, and Гулбахор Турсуналиевна Саидова. "Пути поддержания и коррекции питания женщин климактерического периода." *Latin American journal of education* 6.1 (2026): 770-779.
12. Saidova, G. T., and S. G. Sayfullayeva. "Hygienic analysis of diseases observed during climax period in women." *Modern American Journal of Medical and Health Sciences* 1.2 (2025): 330-335.