Hygienic Characteristics of Teaching Staff Labor Conditions in Different Universities of the Republic of Uzbekistan

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Abstract

The article is devoted to the study of the professional activities characteristics of university teachers, the possible risk factors that affect the state of teacher's health in the course of his work are considered, solutions for protecting the health of the teaching staff and the increase in the labor efficiency of teachers of higher educational institutions are proposed.

It was revealed that the actual time costs of teaching staff exceed the established standards of the teacher's working time; however, the teacher's work does not have clear regulation (except for scheduled classes); all types of work performed take up 95% of the working time and are integral elements of the teacher's activities. A general assessment of working conditions by the tension level, the harmfulness and danger degree, performed in accordance with SanPiN 0141-03, considering the most significant factors (the labor process intensity), allows to classify the labor of university professors in our republic as class 3 (harmful), 3 degrees of harmfulness.

Keywords: *Teacher, professional activity, working day timing, working conditions, fatigue, health.*

Introduction

Ensuring the safety of life and health of workers by improving working conditions in the labor process is one of the most important tasks of our State. The work of university teachers belongs to a field of activity that is not directly involved in the production process but continues to be one of the most widespread varieties of mental labor. It is well known that mental stress leads to fatigue much faster than physical ones[1]. Today in our country more than 22 thousand teachers share their knowledge with students.

What our country and the younger generation will become tomorrow, directly depends on those who teach us. The teacher in a higher educational institution (university) is a key figure in the educational process, the effectiveness of which is determined not only by the teacher's professional competence but also largely depends on his physical health.

The teaching profession deserves comprehensive and in-depth study, as it has several characteristic features. After analyzing a large number of literature sources, we can say that today the work on studying the working conditions of teachers of higher educational institutions, assessing their health status is extremely insufficient and they relate mainly to the period of 60-80s of the last century. In these works, adverse sanitary and hygienic working conditions of educational institutions' teachers were noted due to the mismatch of microclimate parameters in the classrooms in the winter, insufficient level of artificial lighting in the classrooms. A decrease in the education financing level in the 90s of the last century led to a reduction in the construction of new classrooms, laboratories and complexes, the impossibility of repairing and rehabilitating existing ones, replacing equipment, furniture, and ensuring the required levels of lighting and air-thermal conditions in lecture halls. In addition, in recent years there has been

a significant change in the labor process in educational institutions due to the introduction of some innovations in the educational process, and the teachers' working conditions remained the same as 20-30 years ago[2].

Now, a fairly limited number of studies have been conducted on the health of universities' teaching staff and the factors that shape the health[3], however, based on these works, we can conclude the significance of this kind of research.

The aim of research: Study and assessment of teaching staff's working conditions in various universities of the Republic of Uzbekistan.

Research Method

The objects of research were 3 largest universities of the Republic, located in Tashkent - the National University of the Republic of Uzbekistan named after Mirzo Ulugbek (NUUz), the Tashkent Medical Academy (TMA) and the Tashkent State Technical University named after Islam Karimov (TSTU), as well as the faculty of these educational institutions.

The assessment of social factors affecting teaching staff was performed according to the survey-questionnaire results of 430 teachers (15.9% of the average teachers' number among the three universities studied); the survey was based on a questionnaire recommended by the WHO regional office. To assess the content and intensity of teaching staff work, the working hours were timed (10-12 teachers in each university). Hygienic working conditions are studied in each university at the main workplaces; microclimate indicators (by seasons - 95 measurements), lighting of workplaces (88 measurements), noise level (90 measurements), electrostatic field (16 measurements), the number of aero ions in 1 m^3 of air (28 measurements), its anthropogenic pollution (content CO2 - 123 measurements), radiation environment (radon content, radiation dose rate - 30 measurements). Studies of hygiene factors were performed by generally accepted instrumental and laboratory method; all research results were subjected to statistical processing with the calculation of indicators M±m, and their assessment - according to the relevant SanPiNRUz.

Results

Work content and teaching staff employment level during the working day: During scientific research, we had the opportunity to compare the organization and working conditions of the teaching staff in our republic and in South Korea. During 2017-2019, in TMA, in the framework of international cooperation with the *State University of South Korea*, *3 business visits* of the teaching staff were organized (with our participation) to the above mentioned university in order to familiarize themselves with the organization and conduct of the educational process at the *State University of South Korea*.

During the working meetings, attention was paid to the peculiarities of the teaching staff and the organization of student tutoring. It was noted that the educational process is performed in well-equipped rooms with a favorable microclimate, good ventilation, proper lighting, and physiologically adapted furniture. With all types of work performed, there is widespread computer equipment use, and modern technical equipment and laboratory equipment are applied during the educational process. The teaching process is performed in accordance with very dynamic programs that consider both modern knowledge and requirements for specialists, and the wishes of students (master's program). Teachers perform only those tasks that require teaching, and the schedule of their work is not rigid, although in general the teaching load of teachers is quite large. The profession of a university teacher is considered very prestigious and, accordingly, the teacher's work is highly paid.

An important feature of the universities' teaching staff work of in our republic is that due to the versatility of the teacher's functions, he is forced to constantly change his workplace, so during the working day he can work in the classroom, in the office, in the laboratory, in the vivarium, in the hospital ward (medical university), in a hostel, etc.

To characterize the work content and the employment degree of the modern university teacher in Uzbekistan, we conducted a direct timing of the teacher's working day in each university under study. The study involved 9-12 teachers in each university, after which the averaging of the teaching staff in general was performed.

Timekeeping of the teacher's working day in all the universities studied has shown that the university teacher's work is currently characterized by a very wide range of work. In addition to classes with students in accordance with the schedule, the teacher performs many different types of work related not only to the

main areas of his activity. This includes preparation for lectures, workshops, seminars, advisory work, work with lagging students, a large amount of methodological work, scientific research, educational work, fulfilling public assignments, preparing reference and reporting materials, etc. All these activities are associated with the need of working with literature, applying modern information technologies and modern office equipment, working with a huge amount of information that requires analysis and relevant conclusions. It should be noted that, in addition to classes that are strictly regulated by the schedule, it is almost impossible to regulate other types of the teacher's work - they are performed either as necessary, or considering the temporary capabilities of the teacher.

The determination of the time spent on the performance of certain work types showed that for 80% of the teachers included in the study, the working day goes beyond the statutory 6-hour working day. The average statistical indicators of the teacher's time spent on various work types are characterized by Table 1.

Table 1: The results of the working timing day of a university teacher, M±m (n=20)

No	Work implemented	Actual elapsed time, hour (min- ′)	% of total time
1.	Lecturing	0,4±0,1 (24′)	4,6
2.	Lecture preparation, including presentation preparation	0,2±0,1 (12′)	2,3
3.	Conducting practical (seminar) classes	3,0±0,5 (180′)	34,5
4.	Preparation for practical exercises (laboratory base, handouts)	0,5±0,3 (42′)	8,0
5.	Preparation of training documentation, rating calculations	0,5±0,3 (48′)	9,2
6.	Consulting work	0,2±0,1 (12′)	2,3
7.	Verification of student work	0,3±0,1 (30′)	5,7
8.	Work on the Internet (reference materials, new data)	0,5±0,1(30′)	5,7
9.	Reception of missed classes	0,2±0,1 (12′)	2,3
10.	Preparation of materials at the request of deans, administration, scientific part, ministries, etc.	0,5±0,2 (30′)	5,7
11.	Preparation of teaching materials	0,5±0,2 (30′)	5,7
12.	Scientific work (Internet, library, collection of scientific data)	0,6±0,2 (36′)	6,9
13.	Educational work (curatorial, visiting dormitories, extracurricular activities)	0,2±0,1 (12′)	2,3
14.	Lunch break, personal distractions	0,4±0,2 (24′)	4,6
	Total	**8,0±0,2 час**	**100**

The data presented allow to determine that the teacher spends 95.0% of the total working time for all types of work, which is already 2 hours longer than the officially established working time of the teacher.

At the same time, it was revealed that the work of teachers is mainly accompanied by a static muscular load while in 30±4.6% of the working time in a free working position (standing or sitting), which allows us to characterize such work as a lightly stressed light physical work (except for physical teachers education, as well as teachers of certain medical disciplines (surgeons, traumatologists) requiring significant physical effort) - class 1b in SanPiN 0325-16.

When assessing the nervous load, it was determined that the teacher's work is characterized by high tension, due to both the mandatory fulfillment of the class schedule and the lack of time, increased responsibility for the work results, prolonged strain of visual functions, the need for large random access memory (a set of many changing elements that must be memorized during hours and a working day), high intellectual stress associated with performing creative work, frequent unrepeatable stressful situations when working with a large and diverse student population. The indicated labor characteristics of the teaching staff allow to determine the intensity of such work as hazardous (very hard) work of 3 degrees (SanPiN 0141-03).

It can be assumed that the teacher's actual work schedule in the universities under study, even with favorable hygienic factors of the working environment, can have an adverse effect on the body and, above all, on the central nervous system (CNS). It should be borne in mind that a high neuropsychic stress for a teacher is a factor affecting his body every day throughout the entire academic year and throughout his work at a university.

Hygiene factors' characteristics in workplaces: Based on the timing of the working day, we can assume that the main jobs of the teacher are classrooms and study rooms, and therefore, to characterize the main hygienic factors of the teaching staff environment, we studied these factors precisely in classrooms, laboratories and study rooms.

During a visual examination of these workrooms, it was noted that the rooms dimensions generally meet hygiene requirements. At the same time, despite the fact that the main part of the investigated premises is located and equipped in specially constructed buildings, violations of hygiene requirements were noted at many workplaces. Most often this relates to insufficient ventilation of the premises, the presence of idle lamps, non-compliance with the hygienic requirements of the furniture used, malfunctions of the water supply and sewage, i.e. the operating conditions of buildings and premises.

To characterize hygienic working conditions, we evaluated the microclimate, the workplaces illumination, the noise level, the electromagnetic field magnitude, the carbon dioxide concentration, measured the dose rate of external radiation and the content of radon in the working area air.

The microclimate parameters of the premises, which we studied in the cold and warm periods of the year, are presented in Table 2.

It was revealed that in the cold season the optimal parameters of air temperature as the main indicator of the microclimate take place only in the clinic, which is understandable, since for patients the requirements for the microclimate are more stringent. In all classrooms at the school day beginning, the air temperature was 4-5 degrees below the optimal values and approached those only at the end of the day. At the same time, in no case have we recorded air temperature below the established SanPiN 0324-16 border for the cold season (170 C). With regard to air humidity and its speed, the parameters of these indicators in all cases were within the established hygiene standards.

In the warm season, the air humidity at the measured points was within acceptable limits, but the air temperature was 1-4 degrees higher than the optimal parameters. The air movement speed in all rooms was 1.5-2 times lower than the recommended values. The indicated microclimate parameters in the warm season can be the cause of some tension of the thermoregulation function and increase the already high emotional stress level of teachers.

The work of most university teachers is associated with the need for long-term high voltage of the vision organs, with objects of discrimination 0.3-0.5 mm (fonts), high contrast on a light background, which allows to classify this work as a 3rd category of high-precision work, sub-category "G" (KMK 2.01.05- 98 "Natural and artificial lighting"), for which the normalized value of daylight factor with natural side lighting is 1.2, and the general level of illumination of workplaces is 200 lx (fluorescent lamps).

Table 2. The microclimate parameters of educational facilities in the universities studied in the cold and warm seasons

University	Place of measurements	Cold season,M±m			Warm season, M±m		
		Air temperature, °C	Air humidity, %	Air speed, m/s	Air temperature, °C	Air humidity, %	Air speed, m/s
TMA	Building 1	18,3±3,1	71,3±4,8	0,2±0,04	27,4±1,2	54,3±1,2	0,1±0,08
	Building 3	17,8±2,2	72,6±5,2	0,3±0,04	26,8±2,4	51,8±2,3	0,1±0,09
	Clinic (Department of Cardiology)	20,1±1,1	70,4±6,1	0,1±0,05	25,2±3,1	54,2±2.4	0,1±0,07

University	Place of measurements	Cold season,M±m			Warm season, M±m		
		Air temperature, °C	Air humidity, %	Air speed, m/s	Air temperature, °C	Air humidity, %	Air speed, m/s
NUUz	Building 1	17,2±2,2	71,6±5,1	0,2±0,06	26,4±2,2	60,0±0,8	0,2±0,04
	Pavilion 2	18,1±3,1	72,4±5,1	0,3±0,04	27,5±2,4	54,3±0,8	0,3±0,01
TSTU, main building	1st floor	17,1±2,2	73,0±1,5	0,3±0,09	26,2±0,8	55,6±0.9	0,3±0,08
	2nd floor	17,5±2,4	70,8±2,6	0,3±0.07	27,1±0,9	59,1±0,9	0,4±0,04
Hygienic norm (SanPiN 0324-16)		Optimal-21-23 Permissible-17-25	40-75	0,1-0,2	Optimal-24-26 Permissible-22-32	40-60	0,3-0,6

In the premises examined, the workplaces illumination parameters were determined both by the nature and purpose of the premises, their orientation, and the time of day and year (Table 3).

The best lighting parameters were identified in NUUz and TSTU, which are built according to individual projects developed for these universities. Both the daylight factor value and the combined illumination level of classrooms in these universities mainly correspond to hygienic standards, but the artificial lighting level in 32% of cases was 60-70 lux lower than hygienic requirements. This is mainly due to the fact that in some audiences there are faulty lamps.

As for TMA, we have studied the premises of buildings 1 and 3, which are the premises of former dormitories adapted for classrooms. In the studied rooms, the daylight factor value was 25% lower than the norm, and therefore artificial lighting is widely used in these buildings, which makes it possible to bring the general illumination level of classrooms to a hygienic norm. In the absence of artificial lighting, the level of illumination is 90-120 lux, which greatly complicates the work of both teachers and students.

Table 3: The illumination state of teachers' jobs in the universities studied, M±m

University	Place of measurements	Number of measurements	Daylight Indicators		The illumination level of working places	
			Room orientation	Daylight factor	Combined lighting, lux	Artificial lighting, lux
TMA	Building 1	14	East	0,8±0,1	170±50	150±60
	Building 3	14	Southwestern	0,9±0,1	170±48	154±50
	Clinic	10	Northeastern	1,1±0,1	134±60	132±60
NUUz	(Department of Gastroenterology)	10	Western	1,3±0,2	184±40	130±40
	Building 1	10	Northwestern southwestern	1,4±0,3	180±50	140±40
TSTU, main building	Building 2	10	Northeastern	1,4±0,2	180±49	140±38
	1st floor	10		1,5±0,2	188±50	138±42
	3rd floor	10	Northeastern	1,8±0,2	180±49	140±40
Hygienic norm (KMK 2.01.05-98)				1,2		200

No sources of intense noise were found in all the educational institutions studied - the noise level in the premises is mainly due to the presence of a large number of fairly active young people, whose communication, especially during breaks, creates a noise background in the rooms, which can be characterized as intermittent broadband noise. The measured total noise level in classrooms and classrooms (n = 12-14 in each university) during classes was 50±8 dBA, and during breaks - 60±7 dBA, which corresponds to hygiene requirements for highly skilled work requiring concentration (60 dBA according to SanPiN No. 0325-16). At the same time, attention is drawn to the fact that in the TMA buildings 1 and 3, in rooms whose windows face a street with heavy traffic, the noise level averages 72±4 dBA, reaching 85-87 dBA in separate time intervals (building 1), which is 12-27 dBA higher than the established hygiene regulations.

The widespread use of computer technology in various educational institutions suggests the possibility of forming electrostatic fields in the area of their location. We measured the electrostatic field value in the area where computers of both the old type (CRT screens) and new generations (LCD screens) are located. In accordance with SanPiN RUz No. 0303-12, when working on a computer for up to 8 hours, the permissible electrostatic field value should not exceed 10 V/m. Measurements made by us at the TMA Department of Communal Hygiene and Department of Informatics (16 measurements) showed that in the area where computers with CRT screens are located, the electrostatic field is 7.4±0.3 V/m, and with LCD screens - 2.05±0.5 V/m.

In most classrooms of the universities under research there are no man-made sources of intense chemical air pollution, but during some laboratory studies small amounts of various chemicals can be released into the air, and therefore, such laboratories must be provided with effective ventilation, including equipment for working fume hoods. During our research, we considered the fact that such equipment is practically absent in classrooms.

When conducting research, we did not reveal any classrooms of artificial chemicals in the air, which, in our opinion, is due to the fact that only demonstration chemical studies were conducted in classrooms during this period. At the same time, in the air of classrooms, we constantly revealed chemical components of anthropogenic origin - carbon dioxide, ammonia.

Table 4: Carbon dioxide concentration in classrooms, %, M±m

University	Time of measurements	Warm season		Cold season	
		Number of measurements	M±m	Number of measurements	M±m
TMA	Before class	15	0,05±0,01	12	0,08±0,03
	12^{00} - 13^{30}	15	0,12±0,08	12	0,09±0,03
	16^{00} -16^{30}	15	0,16±0,08	12	0,21±0,06
NUUz	Before class	12	0,04±0,01	10	0,06±0,09
	12^{00} - 13^{30}	12	0,08±0,02	10	0,09±0,03
	16^{00} -16^{30}	12	0,12±0,04	10	0,18±0,08
TSTU	Before class	14	0,04±0,01	11	0,06±0,02
	12^{00} - 13^{30}	14	0,11±0,06	11	0,14±0,05
	16^{00} -16^{30}	14	0,16±0,07	11	0,18±0,06

The determination of an indirect indicator of anthropogenic air pollution in classrooms - carbon dioxide - at various time intervals (Table 4) indicates that, both in the warm season and in the cold season, natural ventilation of the premises does not provide the necessary air purity. The CO2 concentration, indicating the absence of anthropogenic air pollution in residential and public buildings, is assumed to be 0.1% or lower. According to our data, such carbon dioxide concentration in classrooms is only before classes and, partually, in the classroom. By the end of the school day, an increased CO2 concentration (up to 0.24%) is detected in almost all classrooms.

The airborne content of the air ions indicates air pollution throughout the working day (Fig. 1.).

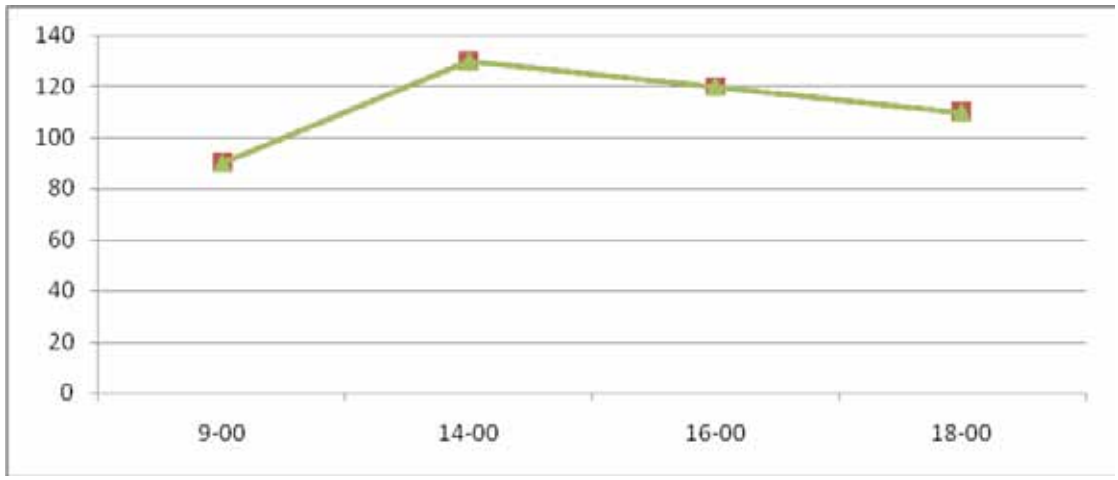

Fig. 1. The dynamics of the positive ions number in 1 m^3 of TMA classrooms air during the day.

Low-quality ventilation of classrooms is also evidenced by the results of measuring the concentration of radon in the air of these rooms (Table 5).

Table 5: The concentration of radon in the air of classrooms, Bq/m^3

University	Place of Measurements	Level	Number of Measurements	Concentration of Radon, M±m
TMA	1-Educational building	1	7	40,8 ± 4,5 Бк/м^3
		3	7	38,8 ± 3,8 Бк/м^3
		4	7	30,8 ± 2,5 Бк/м^3
	3- Educational building	1	7	39,8 ± 3,5 Бк/м^3
		3	7	34,6 ± 2,9Бк/м^3
		4	7	30,2 ± 5,1 Бк/м^3
	TMA hospital (Department of Cardiology)	2	7	36,7 ±,5 Бк/м^3
NUUz	Building 1	1	6	44,1 ± 4,5 Бк/м^3
	Building 2	2	6	35,8 ± 2,5 Бк/м^3
TSTU	Main building	1	6	40,6 ± 6,6 Бк/м^3
		3	6	31,8 ± 2,7 Бк/м^3
		5	6	30,5 ± 4,5 Бк/м^3

According to Zaredinov D.A. (2001), the average radon content in indoor air in the Republic of Uzbekistan is close to the national average - 30.8+3.5 Bq/m^3, but higher concentrations of radon are detected on the first floors of multi-storey buildings, where the underlying source of radon is : on the 1st floor up to 48.5 + 2.9, above - up to 25.7 + 1.6 Bq/m3.

The data obtained by us indicate that, despite the absence of high values of the measured indicators, their dynamics indicates a gradual deterioration in the quality of the air in the classrooms during the working day. These data reflect not only the quality of ventilation, but also the radiation exposure due to radon.

The level of general unprofessional radiation exposure on a person is determined not only by the incorporation of radon, but also by external background γ - radiation. The gamma background measured by us at the university premises was in TMA (n = 20) - 18-26 μR/hour, NUUz (n = 16) - 16-21 μR/hour, TSTU (n = 14) - 16-22 μR/hour.

We did not reveal higher indicators of external

exposure in computer labs in which the measured dose rate of external exposure was 23.5±2.8 μR/h. Only at one of the TMA departments (the former Department of General and Radiation Hygiene) during classes in radiation hygiene, during which a demonstration of exemplary radiation sources is conducted, a radiation dose rate of up to 42 μR/hour is recorded directly near the teacher's hands.

According to Zaredinov D.A. (2001), in our republic, the exposure dose rate of gamma radiation outdoors is 13 mcr/h-1, whereas in rooms it is higher (up to 23 mcr/h-1); our data confirm the results of D. Zaredinov's studies and indicate that the external gamma radiation level in the educational premises of universities is small and does not go beyond the background radiation, typical for the climatic and geographical conditions of the republic.

The above radiation factors characteristics, measured at the main teaching staff's workplaces in universities, allow to classify working conditions by this factor as optimal values that do not have a harmful effect on the body of workers.

Conclusions

Thus, the study of the universities' teaching staff content and the hygienic conditions of their work allows to draw the following conclusions:

1. The actual time costs of teaching staff exceed the established standards of the teacher's working time; however, the teacher's work does not have clear regulation (except for scheduled classes); all types of work performed take up 95% of the working time and are integral elements of the teacher's activities.
2. The general assessment of working conditions by the employment level, performed in accordance with SanPiN 0141-03, considering the most significant factors (the labor process intensity), allows to classify the university teachers' labor in our republic as class 3 (harmful), 3 degrees of harmfulness, whereas other hygiene factors, we have described working conditions as optimal or acceptable (table 6).

Table 6: Working conditions classes of universities' teaching staff in the Republic of Uzbekistan (according to SanPiN 0141-03).

Researched Factors	Working Conditions Classes					
	Optimal (1 Class)	Permissible (2 Class)	Harmful (3 Class)			
			1 Deg.	2 Deg.	3 Deg.	4 Deg.
Total noise	+	+				
Microclimate		+				
Lighting			+			
Ionizing radiation	+					
Labor intensity					+	

Ethical Clearance: No ethical approval is needed.

Source of Funding: Self

Conflict of Interest: Nil

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