The Analysis of Some Medical Biological Aspects of Distant Learning Technologies in Russian Regional State Universities *

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Abstract. The paper refers to the necessity of investigation of "Russian regional state universities" (RRSU) as a special category of educational establishments. Authors have investigated the role of distance learning technologies (DLT) in the organizing of educational process at RRSU with the students of different forms of study; advantages and disadvantages of DLT using in comparison with contact forms of study, under the conditions of the system of anti-epidemic measures. To formalize the concept of the «level of medical-biological danger» of the individuals living environment the mathematical model is proposed. On its basis approaches of evaluation and management of medical-biological factors (MBF) of the individuals living environment in any degree connected with DLT use are substantiated. The main MBF groups are analyzed: sanitary and hygienic conditions of educational activity of tutors and other RRSU staff, student of different forms of study; measures to counteract the spread of infectious diseases in regions and settlements; their effect on DLT application volumes, the possibilities of using population intellectual potentials; the effect of DLT implementation at RRSU on well-being and objective indicators of the student and staff health. From the point of view of the MBF effect characteristics, the following categories of objects of different hierarchical levels are considered: regions and settlements; employers for university students; RRSU in general; RRSU units; some RRSU tutors; student educational groups; some students; tutors and students families. Authors have also investigated the MBF risks structure for the categories of "objects"; available methods of MBF control characteristics on the part of various groups of legal entities and individuals including DLT implementation in the combination of full-time studies or the order of its replacement.

Keywords: Russian Regional State Universities, Activity Conditions, Distance Learning Technologies, Medical-Biological Factors, Risks Control, Information Telecommunication Technologies, Anti-Epidemic Measures System.

1 Introduction

In the framework of the Russian higher education system, state universities play a key role. They provide students training at budgetary funds expenses and a commercial base, using different education forms. Russian regional state universities (RRSU) are the most numerous. This category includes universities located outside the cities of Moscow and St.Petersburg and which don't have the status of national research or federal university.

It is generally recognized that the use of distance learning technologies (DLT) in universities has both advantages and disadvantages [5,10]. In available publications DLT has analyzed in some areas: its implication methods; DLT implication for self-education [6] and for "education quality" providing [8]; DLT implication specifics for different areas of studying, including medicine [12,16]. At the same time, medical-biological factors (MBF) connected with DLT use are practically not considered in the available publications.

At the present moment, RRSU is subordinated to different state departments: The Ministry of Science and Higher Education of the Russian Federation, the Ministry of Agriculture of the Russian Education, some security agencies, as well as authorities in the regions. Various departmental subordination is one of the reasons for the fact that approaches of DLT implication in the Russian Universities are not unified, and the processes of educational materials "consolidating" for DLT at the country level are not taking place.

Different RRSU has definite peculiarities, including DLT implication and MBF control, in the following directions.

(**a**) Access control organization at the entrance to educational buildings and dormitories; less often – to sport facilities. At the same time, physiological state control of the incoming persons is usually not carried out. Additionally in the universities subordinating to security agencies the access of private persons (PP) to their territories is controlled; the possibility of cadets (and in some cases of tutors) exit from these territories are "regulated". For the university branches, located in «closed administrative-territorial units» (CATU), it's also necessary to note the restrictions on entry-exit from such territories. The restriction (or exclusion) of unauthorized person's access to the territories, to educational buildings, and the dormitories of RRSU significantly reduces not only criminal but also medical-biological risks.

(**b**) Technical equipment levels including DLT implication ensuring means.

(**c**) Availability in buildings and the air conditioning systems effectiveness including centralized ones. At the same time, separate air "disinfection" systems of the "recirculation with ultraviolet irradiation for passing air" type in RRSU are not used as a rule.

(**d**) The comfort of tutors and students staying in the RRSU classrooms, including typical densities of students in the classrooms in the classes of different types, in the libraries.

(**e**) Terms of RRSU staff and students catering, including in educational buildings and dormitories.

(**f**) Quantitative and qualitative characteristics of tutors contingents, Russian and foreign students, post-graduate students including their health state, chronic diseases, immunity level, etc.

(**g**) Academic exchanges intensity [9] of tutors and students with other universities, including the foreign ones.

(**h**) The number of international conferences with a large number of participants from abroad and other regions held at RRSU.

(**i**) The quality and the comfort level of dormitories for students, post-graduate students, and young scientists, including the "density" of their accommodation in the rooms.

(**j**) Technical and staff equipment of RRSU medical centers, and also their "branches" in the large universities.

(**k**) Availability and technical equipment of dispensaries, operating at RRSU.

(l) The quality and the quantity of RRSU sports facilities, including sports gyms, swimming pools, etc.

(**m**) Salary levels of tutors and other university staff. These levels affect the following: the possibility of purchasing quality computer equipment, including for use in the DLT framework; comfort and sanitary conditions of home "workplace"; food quality; rest conditions; health conditions and treatment options; immunity level, etc.

(**n**) For universities subordinated to security agencies and for some specialties in "civil" universities – the amounts of general and special physical training (they also influence the students' health conditions).

The enumerated peculiarities must be taken into account when planning and realization of the educational process at RRSU, including DLT; training environment for tutors, staff, university students; vital activity environment (VAE) for other residents at the RRSU regions. At the same time, DLT use can have a positive or/and a negative impact on the VAE conditions of PP, organizations, regions. However, these items in the available literature practically don't have any complex observations. It determines the necessity and the relevance of this article.

2 General Characteristics of DLT Application Areas in RRSU.

Currently, DLT is used for all three education forms realization. (**a**) For full-time students, DLT is used in general as a self-guided work organization means [2] – while carrying out the full-time classes (lectures, seminars, laboratory, and practical classes, etc.). At the same time, the tutors can use DLT while at the university's "territories"; at home; at business trips, including only abroad Russia. The full-time students can use DLT, being in RRSU reading and computer halls; at home; at dormitories, and even during trips by transport. As a rule, any strict time limits for DLT use in RRSU are not set (except examinations and tests). Therefore, tutors and students usually use DLT in offline mode at any time, convenient for them, except for cases of teleconferencing. (**b**) For students of mixed attendance and part-time modes, DLT at RRSU is usually used

as a basic means in educational process organization. Such students use DLT in general at home, sometimes additionally at work (after the working period is finished). Combination of work and study by part-time students can lead to their physical overloading – especially if employers don't want to give them educational vacations and "days off", which are officially fixed in legislation.

With the introduction of the anti-epidemic measures system (AEMS) in the country and the regions the volume of DLT implication in RRSU, of the staff distance work implication significantly increases (fig.1). The following is used: DLT support systems ("Moodle" more often); video conferencing tools (e.g. "Zoom"); two-way audio-video communications (e.g. "Skype"); RRSU sites; other Internet-resources, including educational; Automated university control systems; e-mail systems; telephone communications.

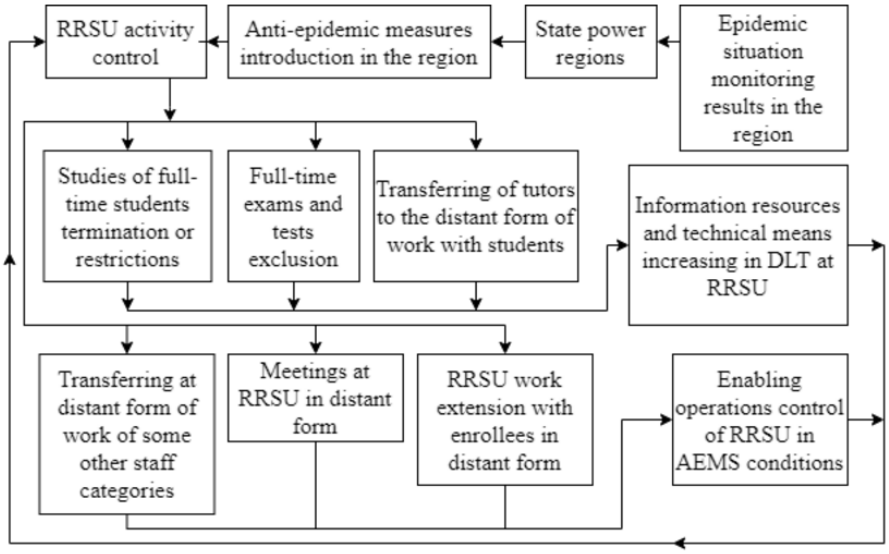

Fig. 1. To characteristics of AEMS introduction consequences for RRSU

At the same time, the materials quality used in DLT and distance learning organizations begins to affect to a greater extent the university image perception by the students. Due to the changes in the job places structure in economics, services for "new qualification" quick obtaining are becoming more popular allowing "work from home".

The main directions of DLT implementation at RRSU are the following: training materials presented to students (texts, including formulas, static graphics, audio, and video clips, etc.); remote consultation carrying out, including in online mode [3,15], teleconferences [7]; learning operational control; students assessment – including in automated form. At the same time various types of educational materials, teaching methods, and knowledge control can be used in the DLT framework. Most RRSU are oriented at creation, accumulation, and use of their own "training materials bases" for

their implementation in the DLT framework; they don't put forward any strict requirements to hardware and software characteristics of DLT users. In practice, the DLT "points of use" (PoU) can significantly vary in terms of sanitary and hygienic and other conditions, including the different concentration of people, the speed of the Internet resources access, and communication channels stability (the latter can significantly affect the emotional and psychological state of DLT users).

Therefore, it is important to analyze the medical-biological factors (MBF) nomenclature, connected with DLT implication; directions of their influence on the levels of medical-biological hazard (LMBH) of VAE; goals and possibilities of LMBH control – including in conditions of AEMS realization.

3 «The Levels of Medical-Biological Hazard» for Vital Activity Environment and Education, their Evaluation Approaches

In general, LMBH can be evaluated for «objects» of different hierarchical levels. For a definite *j*-th private person LMBH from his external environment (L_j) will be evaluated as

$$L_j = \sum_{k=0}^{K} \sum_{i=1}^{I} P_{i,j,k}^{(1)} P_{i,j}^{(2)} U_{i,j,k} \tag{1}$$

where: *K* is the number of objects «categories», which can be damaged, connected with the PP. Let's take, that κ=0 corresponds to the «country in general» without taking into consideration the PP location region; κ=1 corresponds to his location region; κ=2 is PP employer itself; κ=3 is RRSU in general; κ=4 is RRSU branch; κ=5 is other students from the student group; κ=6 is PP himself – a tutor or a student; κ=7 is PP's family. Other values in (1) are as follows: i is the number of external environmental factors, which can have medical-biological influence at PP; $P_{i,j}^{(1)}$ is the probability of the fact that in the selected period (for definiteness per day) such influence will be affected from the *i*-the factor at *j*-th PP; $P_{i,j,k}^{(2)}$ is the probability of that such influence will lead to negative consequences; $U_{i,j,k}$ is the damage amount value (monetary expression) if the negative consequences will take place. Thus, the evaluation L_j is carried out as the sum of "components".

For the region and the settlement with *J* population amount the evaluation of the probable loss experience for the chosen period

$$L^{(R)} = \sum_{j=1}^{J} L_j \tag{2}$$

The evaluation of mean cost (it is defined as LMBH for the region and the settlement) we will give as

$$\bar{L}^{(R)} = L^{(R)} / J \tag{3}$$

LMBH control for VAE can be carried out due to the measures taken by the PP himself, and by other «object categories», including country and region government, RRSU management, etc. In this case, the coefficient values in the formula (1) $P_{i,j}^{(1)}$; $P_{i,j,k}^{(2)}$; $U_{i,j,k}$ have to be changed. In most cases, these measures' realization requires either direct costs, or leads to «losses». For example, it may be losses, associated with the decrease in economic activity in the regions connected with AEMS use. The costs of implementing measures, reducing LMBH are economically justified by reducing the values of «prevented damage». In this case, AEMS influences at MBF of VAE, including factors directly connected with DLT implementation.

4 The Main Group of Factors, which Can Influence DLT Implementation Effectiveness by Students

Schematically the influence of different groups of factors is shown in Fig. 2

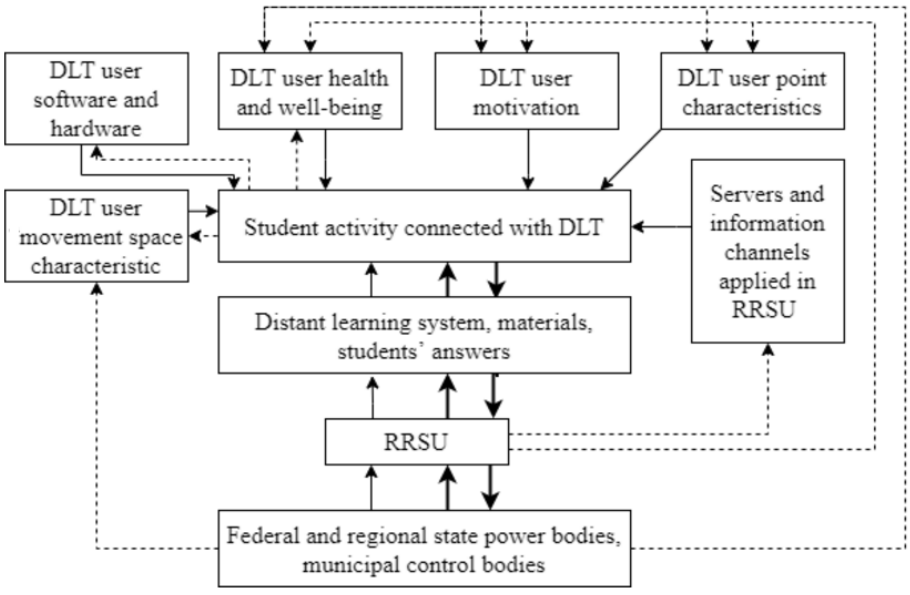

Fig. 2. To the characteristic of interconnections of students and the environment in the DLT framework.

The 1st group of factors is connected with the equipment and hardware, used by DLT final users. (***f1***) The size and resolution of the monitor screen, image contrast, the screen flickers intensity, etc. The negative influence can be provided by such factors: the use of desktops with large grain size and low contrast, with insufficiently high brightness, with a large «response time»; with the insufficiently high frequency of image regeneration. It can lead to an increase in the load on the visual apparatus of a person, the appearance, and accumulation of eye fatigue; with prolonged effects, it may lead to the appearance (or to the development) of diseases. Earlier the factor of «soft x-ray radiation» from monitors on cathode ray tubes was also taken into account, however, at present these monitors are practically not used. (***f2***) Convenience and intuitiveness of the interface of a software tool (SWT), that implements DLT affect user fatigue. (***f3***) The presence in the SWT of the contextual prompts means of identifying, signaling, and correcting the results of user error activity. Adequate implementation of SWT on the points «*f2*» and «*f3*» reduces the intellectual load on DLT users, it helps to maintain their concentration and attention during the DLT use.

The 2nd group of factors corresponds to DLT's "points of use". (***f4***) The PoU illumination levels, direction and spectral composition of lighting, brightness fluctuations existence. (***f5***) Noise levels in PoU, including related to the operation of computer and other equipment, the volume of domestic and industrial noise. (***f6***) The vibration level – mainly at DLT use in moving transport. (***f7***) The levels of electromagnetic radiation – this fact is essential only for long-term work in PoU with an increased electromagnetic background. (***f8***) The levels of «infectious» (bacteriological) danger in DLT PoU including associated with the existence of other PPs. (***f9***) The PoU DLT information security levels, including determined by the ability to visually familiarize unauthorized persons with the «login-password» of the DLT user, with his answers to DLT questions/tasks, etc. (***f10***) The levels of physical and criminal security at DLT PoU – they can affect the physiological tension of the user, his attention concentration, etc. (***f11***) Distracting factors. For example, it may be some periodic addressing of children to the DLT user during his work at home; numerous phone calls to him; the existence of people in the family, who are receiving treatment at home [1], require care and constant monitoring.

The 3rd group of factors corresponds to DLT users themselves – students and tutors. (***f12***) Possibilities of hypokinesia appearance at the prolonged work at PC. It is especially important if part-time students as part of their production activity are constantly working on a PC. (***f13***) The existence of diseases (or predispositions of diseases) among DLT users, including vision organs; for example, legs thrombotic phlebitis. (***f14***) Insufficiently high perseverance of the users, preventing them from DLT fully use. (***f15***) The presence of necessary vaccination of DLT users, their general level of immunity. These factors affect the possibility of the appearance/development of diseases and as a consequence the possibility and productivity of their DLT use.

The 4th group of factors relates to the PP «movement space», including their DLT PoU attending. (***f16***) The levels of «bacteriological danger» at PP moving outside the house or to the other PoU. It can refer for example to travel by transport, especially in tight conditions. (***f17***) The levels of physical load affecting DLT users at space move-

ment, including vibrations, shocks, etc. It can lead to their fatigue, decrease in the subsequent opportunities for work with DLT. It should be noted that the larger the settlement is the longer students and tutors get to RRSU. (***f18***) The levels of criminal danger, including associated with the possibility of inflicting (or threatening to inflict) various injuries to PP. (***f19***) Urban injury risks levels not connecting with criminal threats. For example, there are high injury risks at PP walking along the city streets in ice conditions, with a strong wind and intensive rain, etc.

The use of RRSU dormitories and hostels located in their "isolated" territories may be important to reduce the number of RRSU students and tutors contacts with the «urban population», as well as to reduce the criminal threats levels for them. At the same time creation of special opportunities for DLT implementation are often specially provided at University dormitories, including rooms for self-education, wired Internet access, Wi-Fi access points, etc. As a maximum special university "campuses" with educational buildings, dormitories, service institutions can be created. Even more opportunities for "relative isolation" from the "urban environment" are provided by the "military schools" territories and similar "regime" organizations.

The 5th group of negative factors is related to the DLT materials themselves: small print in combination with large, low-contrast, and blurry images, use of complex stylistic expressions, non-structured texts, etc.

The 6th group of factors is reliability (time stability) of DLT server work at RRSU; the speed of access to the DLT materials at the university server.

Thus in the context of AEMS introduction in regions the requirements to DLT information and technological base at RRSU are increasing and the university's costs for this base development are becoming more profitable.

5 DLT Implementation Medical-Biological Items Analyses for the "Objects" with Different Hierarchical Levels.

Regions and settlements. The DLT implementation allows expanding the possibilities covering the population with different forms of education and additional training including RRSU activity. It contributes to an increase in the "intellectual potentials" of the regions, an increase in the qualifications and capabilities of their "labor resources" including PPs working in the health care sector, an increase of tax revenues to the budgets of the country, regions, and settlements.

Actual opportunities for labor resources using in the regions are provided by some medical measures, the development of hospital and outpatient medical institutions network [4], ambulance stations; preventive medical examinations of the regional population; vaccination [4]; "electronic health passports" use; public sports facilities network expanding; healthy lifestyle promotion; taking measures for improving the environmental situation in regions, settlements, etc.

State authorities in the country and the regions have a significant impact on the implementation of information and telecommunication technologies (ITCT) by organizations and by the population, on increasing ITCT competence of the population. For

these purposes, special federal programs such as «Russian Federation Digital Economics» (http://government.ru/info/35568/); national project "Education" (http://government.ru/info/35566/) are implemented. Besides preferential taxation is used for organizations working in the field of "high technologies", including the ITCT sector. As a rule, the ITCT increasing implementation leads to an increase in gross domestic products of the country and regions; and in many cases to expanding of the "distance use" of specialists labor within the Russian Federation, including at large distances from the employers. The growth of regional informatization usually leads to an increase in the "services export" from Russia including ITCT development form. For example – in the form of creation and maintaining sites for foreign organizations (such tasks are carried out even by the RRSU full-time students). However according to the information known by the authors, Russian ITCT specialists are more in demand abroad for solving complex, science-intensive tasks, but not for performing typical tasks of ensuring business activities. Besides attracting Russian specialists to ITCT developments on an individual basis, large foreign companies also practice opening branches in Russia and recruiting Russian students for internships. For such individual's adaptation for solving special ITCT tasks, solved by the firms, DLT tools are widely used, including tools designed abroad.

The overall growth of the ITCT competence of organizations and populations in the regions as well as the development of the infrastructure to support ITCT use also potentially contribute to the expansion of DLT use possibilities within the framework of RRSU activities.

Below we will more in detail observe state authority's decisions influence related to AEMS introduction in regions on the DLT use at RRSU. These measures are aimed at reducing the intensity of "personal" contacts among PPs, including university students and tutors.

(***a***) "Compulsory self-isolation" introduction for PPs in "risk-groups". In these groups, there are many RRSU staff and tutors, including "Categories 65+». (***b***) An access control introduction in settlements. It significantly restricts PPs moving possibilities, including tutors and those students, who are not included in "production activity». (***c***) The widespread use of «test systems», to identify PPs carries infectious diseases. (***d***) The introduction of «mask mode», including when PPs are in buildings. It can reduce PPs usability and dialogue options. (***e***) Limiting the PPs entry intensity to the regions from outside, the use of compulsory self-isolation for these PPs for two weeks period. When entering from abroad such PPs can be placed for observations in medical institutions. As a result of AEMS introduction in regions, the RRSU part-time students (especially from other regions and from abroad) can simply lose the possibility to personally visit universities even during the session period. Under such circumstances, RRSU is forced to take exams and tests only using DLT [14]. (***f***) For the AEMS introduction in the regions, there is the termination or significant restriction of full-time classes at universities, with the transition to DLT implementation.

It is significant that AEMS, introduced in regions, usually don't affect the organizations selling computer equipment, communications, etc. Therefore the opportunities in technical resources "increasing" for DLT remain for RRSU, tutors, and students.

Employers where RRSU students work (or can work). In some cases the organizations are significantly interested in their employee's qualifications improving (including full-time and part-time students) with the DLT use, So they allow the use of personal computers and the Internet for these purposes at workplaces after their working hours. Also for some activities, employers can use the labor of «distance workers» (including full-time and part-time students) – especially when AEMS are introduced. Besides women having small children, persons with disabilities, etc. can be used for distance work.

Employers usually do not accept RRSU full-time students for practical training in the conditions of AEMS introduction. The temporary "loss" of practice places is negatively influenced by RRSU activity, and as a rule, it can't be fully compensated by the use of DLT by tutors.

RRSU as a whole. As it was already mentioned above at most RRSU DLT is used mainly for work in "mixed" mode and with part-time students. For full-time students, it is used as a means of their self-work supporting [2], including those students who have an individual schedule. To ensure some favorable medical-biological conditions of the students and tutors educational activity environment such methods are implemented. (***a***) The formation of the ergonomic environment of university educational classrooms. (***b***) Ensuring the living and classroom comfort in RRSU dormitories. However, in most cases, RRSU can't form student campuses. So they are forced to use dormitories in different parts of the cities. As a result, the DLT implementation allows reducing the number of student trips to the RRSU buildings. (***c***) The first-aid posts use at RRSU. They can provide the "first aid", prompt identification of PP patients, suspend them from classes for infectious diseases spread reduction; support for vaccinations of universities staff and students, preventive medical examinations. (***d***) Creation and use of dispensaries at universities – for tutors and full-time students. (***e***) Ensuring the sports facility's accessibility for students, tutors, and staff.

Currently, the analyses of issues related to the organization of RRSU education activities during the AEMS implementation in the regions are relevant.

(*****) «Primary» measures to limit the epidemiological diseases spread at university sites. (***pm1*)** PP entering the RRSU building control using infrared thermometers or thermographs to identify individuals with high body temperature. (***pm2***) periodic airing of the rooms. (***pm3***) The use of mobile ultraviolet emitters for disinfection of the air in the rooms. (***pm4***) «Frequent» wet cleaning using antiseptics. (***pm5***) Their use for disinfection of the objects, that may be touched by PPs, including door handles, PC keyboards, etc. (***pm6***) Mandatory use of the mask mode in the university buildings. However, masks can bother the staff's speech (especially in a loud voice), dialogue between them.

(******) Secondary character measures: limiting the number or suspension of full-time classes at universities; in some cases – cancellation of university buildings visiting for some staff categories, including tutors. This measure can have the following effects. (***ef1***) Full-time class cancellation (especially laboratory practical classes) can lead to a decrease of students' educational activity control level; to aggravation in the quality of their adopting of learning materials. At the same time, additional labor costs for tutors using DLT can't always compensate for such aggravation in quality. (***ef2***) The need for

DLT resources at universities is growing – «information» and «technical support means» [14]. (***ef3***) The DLT use by tutors and students especially by full-time students is increasing. (**r**) Significantly changing the MBF, which is affecting tutors working conditions. (***ef4***) The conditions for full-time student education are also changing – by expanding the DLT use. (***ef5***) For the students of part-time and "mixed" education mode (including students from other cities), a transition can be made to taking exams and tests, defending final qualification works fully based on DLT. (***ef6***) The RRSU control technologies are also changing, including the part of the meetings are hold in the distance technologies forms. (***ef7***) Academic exchanges between universities (among students and tutors) [9] are significantly reducing, especially with foreign universities. (***ef8***) The applicants of "agitation" technology are changing about RRSU admission. The reasons are the following: the possibility of personal agitation of the RRSU representatives can be excluded (or can be significantly limited) including at regional schools, at secondary specialized educational institutions. In such conditions the RRSU sites need to be used in most cases, video conferencing systems for groups and couples; should be involved in e-mail and social networking options. (***ef9***) The RRSU new employee hiring is more complicated. (***ef10***) The use of RRSU dispensaries, indoor sports facilities, including swimming pools, are excluded. (***ef11***) The «access mode» to the RRSU student dormitories becomes more strict. Also in some cases, the possibilities to exit from the dormitories are restricted for students living in. The permanent presence of students in restricted spaces of the dormitory rooms (especially as there are several students in rooms) can have a negative psychological effect and makes DLT use more difficult. If there is no wired Internet connection in the dormitory, the students need to use radio modems for DLT. However, most of the tariff plans of mobile operators provide some restrictions in traffic amount for «mobile users». Therefore when the constant use of DLT at a large scale, these restrictions can be significant.

RRSU departments. With the DLT use increasing the labor technologies of tutors and support staff are changing. The processes of planning, accounting, and control of the educational activities of the department heads, tutors, and other RRSU employees, including processes of interactions with students, are also changing. In the case of AEMS introduction in regions, some RRSU employees (not only tutors) can be transmitted at "work at home". The aim is to reduce the number of their contacts with other PPs; their moving within settlements, especially by public transport means.

The possible negative consequences of such «transmissions». (***a***) Aggravation of conditions of university staff interact with each other (including tutors and support staff), and also with students. (***b***) Additional emotional and psychological stress on the RRSU department employees caused by the inability of personal communications. (***c***) An increase in the employee's work amount including associated with the DLT use expansion the needs of taking into account the result of their implementation. (***d***) Significant difficulties in document processing requiring personal PPs signatures – because the electronic signature technologies are not implemented at most RRSU. (***e***) Certain difficulties in meetings effectiveness ensuring and of other event groups in the distance form.

RRSU tutors. In the framework of DLT realization, they can use their workplaces at the RRSU site or home. Let's state once more that the DLT implementation enlarges

instead of full-time classes often increases the time spent by the tutors and the load on their vision organs. It is necessary to indicate the specific consequences of the DLT implementation for tutors.

(**a**) Some students using the DLT for interaction with tutors have poor skills in the written Russian language (mainly they are students from abroad and from some Russian regions). In such cases, tumors can't promptly clarify with students the meaning of the written phrases. Consequences for tutors: the emergence of additional intellectual and emotional psychological stresses; the need of additional «time expenditures» to comprehend the materials sent in "poor" Russian to formulate comments and answers to such students in the simplest form.

(**b**) In the case of DLT implementation tutors often work with students in the individual form using video conferencing in online mode. If students live in some remote regions (about tutor settlement) the differences in time zones can be significant. As a result, the problem is in establishing the mutually acceptable time for the tutor and the student for the communication session. If such sessions are carried out (forcedly) in the early morning or the late evening so this can "knock down" the tutor's biological rhythms (especially if they are elderly persons) and can lead to a violation of their sleep patterns.

In the case of AEMS introduction in settlements, tutors in some cases are forced to work only at home. It can require equipping their home workplaces not only with PCs but also with printers, scanners, video cameras, "sound columns" or headphones, microphones. It can lead to a certain increase in the number of not only electronic but also paper form documents stored at home. As a result, the volume of available personal space of tutors can decrease. Besides tutors working at home can be distracted from the work performance related to DLT implementation by children, by other family members. Also, VAE limited space within city apartments can have a negative influence: reduction in the number of direct informational contacts with other persons outside their families; decrease in the volume of physical activity and the possibilities of the outdoor recreation; restrictions on a trip to other regions, including participation in scientific events.

RRSU students study groups. During studies such students (especially full-time students) have close information contacts with each other; for a long time, they are at a close distance. Therefore the changing of full-time studies for DLT implementation provides a significant reduction in the risks of epidemiological diseases spreading inside the groups. However, at the same time, the possibilities of student's mutual assistance within groups are also reducing.

Students and other persons studying at RRSU. Favorable factors connected with DLT use. (***a***) Universities and specialties choice expanding for studying at full-time, part-time and mixed-mode. (***b***) The possibility for full-time students to take the second high education with the DLT use, including outside of the RRSU where they have full-time studies. (***c***) The best opportunities for full-time students to combine the work with the study. (***d***) Attracting additional contingents for post-graduate courses through the DLT, including from other regions. (***e***) For persons having higher education – expanding the opportunities for advanced training by choosing any universities and specialties, including those who live outside regions of their residence. (***f***) Reducing the number of

student trips to the university buildings provide the following advantages: saving on transportation costs; reduction of public transport risks during epidemics, especially by using minibusses; the exclusion of infection possibility in the university buildings.

Additional benefits of DLT using for the students living in other regions of Russia or abroad are connected with the reduction of trips to RRSU. (***a***) The risks of getting epidemic infections while traveling by intercity transport are eliminated or reduced; «motion sickness» with such a passage, getting colds due to drafts, violation of the sleep mode when traveling to long distances, etc. (***b***) The loads on the student's organisms associated with a change in climatic conditions during such trips are reduced; with changes in atmospheric pressure; with the existence of large amounts of pollen of unusual allergenic plants at the RRSU location; the risks of drinking water that is unusual in salt composition (if students do not use bottled water); effects of ionizing radiation influence on aircraft passengers during long flights.

Besides for the regions and for RRSU the absence of long-distance student travel reduces the risks of epidemiological diseases being transmitted across the borders of regions or of Russia.

Possible negative factors of DLT use for students studying at RRSU. (***a***) Students (especially working ones) often use DLT at night. Moreover, they are forced to work in low light in the rooms in which other persons live (for example children are sleeping). It can not only violate the biological rhythms of students but also impair their vision. However, the use of backlight keyboards can help to extend this unfavorable factor. (***b***) When using mobile devices with small monitors (smartphones, e-books, or small tablets) the load on the students' vision apparatus can significantly increase. It is especially important with small print and small sizes of images and/or formula in educational materials, with jolting in transport, with intense external illumination of monitors, etc. (***c***) The appearance of hypokinesia with long durations of work with desktop PCs and laptops. (***d***) A long stay in confined places including the presence of other persons applies first of all to the students living in city apartments. At the same time persons, which are living in cottages, can dispose of themselves for DLT use on summer verandas, near cottages, etc.

Students families. The DLT use makes it possible to reduce the number of the RRSU student's contacts with the "external" (with families) environment - it is especially important during epidemics. As a result, the risks of family member's infection through the "transfer" of student illnesses are also reduced. It is necessary to note some negative effects of the DLT use by students. (***a***) The student's frequent use of a single computer in the family can limit the possibilities for others to use it. (***b***) Increased risk of computer crashes that are used most of the day. (***c***) The use in families with children a single PC for games and entertainment can reduce the level of "reliability" concerning the use of it for DLT. (***d***) A student's permanent residence within a city apartment (especially with a small area) can significantly limit the amount of "available space" for other family members. It is especially important if students are "on self-isolation" during the period of AEMS introduction in regions or if they cannot leave the apartment due to the presence of diseases of the musculoskeletal system. At the same time, when families live in cottages, the "available space" restriction factor is less significant - especially in the spring-summer season. (***e***) Long students stay "at home" together with other family

members in confined spaces can, in some cases, lead to additional emotional and psychological stress due to the excessively large number of interpersonal contacts. (***f***) The closest contacts with other persons usually take place in families. Therefore, the infection risks in families are high enough – especially if a sick person cannot be allocated to a separate room for the disease period. As a result, under AEMS conditions introduction in populated areas, RRSU students, who temporarily leave their permanent residence places, can not only become infected themselves but also infect other family members - especially those with weakened immunity.

6 Conclusions

1. The DLT use at RRSU is an important technical tool to support the educational process. It has some advantages in terms of ensuring the accessibility of higher education, in some cases, it can improve the quality of education. For example, it applies to the use of additional training materials; opportunities for students to familiarize themselves with such materials at a convenient rate; to materials revision - if necessary. At the same time, unwanted emotional and psychological stresses associated with students' misunderstanding of the material in the process of education can be eliminated. It applies, in particular, to foreign students who do not speak Russian well enough; “poorly progressed” Russian students, etc.

2. At the same time, DLT use can lead to negative effects, especially concerning the quality of full-time student's education.

3. The expansion of the DLT use allows reducing the diseases spread possibility during epidemics - including within regions, settlements, student groups, and certain RRSU staff.

4. Besides, the DLT use can improve the "educational environment comfort" - especially for students with disabilities [11,13], including due to musculoskeletal system disorders.

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