

Fifth Generation Internet Network in of Higher Education. Issues of Medical and Information Security of Students' Personality

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Abstract. People have talked about the 5G mobile Internet networks for a long time, and their moment has finally come. Since July 2019 of this year there is already one state completely covered by 5G. This is Monaco [1]. The time of transition to 5G mobile networks is close. However, along with the technological advantages of these networks, there are a number of negative, or rather side effects on humans. They should be known, because some of them are emergent properties of networks of this type (microwave, electric, magnetic fields etc.), and should be regulated by applicable law.

Most of the side effects are likely to be caused by the lack of awareness of the trainees and, accordingly, is quite surmountable under condition of formation of a certain information culture in terms of information, technological and medical safety. In the framework of this work, we will consider precisely these aspects of the information security of a person in terms educational organization of higher education and the educational space of a student.

For children and teenagers, the Internet and gadgets are now the basis of socialization and life. With all the positive examples of the active use of digital media and digital educational resources (DER) in teaching practice, there is no hygienic regulation in terms of the use of the media (gadgets), and in terms of the safety of DER. Below we will try to present the observations of a number of researchers regarding the influence of the fifth-generation networks on the trainees.

Keywords: Student's health, 5G Internet, digital educational space of higher education, Digital educational resources.

1 Introduction

In the view of economists, the networks of this generation increase the possibility of forming of the "Internet of Things", which will greatly simplify human life. Many worries will be removed due to the fact that things themselves will communicate with each other and servers without human intervention. Given the fact that the bandwidth of the fifth-generation networks is much higher than the current fourth-generation networks, it is not only possible, but also directly caused by the needs of manufacturers of end

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devices – gadgets. High transmission speed necessitates a closer location of the network cell and a higher EMF load. It is also important that a replacement of existing network modules, mobile phones will be needed with the transition to 5G. And, accordingly, it is necessary to speak about the radiation of base stations and the mobile phones. The impact of this load was quite difficult to assess in the life of the fourth-generation networks because of the short-term nature of this period and the inability to organize a reliable clinical trial. Now it's getting even more complicated, but one thing is certain. EMF has a negative impact on human health. Existing sanitary standards were created a long time ago and simply do not consider exorbitant, for them, radiation levels based on their impact on humans. Business entities are even less interested in this, because the amount of money already spent on infrastructure and development of devices is massive and no one is interested in losses.

2 Materials and Methods

Considering the impact of the fifth-generation networks on the health of a person, let us first of all inspect the very foundation of these networks, physical and technological methods of its implementation. Children and adolescents are in a more difficult situation today. Significant hopes are pinned on these networks in terms of economic development, but its impact on one of the subjects of the economy, people, has not yet been adequately studied [2]. At the same time, due to the short period of the use of network technologies in the history of mankind, it was not possible to conduct extensive studies. Currently, there is a well-formed social movement of EU doctors who advocate a moratorium on the fifth-generation networks until the completion of full-scale research. At the heart of this position is the traditional principle of medicine - “the disease is easier to prevent than to cure” [3]. According to AT & T, 5G networks will provide speeds 100 times faster than 4G networks, which makes it possible to connect at least 100 billion devices with a download speed that can reach 10 gigabits per second [4]. The prospects of these networks in terms of education are seen not only as a basis of the “smart city” technology, but also in terms of the use of massive open online courses chosen by a student, regardless of the location of the educational organization. Parents are given the opportunity to track the learning process of children and respond to it in real time. The training itself will go beyond the educational organizations and will integrate it into the virtual elements and augmented reality [5]. In this situation, the priority is the absence of a working system of informing parents and children of the dangers of modern technology as well as control of a digital learning environment outside of an educational organization in terms of the medical and psychological effects of the use of means of informatization of education [6,7]

The formation of students' information culture in terms of the safety of using the Internet and devices used to access it is now becoming a priority, because people of this age are the most vulnerable to the existing negative impact of information and communication technologies on their health [8].

3 Results

Turning to the physical foundations of next-generation networks, let us analyze the factors that directly affect a person. The standard 4th generation mobile base station is characterized by capacities of the order of 50W and a coverage radius of up to 100 km. Smaller stations (macro-, micro-, pico- and femtocells) have a coverage radius of several hundred meters to 5 km. In fifth generation networks, the distance between stations will be from 100 to 250 meters. In fact, communication loses its cellular definition and is implemented in the form of direct communication between mobile devices and servers. In fact, in terms of urban development we are talking about increasing the number of stations in the hundreds and thousands of times. With regard to fifth-generation networks, it is necessary to speak not so much about the power of the transmitting devices and EMF, but about the frequency of the transmitter. The basis of such networks is the use of a wide range of frequencies from the millimeter range to 20-60 GHz with the possibility of combining them. Thus, we are talking about another negative factor for the health of students, namely, RF-EMF radiation - radio frequency electromagnetic fields (RF-EMF). For fourth-generation networks, frequency ranges from 20 to 60 MHz are used, and fifth-generation networks from 100 MHz to 25 GHz [9].

Although the developers claim that 5G networks require many new base stations, the distance between them is much smaller than in 4G networks, and the transmitters operate at lower power levels, respectively, the level of radiation exposure from 5g antennas is lower [10]. At the same time, there is no unambiguous assessment confirmed by independent studies. Since the low radiation of one station is offset by the number of stations themselves.

Such a situation cannot but stimulate concern of both specialists in the field of telecommunications and doctors, environmentalists and other interested parties. Given the high interest in fifth-generation networks of business representatives, there are concerns about the impact of a number of companies on regulatory authorities regarding the artificial change of safety standards regarding RF-EMF and EMF [11]. The same authors note that the current research base on these topics is ignored by regulatory authorities and WHO. Emphasis on the EMF level leaves behind the questions of RF-EMF radiation, the foundations of fifth-generation networks and the physical principle of operation of microwave ovens. These are non-thermal [12] and thermal effects on biological tissues and the effect of high temperature on the living cell. The implementation of 5G networks via Wi-Fi causes oxidative stress, sperm damage, neuropsychiatric effects, including electroencephalogram changes, cellular DNA damage, endocrine changes, acts as a blocker of calcium channels. In addition, this type of damage is more pronounced in young people [13]. However, according to studies by the International Agency for Research of Cancer at the WHO (IARC), not only the possibility, but also the ability of radiation of wearable phones to have a potentially carcinogenic nature has been determined [14]. Although there are other studies that do not confirm such results [15]. The WHO IARC has classified RF-EMF as a "possible carcinogen for humans" based on studies showing the reproductive, metabolic and neurological effects of RF-EMF. In addition, there is an increase in skin temperature, changes in gene expression, cell proliferation increases, a state of oxidative stress is formed, vision is impaired, and

neuromuscular dynamics change. However, it is noted that available research is not enough for a more effective and independent study of the health effects of RF-EMF. But the available data on the biological effects of RF-EMF can identify exposed individuals as potentially vulnerable and redefine existing constraints. In particular, when considering evidence pointing to external factors as serious risk factors for cancer and the progressive epidemiological growth of noncommunicable diseases [16]. However, recently there have been studies showing the direct carcinogenic effect of RF-EMF in studies on laboratory animals [17] and especially in the formation and progression of head tumors [18]. When switching to 5G networks, hundreds of thousands of new transmitting devices will be required, which naturally leads to an increase in the so-called electromagnetic contamination. Since the new technology operates at very high frequencies, its range is much smaller than that of previous transmitting devices. The existing recommendations of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) assess new research on the safety of 5G networks for humans as irrelevant. This, however, is only a private club registered in Germany without any official status, which forms its own structure, excluding professionals with different opinions. Therefore, more and more critics of this position are calling for the creation of an independent assessment of possible harm to health [19].

The biological effect of EMF mobile communications and Wi-Fi has been repeatedly studied [20]. But, as a rule, these are single, non-repeatable studies in a local group. Multicenter studies in several states have simply not been conducted. And the background level of EMF is now significantly higher than what was during the last hygienic standardization - the end of the 20th and the first years of the 21st century. The negative effect is in the form of DNA damage and leads to reduction of resistance to diseases and neurodegenerative changes [21], which, in turn, can seriously affect metabolism and reproductive functions in terms of high risk of miscarriage [22] or the complete loss of this function [23]. With regard to carcinogenesis, recent studies can draw attention to studies conducted under the auspices of the U.S. Department of Health published in November 2018, which show the effects of EMF and RF - EMF on the appearance and especially the rate of progression of cancer cells [24].

Today, it is generally accepted that radiation (EMF and RF - EMF) of base stations causes the development or progression in humans of the following conditions or diseases: tumors; chronic fatigue; Alzheimer's disease; depression; infertility [25]; mental disorders and others [26].

Despite the rather large amount of data on the negative effects of EMF and RF - EMF radiation, the regulation in this part, in particular in Russia, is quite outdated. The newest of them date back to 2012, and sanitary standards regarding ICT were last updated in 2003. But they did not apply to computers moved in the process of activity (laptops, tablets, smartphones, etc.).

As can be noted from the sum of existing regulatory acts, the possible negative consequences regarding 5G networks are not considered by them. Existing regulation does not take into account new realities and new sources of radiation.

What can each of us do to prevent the damaging effects of both fifth-generation networks and mobile phones operating on this principle? The easiest way is to use a headset when talking or to hold the phone at some, more than one centimeter, distance from

the head, within the distance of safe impact on the tissue [27]. No need to keep your phone in your pants pocket or outerwear. This is especially true for young people [28]. In terms of Wi-Fi routers and especially 5G, it is necessary to place them outside the room in which you spend most of your time or sleep. Their action is based on short waves, so the further you get from them, the less intense their impact on you will be. Naturally, it's better to turn off the router at night. You can use on and off timers. Although in regard to 5G base stations this is not possible. But it is possible to use protective paint for the walls of the room, use curtains or blinds with conductive metal fibers or made of metal to delay the passage of radiation through the windows. There is no need to keep the phone near you at night and it is even better to disconnect it for this period. It is optimal to use Ethernet connection on a single desktop computer. In the EU, the use of Wi-Fi in places of compact accommodation for children and adolescents (kindergartens, schools, clubs) is prohibited, in the USA, the movement for the complete ban of Wi-Fi is gaining strength. In Russia, by Decree of the Government of the Russian Federation No. 53 of October 12, 2004, the maximum power of user devices that can be used without registration has been determined: these are routers with a capacity of up to 100 mW or 20 dBm (-10 dBW). This is enough to cover an area of about one or two apartments. More powerful ones have a greater negative impact on human health. It is possible to use specialized devices for routers to block RF - EMF, as well as use radioprotective covers for phones. It should be noted that existing and marketed radioprotective products do not have valid effect, proven by evidence-based studies [29]. US Federal Trade Commission (the FTC) does not recommend using phones when the signal is weak, as the amount of EMF increases. When talking, the maximum radiation is seen during transmission and the minimum during reception. It is preferable to use certified and approved mobile devices on the market, with the level of specific absorption rate (SAR - shows the maximum amount of radiation that the human body absorbs from the phone during its transmission) within the guidelines of safety.

Considering the presence in a standard apartment of a device based on RF - EMF radiation (microwave ovens, etc.), it is optimal to measure the existing electromagnetic background of the room in terms of radio frequency radiation, electric and magnetic fields. Although there are no household 5G frequency meters yet. Wireless charging devices for telephones operate on the principle of magnetic induction, which increases the risk to the user's health and leads to additional EMF "pollution" of the room. At the same time, all these events are relatively effective when used in fourth-generation networks and Wi-Fi. When switching to fifth-generation networks, the number of base stations will increase sharply, and today there is no protection from their actions.

4 Discussion

Speaking about the final block in terms of information security, we will proceed from the assumption that the transition to 5G networks will entail a significant increase in the number of Internet access points and these points will, in one way or another, be used as storage or intermediaries in the transfer of person data. Installing a traditional

antivirus on a gadget and a home computer to stop possible leaks is not going to be effective.

In terms of the problem of information security of the individual, it is necessary to take into account that the transition to 5G networks will entail a significant increase in the number of Internet access points and these points will, in one way or another, act as servers or intermediaries in the transfer of personal data. Installing a traditional antivirus on a gadget or home computer to prevent possible leaks is not going to be effective. For many devices operating in semiautomatic or automatic mode access terminals are not provided, and the firmware does not include any options for data protection. In this regard, extremely important is the training of students in terms of information security, both the individual himself and the technical means under his control [30].

In this regard, seriously exacerbated is the problem of ensuring information safety of the person in modern information educational environment (IEE), so the total introduction of ICT in all human activities largely changes the nature of the interaction in the sphere of education, as further improvement of educational activities becomes related to the successful use of the Internet environment with mandatory effective counteracting of its negative impacts.

As has been noted in pedagogical theory and practice, "...a theoretical basis for the training of educational professionals in the field of informatization of education according to the requirements of information security of a person are constituted by the pedagogical insights of science in the field of development of education informatization in the conditions of support of PDS (personal data security) subjects of the educational process in the emerging information society. The humanitarian aspects of the problem of information security of the individual, involving the education of active citizenship, especially in the field of knowledge of information law and information culture, receive a high degree of importance" [31].

The problem of PDS is considered in the national project "Digital economy" [32], one of the goals of which is "to create a stable and secure information and telecommunications infrastructure for high-speed transmission, processing and storage of large amounts of data, accessible to all households."

Ensuring the professional growth of teachers in the field of information technology should be provided not only by the continuous improvement of information training of teachers, but also by the mandatory requirements for ensuring information security of the individual in the educational space.

In the Decree of the President of the Russian Federation from May 7, 2018 №204 "On national goals and strategic objectives of the Russian Federation for the period up to 2024" [33] the goals and strategic objectives of the development of the Russian Federation are stated, including the prescription for the field of education: "...upbringing of a harmoniously developed and socially responsible person on the basis of spiritual and moral values of the people of the Russian Federation, historical and national cultural traditions; ... ensuring the global competitiveness of Russian education, the Russian Federation becoming one of the top 10 countries in the world in terms of the quality of general education; ... creating a modern and secure digital educational environment that provides high quality and accessibility of education of all types and levels".

With this goal in mind, a task is given - to create by 2024 a modern and secure digital educational environment that provides high quality and accessibility of education of all types and levels, which requires the update of model educational programs in the subject area "Fundamentals of security and life" in terms of including issues of cybersecurity and "cyber hygiene", which will ensure the protection of children on the Internet from deviant (going against the moral foundations of society) and delinquent (antisocial illegal acts of the individual) influences, as well as the creation of a tool to ensure the safe use of the Internet by students, preserving their own identity.

As noted [34] in the Russian education system, the most important tasks are objectively meeting the needs of society in creating reliable scientific, pedagogical, legal, methodological and organizational mechanisms to ensure the information security of the subjects of the educational process, preventing harm from dangerous information influences on the mental, moral or physical state of the individual.

Of a particular importance is pedagogical support of exploring issues of personal data security on all levels of education, since the full information training of graduates with a high level of information culture in a multilevel system of education is only possible with all aspects of personal data security [35].

Ensuring continuity of training at all levels of the national education system is important in the implementation of teacher training [36].

Thus, the foundations of information security of the individual should be laid, starting from the first levels of the educational system (preschool and school), which requires adaptation to the new level of threats in the field of information security, curricula and programs of training at school, as well as the inclusion of PDS issues in the information training of teachers.

The Internet environment and information resources in educational institutions are protected professionally in accordance with applicable laws and regulations. Access to the Internet is carried out through a proxy server, through which:

- a) caching of files and storing them on a proxy server to reduce the load on the Internet channel, and for faster client access to the necessary information;
- b) compression of information after receiving from the Internet and transfer of it to the user in a compact form in order to save traffic;
- c) protection of local computer or network from external threats;
- d) implementation of the possibility of connecting to the Internet of several computers with only one IP-address. With the appropriate proxy setting, external computers will not be able to communicate with local machines, but will only see the proxy, and the system administrator can deny users access to a number of websites.

However, it is not constructive to link the information security of a person only with prohibitive measures. Information security of the individual on the Internet should be based on a high level of information culture, which is laid at all levels of training and education in the multi-level system of national education, starting from the stage of elementary school.

Outside of educational institutions, parental control, the organization of which imposes requirements on both parents and students, should provide invaluable benefit in ensuring personal data security of students.

Taking into account the age characteristics of students, teachers should recommend parents to:

- a) create a list of house rules for visiting the Internet with the participation of adolescents and control its following;
- b) have the opportunity and be able to use the means of content control, regularly get acquainted with the sites visited by teenagers;
- c) use tools to block unwanted content;
- d) know the teenager's friends on the Internet to exclude cases of hoaxes;
- e) teach the teenager to report any threats or alarms related to the Internet, never to give out personal data by means of e - mail, to be able to recognize spam and not to respond to unwanted emails;
- e) provide psychological assistance in case of bullying;
- g) explain to the teenager that in any case it is not allowed to use the network for hooliganism, bullying or other illegal actions, including reference to the relevant prohibitive documents (the reason is that a repost or like of provocative posts on the Internet might be considered criminal activity);
- h) teach a teenager not to download programs without parental permission and control, so as not to accidentally download viruses or other unwanted software.

Thus, despite the fact that the large-scale introduction of ICT in all types of human activities largely changes the nature of interaction in the field of education, further improvement of educational activities is associated with the successful use of the Internet environment with the obligatory effective counteraction to its negative impacts.

5 Conclusion

Informatization of education as an integral part of the digital economy is moving from informatization of education management to informatization of education. This inevitably expands the contacts of students with means of informatization. The transition to the fifth-generation network and the use of the DER allows virtualization of education using a distributed information resource. And the learning process is already being implemented not so much within the framework of the educational organization, where the entire educational environment is normalized and controlled, but rather outside of it, in the digital educational environment of the student. There is no external control of the students and the student's parents. Medical, psychological and informational safety is regulated by the student himself. In this regard, studying the rules of medical safety, taking into account the peculiarities of health of the student and information security of activities in the digital educational environment, is becoming more relevant. It seems to us that these issues should be included in the Federal State Educational Standard "Informatics" since the use of information technologies for a modern student is becoming a priority way of training and socialization.

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References

1. Monaco rolls out Huawei-built 5G network in European first. Retrieved from: [https://www.france24.com/en/20190709-monaco-rolls-out-huawei-built-5g-network-european-first?utm_source=ixbtcom].
2. Big promises, unknown risks. Retrieved from: <https://www.investigate-europe.eu/publications/the-5g-mass-experiment/>.
3. 5G Appeal. Retrieved from: <http://www.5gappeal.eu/>.
4. AT&T Plans 5G Network Trial for DirecTV Customers. Retrieved from: <https://fortune.com/2017/01/04/att-5g-directv/>.
5. Rao, S. K., & Prasad, R. (2018). Impact of 5G Technologies on Smart City Implementation. *Wireless Personal Communications*, 100(1), 161–176. DOI:10.1007/s11277-018-5618-4.
6. Mukhametzyanov, I. S. (2011) *Mediko-psihologicheskie posledstviya primeneniya informacionno-kommunikacionnyh tekhnologij v obrazovatel'nom processe* [Medical and psychological consequences of the use of information and communication technologies in the educational process]. *Pedagogical Informatics*. 6, 92-97. [in Rus.].
7. Mukhametzyanov, I.Sh. (2019) Subject Approach in Digital Education. *Proceedings of the International Conference on the Development of Education in Eurasia (ICDEE 2019)*. DOI: 10.2991/icdee-19.2019.15.
8. Mukhametzyanov, I. Sh . (2018) *Sovremennye mobil'nye ustrojstva dostupa v internet v obrazovanii. Gigienicheskie aspekty* [Modern mobile Internet access devices in education. Hygienic aspects]. *Human Science: Humanitarian Studies*. V. 3 (33). pp. 113-122. DOI:10.17238/ISSN 1998-5320.2018.33.113.
9. Wie gesundheitsschädlich ist 5G wirklich? Retrieved from: <https://www.tagesspiegel.de/gesellschaft/mobilfunk-wie-gesundheitsschaedlich-ist-5g-wirklich/23852384-all.html>.
10. Mobile phone base stations: radio waves and health. Retrieved from: <https://www.gov.uk/government/publications/mobile-phone-base-stations-radio-waves-and-health/mobile-phone-base-stations-radio-waves-and-health>.
11. Europa ignoriert mögliches Krebsrisiko von 5G. Retrieved from: <https://www.tagesspiegel.de/gesellschaft/elektromog-europa-ignoriert-moegliches-krebsrisiko-von-5g/23855700.html>.
12. Betzalel, N., Ben Ishai, P. , & Feldman, Y. (2018). The human skin as a sub-THz receiver - Does 5G pose a danger to it or not? *Environmental Research*, 163, 208–216. DOI: 10.1016/j.envres.2018.01.032.
13. Pall, M. L. (2018). Wi-Fi is an important threat to human health. *Environmental Research*, 164, 405–416. DOI:10.1016/j.envres.2018.01.035.
14. Electromagnetic fields and public health: mobile phones. Retrieved from: <https://www.who.int/news-room/fact-sheets/detail/electromagnetic-fields-and-public-health-mobile-phones>.
15. Karipidis, K., Elwood, M., Benke, G., Sanagou, M., Tjong, L., & Croft, R. J. (2018). Mobile phone use and incidence of brain tumour histological types, grading or anatomical location: a population-based ecological study. *BMJ Open*, 8(12), e024489. DOI:10.1136/bmjopen-2018-024489.

16. Di Ciaula, A. (2018). Towards 5G communication systems: Are there health implications? *International Journal of Hygiene and Environmental Health*, 221(3), 367–375. DOI:10.1016/j.ijheh.2018.01.011.
17. Baskar, R., Dai, J., Wenlong, N., Yeo, R., & Yeoh, K.-W. (2014). *Biological response of cancer cells to radiation treatment*. *Frontiers in Molecular Biosciences*, 1. DOI:10.3389/fmolb.2014.00024.
18. Kesari, K. K., Behari, J., & Kumar, S. (2010). Mutagenic response of 2.45 GHz radiation exposure on rat brain. *International Journal of Radiation Biology*, 86(4), 334–343. DOI:10.3109/09553000903564059.
19. Wie gesundheitsschädlich ist 5G wirklich? Retrieved from: <https://www.tagesspiegel.de/gesellschaft/mobilfunk-wie-gesundheitsschaedlich-ist-5g-wirklich/23852384-all.html>.
20. Ibitayo, AO, Afolabi, OB, Akinyemi, AJ, Ojjezeh, TI, Adekoya, KO, & Ojewunmi, OO (2017). RAPD Profiling, DNA Fragmentation, and Histomorphometric Examination in Brains of Wistar Rats Exposed to Indoor 2.5 Ghz Wi-Fi Devices Radiation. *BioMed Research International*, 2017, 1-6. DOI:10.1155/2017/8653286.
21. Dasdag, S., Akdag, M. Z., Erdal, M. E., Erdal, N., Ay, O. I., Ay, M. E., ... Yegin, K. (2015). Effects of 2.4 GHz radiofrequency radiation emitted from Wi-Fi equipment on microRNA expression in brain tissue. *International Journal of Radiation Biology*, 91(7), 555–561. DOI:10.3109/09553002.2015.1028599.
22. Li, D.-K., Chen, H., Ferber, J. R., Odouli, R., & Quesenberry, C. (2017). Exposure to Magnetic Field Non-Ionizing Radiation and the Risk of Miscarriage: A Prospective Cohort Study. *Scientific Reports*, 7(1). DOI:10.1038/s41598-017-16623-8.
23. Othman, H., Ammari, M., Sakly, M., & Abdelmelek, H. (2017). Effects of prenatal exposure to WIFI signal (2.45 GHz) on postnatal development and behavior in rat: Influence of maternal restraint. *Behavioural Brain Research*, 326, 291–302. DOI:10.1016/j.bbr.2017.03.011.
24. Cell Phone Radio Frequency Radiation. Retrieved from: <https://ntp.niehs.nih.gov/results/areas/cellphones/index.html>.
25. Yüksel, M., Nazıroğlu, M., & Özkaya, M. O. (2015). Long-term exposure to electromagnetic radiation from mobile phones and Wi-Fi devices decreases plasma prolactin, progesterone, and estrogen levels but increases uterine oxidative stress in pregnant rats and their offspring. *Endocrine*, 52(2), 352–362. DOI:10.1007/s12020-015-0795-3.
26. Boehmert, C., Freudenstein, F., & Wiedemann, P. (2019). A systematic review of health risk communication about EMFs from wireless technologies. *Journal of Risk Research*, 1–27. DOI:10.1080/13669877.2019.1592211.
27. Awada, B., Madi, G., Mohsen, A., Harb, A., Diab, A., Hamawy, L., Hajj-Hassan, M. (2018). Simulation of the Effect of 5G Cell Phone Radiation on Human Brain. 2018 IEEE International Multidisciplinary Conference on Engineering Technology (IMCET). DOI:10.1109/imcet.2018.8603063.
28. Teksheva, L. M., Barsukova N. K., Chumicheva O. A., Khatit Z. Kh. (2014) *Gigienicheskie aspekty ispol'zovaniya sotovoj svyazi v shkol'nom vozraste* [Hygienic aspects of the use of cellular communications in school age]. *Hygiene and Sanitation*. V2. Retrieved from: <https://cyberleninka.ru/article/n/gigienicheskie-aspekty-ispolzovaniya-sotovoy-svyazi-v-shkolnom-vozraste> (reference date: 09/04/2019).
29. FTC. Cell Phone Radiation Scams. Retrieved from: <https://www.consumer.ftc.gov/articles/0109-cell-phone-radiation-scams>.
30. Bogatyreva, YU. I., Kozlov, O. A., Polyakov, V. P., Privalov, A. N. (2017) Metodicheskaya sistema nepreryvnoj podgotovki pedagogicheskikh i upravlencheskikh kadrov v oblasti infor-

- macionnoj bezopasnosti: koncepciya [Methodical system of continuous training of pedagogical and managerial personnel in the field of information security: concept]. Theoretical and practical aspects of psychology and pedagogy: collective monograph. Iss. 17. Ufa: LLC "Aeterna", pp. 27-47. [in Rus.].
31. Kozlov, O. A., Polyakov, V. P. (2018) *Informacionnaya bezopasnost' lichnosti: aktual'nye pedagogicheskie aspekty*. [Information security of personality: actual pedagogical aspects]. Omsk Academy of the Humanities. The science of man: humanitarian research, V. 3 (33), pp. 105-112. [in Rus.].
 32. National project "Digital economy» Retrieved from: <https://strategy24.ru/rf/management/projects/natsional-nyy-proyekt-tsifrova-ekonomika> . [in Rus.].
 33. The decree of the President of the Russian Federation of May 7, 2018 N 204 "About the national purposes and strategic tasks of development of the Russian Federation for the period till 2024" (with changes and additions) Retrieved from: <http://base.garant.ru/71937200/#ixzz5Wou7jWMQ> . [in Rus.].
 34. Polyakov, V. P., Romanenko, Yu. A. (2018) *Pedagogicheskoe soprovozhdenie voprosov informacionnoj bezopasnosti lichnosti v otechestvennom obrazovanii* [Pedagogical support of personal data security issues in domestic education]. Proceedings of the international symposium "Reliability and quality". Penza: Penza state University. V. 1. pp. 64-67. [in Rus.].
 35. Polyakov, V. P. (2018) *O protivodejstvii negativnym vozdeystviyam internet-sredy v obrazovatel'nom prostranstve* [About counteraction to negative influences of the Internet environment in educational space]: Collection of works XXXVII all-Russian. NTK "Problems of efficiency and safety of complex technical and information systems". Part 6. "Problems of General, secondary, professional, higher and additional education in the field of training in the operation of complex technical systems. A branch of the VA strategic missile forces" (Serpukhov), pp. 258–262. [in Rus.].
 36. Robert, I.V., Polyakov, V.P., & Kozlov, O.A. (2018) Information security of the personality of the subjects of the educational process. SHS Web of Conferences. V. 55, DOI: 10.1051/shsconf/20185503011 . pp. 1–9.