

Students and teachers of a modern higher educational establishment: Ergonomic requirements and satisfaction in learning and work

Requisitos ergonómicos y satisfacción en el aprendizaje y el trabajo en estudiantes y profesores de un establecimiento de educación superior moderno

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ABSTRACT:

The manuscript is written on the social aspects of ergonomic requirements and indicators of the workplace of a teacher and student in a modern higher educational establishment. The manuscript tested the hypothesis that one of the reasons for the students' dissatisfaction with teaching and teachers' dissatisfaction with work is the failure to comply with the indicators and requirements of ergonomics.

Keywords: ergonomic requirements, work, satisfaction, teachers, students

RESUMEN:

El artículo describe los aspectos sociales de los requisitos ergonómicos y los indicadores del lugar de trabajo de un docente y un alumno en un establecimiento moderno de educación superior. Se probó la hipótesis de que una de las razones de la insatisfacción de los estudiantes con la enseñanza y la insatisfacción de los docentes con el trabajo es el incumplimiento de los indicadores y los requisitos de la ergonomía.

Palabras clave: requisitos ergonómicos, trabajo, satisfacción, profesores, estudiantes

1. Introduction

Due to political and economic changes in Russia, for a long time the social problems of higher educational establishments were not given due attention, including the problem of compliance with the national standard of the Russian Federation "General indicators and requirements in ergonomics", introduced for the first time and entered into force on January 01, 2016, performance of work activity as a teacher and educational activity by a student in

a modern higher educational establishment (GOST). Modern realities have proved the demand for the study of the ergonomics requirements in the education system by teachers and students, both in connection with the introduction of the Federal Law "On Education in the Russian Federation", and with the emerging tendencies of the need for creating comfortable and safe conditions for the development and teaching of students and work of teachers, that can serve as an object of research of teachers.

Students, making educational activities in modern higher educational establishments, are often unhappy with the created conditions of the learning environment and workplace, the available educational equipment, and with some types of educational activities. In the process of work, teachers complain of the disorganization of the work process, manifested in the non-use of the social aspect of ergonomic principles: to the modern working place of a teacher, to the educational equipment, to the educational accessible environment, to the filling and architecture of lecture halls. These factors indicate the presence of the problem of non-compliance of the normatively approved social aspects of ergonomic requirements to the realities of the student's educational activity and the work activity of teachers in a modern higher educational establishment. Their adherence, in turn, will improve health, well-being and satisfaction with the process of educating students and the work process of teachers, including people with health limitations.

In this regard, the pedagogical problem of studying the social aspects of ergonomics in a modern higher educational establishment is being updated as an important social institution capable of realizing at a high-quality level the social relations of students and teachers through the system of knowledge of the requirements of ergonomics in the education system and their interaction with socio-technical systems. Failure to comply with the requirements of ergonomics can lead to psychophysiological, mental, hygienic and other dysfunctions in students and teachers. Therefore, it is advisable to learn the opinions of students and teachers about the availability and implementation of ergonomic requirements in a modern higher educational establishment and to present the results of a study on such social aspects of ergonomics as ensuring the adequacy of mental load, temperature load, comfort of temperature conditions, physical environment of education, etc.

2. Materials and methods

Ergonomic requirements as a means of implementing and monitoring the implementation of social aspects of ergonomics in a modern higher educational establishment are designed to provide conditions for labor legislation. The normative documents adopted in the second half of the 20th century in Russia within ergonomic requirements in modern organizations are now becoming obsolete. There was a need to reopen their role and significance in a new way with the transition in the 90s of the 20th century into other conditions of labor activity. In conditions of informatization, computerization of the education system, active interaction of the participants in the educational process (students and teachers) with socio-technical systems (gadgets), the conditions and requirements for the social aspects of ergonomics in a modern higher educational establishment change.

The research was conducted in 2016 in Federal State Budgetary Educational Institution of Higher Education Tchaikovsky State Institute of Physical Culture (Perm Territory) and the branch of Federal State Budgetary Educational Institution of Higher Education Ural State University in Votkinsk (Udmurtia). 150 teachers and 300 third-year students were questioned on a formalized survey (answers options: agree, difficult to answer, disagree) to determine the general ideas about ergonomics and ergonomic requirements for students and teachers. The survey was to identify if students agree or disagree with the following statements:

- I am sure that I know the notion of "ergonomics",
- I am sure that my higher educational establishment adheres to ergonomic requirements,
- I am sure that I use ergonomic things in the process of work (study),
- I am sure that I am familiar with the standards in ergonomics, including the National Standard GOST R 56274-2014 "General indicators and requirements in ergonomics".

The analysis of the survey and interviewing results predetermined the use of the

3. Discussion

Ergonomics as a science that reveals the laws of work (Munipov and Zinchenko, 2001), usually both in Russia and abroad, was researched by engineers, designers, and later by psychologists, programmers and many others. In 2010, the Assembly of the International Association of Ergonomics proposed the following interpretation of this concept: "Ergonomics is a scientific discipline that studies the interaction of a person and a system, analyzing activities to ensure human well-being and optimizing the overall productivity of the system" (Okulova, 2012). Today, ergonomics has entered such fields of science as medicine, biology, economics, including pedagogy.

Foreign scientists are engaged in developing both common (Lee, 2015; Shackel, 1996) and private problems of ergonomics. A sufficient number of studies is devoted to the influence of ergonomic conditions on occupational health and safety (De Beeck, 2015), occupational and emotional exhaustion (Armstrong and Riemenschneider, 2011), professional stress of teachers (Blix, Cruise and Mitchell, 1993), etc. A significant number of foreign studies is devoted to the identification of satisfaction with the conditions of professional work of various professional communities: economists, librarians, and bank and office workers (Ikonne, 2014; Rabia, Mehwish and Abida, 2015; Tomovska et.al., 2014; Veitch et.al., 2007).

Today, the science of ergonomics is gradually beginning to study not only production work, but also a non-production process that is in the sphere of analysis of educational activity. In this sense, pedagogical studies of applying ergonomics will help improve the learning process.

Thus, the innovators, both in Russia and the near abroad, were actively engaged in the issues of ergonomics in the education system in different years of the post-Soviet period. Thus, in 1987, in Kaunas, V.K. Kuchinskias, while defending his thesis, justified the ergonomic foundations of the intensification of the educational process at a higher educational establishment (Kuchinskias, 1987). In 1994, in Minsk, V.N. Naumchik introduced the system of fundamental requirements of pedagogical ergonomics to the demonstration experiment means (Naumchik, 1994). In 1999, in Kyiv, S.A. Skidan proved the ergonomic foundations of the educational process in higher educational establishments (Skidan, 1999). In 2001, in Kazan, R.S. Safin introduced didactic bases for the design of ergonomic technologies for teaching engineering and construction students (Safin, 2001). These ergonomic studies proposed to study educational activity of students and work activity of teachers within a separate part of ergonomics, as a new field of knowledge called "pedagogical ergonomics", which today can become an intra-branch direction in the study of the sociology of education. In the authors' terms, pedagogical ergonomics means a set of achievements of the complex of sciences, consisting of several elements, namely: pedagogical work and work of a student, learning environment and advanced pedagogical experience, modern technical means used in the educational process (Okulova, 2011).

From the point of view of the educational ergonomics, the core of the pedagogical ergonomics study is the modern higher educational establishment, as a social institution. The educational work of students and professional work of teachers at higher educational establishments play the role of social relations of education subjects, reflecting the development of the social system.

4. Results

The quantitative results of the survey of students and teachers are presented in Tables 1, 2.

Table 1
Distribution of teachers' answers to the survey

Answer options:	Question 1	Question 2	Question 3	Question 4

	People	%	People	%	People	%	People	%
Agree	135	90	105	70	135	90	9	6
Difficult to answer	9	6	15	10	15	10	45	30
Disagree	6	4	30	20	0	-	96	64

Based on the survey and in order to reveal the essence and full understanding of previously received formalized answers, a selective interview was conducted with the responding teachers (direct interview).

The analysis of the obtained results allowed for making the following conclusions: teachers are sure, however as they would rather like to be, that they are familiar with the concept of ergonomics, or they think that they have an idea about this, although in reality they have the most general idea about it. When answering the second question, teachers believe that the higher educational establishment cannot fail to comply with ergonomic requirements, since the relevant monitoring bodies constantly check higher educational establishments and if a higher educational establishment did not fulfill any of the requirements, including ergonomic requirements, the higher educational establishment would not function, so they answered affirmatively. Answering the third question, the teachers answered in the affirmative, as they wanted to believe that their workplace, keyboard, etc. are equipped with ergonomic things, although the teachers did not meet with genuine ergonomic things and the teachers did not attach importance to ergonomic things. When answering the fourth question, the overwhelming majority of the teachers answered that they were not familiar with the National Standard for Ergonomics, and added that they would certainly familiarize with it.

Table 2
Distribution of students' answers to the survey

Answer options:	Question 1		Question 2		Question 3		Question 4	
	People	%	People	%	People	%	People	%
Agree	30	10	30	10	80	60	0	-
Difficult to answer	30	10	240	80	30	10	9	3
Disagree	240	80	30	10	90	30	291	97

Based on the obtained results, a selective interviewing (direct survey) was also conducted with the responding students, revealing the essence of the answers received earlier.

The analysis of the obtained results allowed for making the following conclusions: The vast majority of students are not familiar with the concept of ergonomics, but would like to know about it. Since students do not know anything about ergonomics, when answering the second question, the overwhelming majority of the responding students found it difficult to answer. Answering the third question, more than half of the responding students answered in the affirmative, as they were sure that their ignorance of ergonomics does not mean that they do not use ergonomic things, they just do not know about it. When answering the fourth question, almost all the students answered that they were not familiar with the National Standard for Ergonomics, only 9 students suggested that they probably heard about the standard.

Thus, from the standpoint of ergonomic requirements, it is advisable to examine in detail the changes and trends in the implementation of the social aspects of ergonomics in a modern

university in accordance with the standards of ergonomics.

Based on the ergonomics standard (GOST R 56274-2014), the authors investigate some ergonomic requirements and indicators applicable in a modern higher educational establishment.

Accessibility of the educational environment includes the following physical conditions: temperature conditions, lighting, noise, common placement and arrangement of furniture. The listed attributes are basic for respondents and essential for assessing comfort and convenience in the process of work and education.

Table 3
Teachers assessed physical parameters of provision comfort and convenience at work

Conditions of comfort and convenience	Good		Average		Low		Comfort and convenience index
	People	%	People	%	People	%	
Temperature conditions	111	74	12	8	27	18	4.12
Lighting	126	84	21	14	3	2	4.64
Noise	87	58	21	14	42	28	3.60
Common placement and arrangement of furniture	96	64	18	12	36	24	3.80

Table 3 shows that at least 74% of teachers believe that the temperature conditions are met. In the course of the subsequent selective interviewing, it was discovered that 18% of teachers are not satisfied with the temperature in lecture halls, because, in their opinion, temperature conditions are violated in the spring-summer period (there is no cooling system), the autumn-winter period (it is cool by internal sensations, which results in frequent colds). At least 84% of teachers are satisfied with the available lighting in lecture halls, and at the subsequent selective interviewing, 2% of responding teachers indicated total control by the management on energy saving. At least 58% of teachers indicated persistence of silence, absence of extraneous noise at work, 28% of teachers at the subsequent selective interviewing named the "eternal" repair of the building as one of the reasons of noise. At least 64% of teachers consider the available placement and arrangement of furniture in lecture halls and departments acceptable, and 24% of teachers at the subsequent selective interviewing indicated that with the introduction of active education forms, it would be necessary to change the placement and arrangement of furniture in lecture halls. It can be inferred that almost a quarter of responding teachers are not satisfied with at least two attributes for providing comfort and convenience in the work process.

Table 4
Students assessed physical parameters of provision comfort and convenience at learning

Conditions of comfort and convenience	Good		Average		Low		Comfort and convenience index
	People	%	People	%	People	%	
Temperature conditions	162	54	78	26	60	20	3.68
Lighting	114	38	87	29	99	33	3.10
Noise	252	84	15	5	33	11	4.46

Common placement and arrangement of furniture	39	13	186	62	75	25	2.76
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Table 4 shows that at least 54% of students are satisfied and feel comfortable with the temperature conditions; at least 20% of students believe that the temperature conditions are uncomfortable and associate it with a lower temperature mode, which forces them to stay in outer clothing in the lecture halls. At least 38% of students consider the lighting at classes convenient and comfortable, at least 33% of responding students consider the level of illumination in the classrooms uncomfortable, more related to the economy of electricity management of the university. 84% of students believe that the noise level does not interfere with them and is comfortable in the learning process, at least 11% of responding students are sure that the noise level is most often increased due to unplanned repairs in the higher educational establishment. More students are dissatisfied with placement and arrangement of furniture in lecture halls. Thus, only 13% of responding students believe that arrangement of furniture in lecture halls is convenient and comfortable, and at least 75% of responding students believe that the existing placement of furniture is inconvenient. Thus, it infers that the index of comfort and convenience is the lowest in 4 parameters, namely: placement and arrangement of furniture. Students would like to arrange and place desks and chairs not only in rows, but also to change the configuration of their arrangement (amphitheater style, semicircular amphitheater, V-shaped amphitheater, circular arrangement, incomplete circle, conference style, square arrangement, hollow square, "round table", etc.), reduce the number of desks and chairs, consider anatomical and physiological parameters of students because, firstly, they would like to see their interlocutors-classmates, and secondly, the last rows can barely hear and see the teacher.

2. Mental external load include the following factors: short-term: fatigue, monotony, reduced vigilance; long-term: exhaustion, chronic fatigue (burnout). Both teachers and students are subject to the listed psychological and social factors of mental stress. The measurement of these factors was carried out for the psychological assessment of comfort and convenience in the processes of work and learning.

Table 5
Teachers assessed mental external load factors to make a psychological assessment of comfort and convenience level in the work process

External mental load factors	Always		Rarely		Never		External mental load index
	People	%	People	%	People	%	
Short-term: fatigue, monotony, reduced vigilance	114	76	15	10	21	14	1.76
Long-term: exhaustion, chronic fatigue (burnout)	6	4	36	24	108	72	4.36

Table 5 shows that at least 76% of teachers experience short-term fatigue, monotony. At the subsequent selective interviewing, responding teachers indicated that the constant increase in work amount, not included in the functional duties, leads to psychological exhaustion. In this regard, two teachers plan to change their professional activities. At least 4% of teachers believe that they experience long-term exhaustion and chronic fatigue, and at subsequent selective interviewing it was discovered that one of the teachers with a ten-year work experience plans to take an annual leave without pay, and perhaps at that time the teacher will try to open business in the education sphere. Thus, it infers that the teachers like their professional activity, but the overwhelming burden of increasing amount of non-educational, scientific and methodological work forces teachers to look for other activities, sometimes leading to a change of profession.

Table 6
Students assessed mental external load factors to make a psychological assessment of comfort and convenience level in the learning process

External mental load factors	Always		Rarely		Never		External mental load index
	People	%	People	%	People	%	
Short-term: fatigue, monotony, reduced vigilance	87	29	36	12	177	59	3.60
Long-term: exhaustion, chronic fatigue (burnout)	-	0	9	3	291	97	4.94

Judging by Table 6, at least 29% of students experience short-term fatigue, monotony, a decrease in vigilance. At the subsequent selective interviewing it was discovered that the educational process causes fatigue for almost one third of students. Students would like to make the classes more interesting and diverse. At least 59% of students are confident that they do not experience fatigue and exhaustion in the learning process, different types of activities in the learning process (educational, educational, sports, etc.) allow them for successful education and receiving the required professional competencies. None of the students experiences chronic fatigue.

3. Conditions of using a workplace includes the following indicators: educational equipment, educational technology (ET), methodological materials, learning environment (comfortable, convenient, and safe). The listed information and technological conditions include a minimum set of parameters for assessing the state of comfortable and safe working conditions and learning process.

Table 7
Teachers assessed the conditions for using the workplace to make an information and technological assessment on the state of comfortable and safe working conditions

Workplace usage conditions	Always		Partly		Never		Workplace usage index
	People	%	People	%	People	%	
Educational equipment, educational technology (ET), teaching materials	117	78	24	16	9	6	4.44
Learning environment (comfortable, safe)	87	58	27	18	36	24	3.68

Table 7 shows that at least 78% of teachers believe that the teaching equipment used at the workplace, educational technology, and methodical materials are certainly convenient and comfortable. At least 6% of teachers indicated that this technology should be expanded and modernized, since today the workplace of a teacher includes a computer with access to the Internet. When assessing the learning environment, at least 58% of teachers answered that they were satisfied with the conditions of using the workplace and consider it comfortable, convenient and safe. At least 24% of teachers believe that the conditions for using the workplace within the learning environment should be made more convenient, comfortable and safe, for example, automating each workplace of a teacher and student with a computer with the access to the Internet, and using distance and electronic forms of teaching more actively. Also, teachers noted that it is necessary to expand the set of information and technological conditions for students with health limitations, actively develop an accessible

environment, as the number of students with health limitations increases in higher educational establishments.

Table 8

Students assessed the conditions for using the workplace to make an information and technological assessment on the state of comfortable and safe working conditions, while learning

Workplace usage conditions	Always		Partly		Never		Workplace usage index
	People	%	People	%	People	%	
Educational equipment, educational technology (ET), teaching materials	210	70	36	12	54	18	4.04
Learning environment (comfortable, safe)	135	45	99	33	66	22	3.46

Table 8 shows that at least 70% of students consider the conditions for using the workplace within educational equipment, educational technology, and methodical materials as convenient and comfortable. At least 18% of students would like to use of Internet at classes more actively, which requires free access and automated student's workplace (AWS), as well as expansion of the information technology services range, in particular, scanners, printers, cameras, camcorders, etc. At least 45% of students believe that the created educational environment of a modern higher educational establishment is comfortable, convenient and safe. At least 22% of students would like to see the learning environment more convenient and comfortable. Thus, at the subsequent selective interviewing of students, it was discovered that the information and technological conditions of the workplace should be expanded in terms of using gadgets with Internet access, which students brought, at classes. Using gadgets at the class allows students for obtaining in real time the required information, and allows the teacher for teaching this to the student. Also, students indicated that often it is students, who teach teachers of the newly emerged information and technological developments and ways of using them.

4. Adaptability includes the following factors: the opportunity to make changes in the learning environment (move back, change a posture, open a window, make a break, change learning pace, etc.), in the work process (transformation of the higher educational establishment, department, expansion of the functional duties, responsibility, any changes in the working environment). The listed organizational conditions reflect the level of assessment of the comfortable and safe conditions state for students' adaptation in the process of education and teachers in the process of work.

Table 9

Teachers assessed organizational conditions for adaptation of the workplace to assess the state of comfortable and safe work conditions

Workplace adaptation conditions	Always		Partly		Never		Workplace adaptation index
	People	%	People	%	People	%	
Transformation of a higher educational establishment, department: expansion of functional duties, responsibilities, any changes in working environment	78	52	39	26	33	22	2.40

Table 9 shows that at least 52% of teachers successfully adapt to a higher educational establishment and consider the created organizational conditions comfortable and safe for

	People	%	People	%	People	%	
Audible information	210	70	30	10	60	20	4.00
Visual information	207	69	33	11	60	20	3.98
Multimedia	279	93	15	5	6	2	4.82

Table 12 shows that two-thirds of the surveyed students consider the information and technological conditions of information content of workplace in the learning process as comfortable and safe. At least 20% of students indicated that the equipment in some lecture halls has very weak sound, also the screen with educational films is, most often, small, which makes it difficult sometimes to see the formulas or characters in detail. 2% of students indicated that they lacked colors in presentations, shown with the help of multimedia.

5. Conclusion

Thus, it can be inferred that the vast majority of teachers and students of a modern higher educational establishment most often are not familiar with the requirements of ergonomics. In this context, it is appropriate for teachers to master the "Ergonomic requirements of the modern educational process in a higher educational establishment" course within the framework of advanced training courses, and similarly for students it will be useful to attend the "Ergonomics of education" course. Thus, it can be inferred that a modern higher educational establishment often has no conditions for work and rest for teachers and students.

The experiment where teachers measured satisfaction of their work based on five ergonomic requirements revealed that the creation and maintenance of convenient, comfortable and safe working conditions are hindered by the following factors:

- Noise level, most often, by reason of unplanned repairs of the building, forces a teacher to strain their voice; irrational placement and arrangement of furniture in the departments, not always a teacher has own separate workplace, including automated, also often a teacher shares the workplace with another teacher, which forces both to do most of the methodological, consulting, educational and other work at home;
- Permanent short-term fatigue and monotony lead to a decrease in educational services quality, including the thoughts to change the profession;
- Non-automated workplace, extremely low set of information and technological conditions, especially when working with students with health limitations does not allow for complete implementation of the full range of educational services in teaching students;
- Uninterrupted transformation in the higher educational establishment, merging of departments, expansion of functional duties and responsibility of the teacher, etc. lead to formal performance of their work;
- Bad acoustics in the lecture halls decreases the education quality.

The experiment where students measured satisfaction of their study based on five ergonomic requirements revealed that the creation and maintenance of convenient, comfortable and safe study conditions are hindered by the following factors: 1) inefficient placement and arrangement of furniture in lecture halls, in particular, at lectures result in poor sound quality for students at last rows, also they cannot see the presentation screen; invariable configuration of tables and chairs arrangement at practical classes does not allow students for full experiencing the spirit of the group's cohesion and reveal them completely at the class; 2) short-term fatigue and monotony while learning, which is a consequence of the previous factor, result in a decreased interest in learning; 3) a narrow set of educational technologies in classes, a frequent ban on using gadgets in the learning process, as well as low awareness of teachers in innovations in information and communication technologies, hamper the learning process; 4) students also believe that conservative teachers hamper successful adaptation in the workplace; 5) non-adherence to the acoustic requirements in a

lecture hall, a small screen showing educational films and presentations reduces satisfaction with the learning process.

Adherence to ergonomic requirements in a modern higher educational establishment will improve the health and well-being of students and teachers, allow for consistent improvement of performance, productivity and work satisfaction of students and teachers.

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