



An Ergonomic Approach to Higher Education of Psychology and Pedagogy Students

Enfoque ergonómico de la educación de los estudiantes del curso de psicología y pedagogía de la escuela superior moderna

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ABSTRACT:

The paper substantiates the relevance of an ergonomic approach in the vocational education in universities, along with the best authorial practices for its implementation in p education while considering health protection. Methods: study of scientific and methodological literature, interviews, observations, conversations, data analysis, and systematization. The author identified the need for the development of teachers' ergonomic culture and foregrounded the components of the ergonomic approach are: ergonomic knowledge, skills, thinking, orientation. Theoretical significance: supplementing the composition of the ergonomic approach based on the health protection principle.

Keywords: ergonomics approach; university students; higher education; methodic material; health management

RESUMEN:

El documento corrobora la relevancia de un enfoque ergonómico en la educación vocacional en las universidades, junto con las mejores prácticas de autor para su implementación en la educación al considerar la protección de la salud. Métodos: estudio de literatura científica y metodológica, entrevistas, observaciones, conversaciones, análisis de datos y sistematización. El autor identificó la necesidad del desarrollo de la cultura ergonómica de los docentes y destacó que los componentes del enfoque ergonómico son: conocimiento ergonómico, habilidades, pensamiento, orientación. Importancia teórica: complementa la composición del enfoque ergonómico basado en el principio de protección de la salud.

Palabras clave: Ergonomía; enfoque; estudiantes; centro de educación superior; material metódico; manejo de la salud.

1. Introduction

Digital economy requires an unconditional increase in labor productivity, which is also relevant for the education system. The future teacher's professional activity and students' learning activities are complex mental work, and a personalized approach to education as a process of personal development plays the primary role. Nevertheless, the consideration of the human factor has not yet become fundamental in the design of various material and social systems, including education. The lack of design and creation of ergonomic conditions in the educational process has become a key prerequisite for the emergence of a special area of research – pedagogical ergonomics.

Improving of students' mental work requires applying ergonomic methods, techniques and means of presenting knowledge, ways of their studying and understanding. The ergonomic approach will allow obtaining necessary educational service of the required quantity and quality, optimize the time and place of study, thereby implementing the so-called ergonomic mix to education.

Today, the arrangement of teaching process based on an ergonomic approach is important for higher education system. In this regard, the duties of the future psychologist include teaching students productive learning activities in mastering ergonomic knowledge and skills, designing an ergonomic workplace and educational environment in the educational organization. An important role in the teaching process is given to the formation of safe educational environment, that is the ability to specifically arrange an educational space within the workplace and to create learning environment of the entire educational establishment considering comfort, convenience and safety.

To this end, future teachers should master the methods for teaching and developing student's ergonomic personality, which includes methods to develop and arrange work with Internet resources within extracurricular independent work which duration is constantly increasing. A modern student should possess the techniques and ways of using Internet resources as a part of extracurricular independent work and can independently familiarize with the lecture material considering health-saving technologies, by applying methods of electronic and distance learning in the workplace in educational establishment and outside the educational institution. The Federal Law on Education reveals essential changes in the arrangement conditions of educational process, namely, safe and comfortable conditions for teaching and education based on an ergonomic approach.

The relevance of this study is bounded with the need to generate comprehensive solutions to education-related problems in psychological and pedagogical specialties in the modern higher-education establishments while considering health protection. In our opinion, the implementation of an ergonomic approach in a modern school will ensure a higher efficiency of educational processes with regard to students and the professional activities of future teachers. It will further prevent the appearance of negative trends associated with the physical and mental health of students and teachers in modern-day schools. Training of qualified future teachers who are capable of competent independent mastering of educational skills and abilities is one of the critical tasks of modern higher education. In the context of ergonomic education and teachers' professional standards, one of the conditions to successfully solve the problem of low pedagogical efficiency in educational programs using e-learning and distance learning technologies, with the consideration of health protection in modern higher school, is the implementation of an ergonomic approach.

Thus, Our New School, the National Education Initiative, describes the school of the future as an institution that meets the objectives of advanced development, as well as improvement of teaching staff, change in school infrastructure, and preservation and promotion of students' health. These are basic requirements of ergonomics that should be given to future teachers and psychologists of modern higher education. The same ergonomic requirements can be observed in Development of Education, the State Program for 2013–2020. Its priority directions include modernizing the content of education and educational environment, updating the competences of teaching staff, creating modern infrastructure of non-formal education to form students' social competences, and providing a culture of healthy lifestyle. The dynamics of the health indicators of students and teachers and the infrastructure of the educational environment impose increased requirements to the level of ergonomic consciousness and behavior of future education psychologists. Future teachers and psychologists should demonstrate an ergonomic culture and be able to ergonomize their workplace and educational environment in the organization with the consideration of ergonomics requirements. In accordance with the Digital Economy program of the Russian Federation, the modern economy acquires the features of a social orientation and therefore increases the attractiveness of ergonomics in modern human life. One of the nine key areas of this program is the education system, the priority task of which is to train competent specialists. Thus, ergonomization of education is one of the conditions for digital economy development, as well as the application of the ergonomic approach by future teachers who can create learning environment for digital economy development, in the learning process.

The purpose of the article is to describe the method to arrange work with Internet resources (acquaintance with lecture material) for the future teachers on the basis of the ergonomic approach in a university. The subject of studying the ergonomic approach is learning activities performed by a student in the process of interaction with technical teaching aids under the influence of the human factor in the educational environment of a modern university. The combination and complementarity of ergonomics requirements form the unity for ergonomic

approach establishment in educational organization, which provides convenience, safety and comfortable conditions for efficient professional educational activities of the student, preserves his health and develops his personality, and respectively ensures efficient functioning of the ergonomic system as a whole.

2. Literature review

Problems of ergonomics in education still have mixed results, as indicated by Liu et al. (2012), Barcellini, De Greef, and Détienne (2016), and Incantalupo et al. (2014). Fraser (2012) and Al-Hinai et al. (2018) elaborated issues of ergonomic assessment of education environment in a computer classroom. From the perspective of ergonomics basics, any phenomenon in pedagogy has its relevance and is assessed through the functional structure of the ergonomic system comprising of teacher, students, teaching aids, and the learning environment. Singleton (1974) has analyzed the similarities and differences between pedagogy and ergonomics, stating that both aim to increase efficiency of educational activities, preserve health (safety), and develop personality (comfort and satisfaction with content, forms, and results of activities). Certain issues associated with physiological and ergonomic aspects of improving students' performance were described by groups of scientists in previous (Alishev et al., 1985) and recent (Piranveyseh et al. 2016) research. Gastev (1924), a pioneer in the field of ergonomics, stated that the training of physical and mental abilities of workers allows maximization of human factor promotion, while preserving strength and health. Rehman et al. (2014) found that certain repetitive injuries can be timely addressed by ergonomic education. Radas et al. (2013) confirmed that prolonged sitting affects both tutors and students.

Objective: To identify the occurrence of leg pain amongst computer users and assess its relation to age, sex, occupation and duration of computer use.

Methodology: It was a cross sectional study conducted from January till December 2011. A self reported questionnaire tailored with Occupational Health and Safety Act of the Ministry of Labor, Ontario, Canada was used. Participants were randomly selected; responses analyzed by SPSS software version 15. Chi square test was applied to results and considered significant with p value <0.05

Results: A total of 416 participants responded with mean age of 34.87 ± 8.78 years. There were 231(55.5 %) males. Out of 416, 123(29.5%) participants had work related leg symptoms [66(15.8%) male and 57 (13.7%) female]. Occurrence of leg pain within one to two hours of consecutive work was significantly more in 26-35 and 36-45 year age groups. Postural changes incorporated through frequent short breaks improved leg symptoms in between eight to nine out of ten participants (104/123). The improvement was significantly more in 26-35 and 36-45 year age groups. Leg symptoms showed no relation with the length of computer usage or daily usage or between both sex and working groups.

Conclusion: Leg pain/tingling/numbness is an early sign of repetitive injuries that can be timely addressed by ergonomic education and improving postural health through short breaks

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More recently, Pechnikov and Shikov (2014), Davy et al. (2019), and Cuenca and Aslanides (2019) presented an ergonomic approach to learning as a flowchart, adoption of which guarantees that each student will learn certain aspects of educational content. Chang and Yang (2014) found that high-school learners' work within web-based environment raises their grades. These aims are attained by studying the material by going through certain operations, rather than actions with respect to any subject studied (Cifter et al. 2013). Therefore, this direction of pedagogy—the ergonomics of education—seems to be particularly significant in connection with the problem of the lack of knowledge and skills among teachers and students required to be more adaptable to the information-subject learning environment, and to the means of on-the-job training in a modern educational institution. Rubegni and Landoni (2016), Sonne et al. (2012) found that digital tools can be both helpful and harmful depending on ergonomic use.

3. Materials and Methods

Analysis of research and publications on this topic showed that the methodological, theoretical and practical aspects of this fundamental problem remain unclear. The peculiarity of the methodology of this complex study of pedagogical ergonomics is that it incorporates and widely uses complexes of various methods: psychological, pedagogical, social, mathematical, statistical, and ergonomic.

The research project suggests that psychology and pedagogy students will favor from application of ergonomics in their education, as it was proved recently for office computer workers (Mani, 2018). The ergonomic approach to the education of students pursuing degrees in psychology and pedagogy in modern higher education establishments can thus address complex tasks required for forming the ergonomic culture of the personality of the future teacher and introduce students to a healthy and safe lifestyle and culture, as a requirement for creating a favorable, comfortable and safe learning environment.

As students pursuing degrees in psychology and pedagogy do not study Ergonomics of Education at the university as a compulsory subject, they lack the skills required to adopt the education process in line with the ergonomic approach which affects the level of training of the future teacher. In our opinion, the modern pedagogical science actualizes the inclusion of studying such ergonomics basics as the interrelation of mental processes with technical teaching aids into the teaching process, and fully utilizes higher body functions such as memory, thinking, attention, and consciousness. Thus, the ergonomics of education is an integral part of digital education, as it defines the ways of receiving and processing information in the learning process, digital opportunities for updating the content and teaching methods, the role of student and teacher in the digital learning process, and unlimited access to education for students.

As part of research, we understand the method as a way of self-extracurricular activities performed by students when working with Internet resources to master lecture material, the successful result of which will be the formation of ergonomic competence. The distance learning process takes place in the Moodle system with the application of Inverted Class learning model. This model allows teacher to provide access for extracurricular work of students to familiarize themselves with the lecture material and to verify the correctness of the theoretical lecture material perception they mastered individually. This method is implemented through a learning

management system that implies application of Internet resources (interactive lectures, tests, self-study documents, forums, wiki pages).

4. Results

The ergonomics of education is aimed at solving a complex of tasks, the main of which include the tasks to develop individual and social ergonomic consciousness of the future teacher based on creating comfortable, favorable, safe conditions in the workplace in view of ergonomic knowledge and practical ergonomic activity, responsible attitude when creating convenient learning environment. Ways for solving these problems within the educational process in the higher education establishment should be based on students' learning motivation and include the creation of convenient learning environment and individual workplace, development of ergonomic knowledge and skills, such as:

- ergonomic focus of students on the development of new direction in pedagogy - pedagogical ergonomics – has a decisive factor in the efficiency of the educational process at the university;
- ergonomic conditions that promote students' activity in educational process to solve safety and health related issues;
- ergonomic knowledge of the ergonomics system: student – teaching aids – learning environment;
- ergonomic requirements for the implementation of efficient educational activities carried out by the student, as components of good performance, physical and mental well-being in the learning environment.

Modern education system should consider distance and electronic forms of education (The Law on Education in the Russian Federation, 2014). The problem of development and arrangement of student's work using Internet resources in frames of extracurricular work becomes actual as one of the forms of increasing the efficiency of studying academic disciplines by an individual student in the university. In our opinion, in the era of the digital economy, the ergonomic approach can claim to be actively used in the educational process as an adequate health-saving methodical approach. The ergonomic approach in the education system involves the implementation of ergonomics requirements to the arrangement of educational process, student's workplace and learning environment in the educational establishment through such ergonomic properties as: anthropometric, physiological, hygienic, psychophysical, psychological. In frames of technical teaching aids, these ergonomic properties are called human factors. They reflect the indicators of the interrelation of student's learning activities with the technical teaching aids in the learning environment in order to achieve high quality of work and learning as well as good efficiency and health. Thus, the ergonomic approach is focused on the adaptation of the information-subject environment and technical teaching aids in the student's learning activities. Ergonomic properties solely provide possibility to assume the formation of human factors within the technical teaching aids, ergonomics of the 'student – technical teaching aid – learning environment's ergonomic system.

Health protection in a higher education establishment implies formation of general cultural worldview among students to preserve and promote health and protect teachers' health in the course of professional duties performance. Thus, ergonomic approach bases on the principles of health preservation and involves:

1. ensuring hygienically optimal conditions of the educational process,
2. optimal arrangement of the educational process and students' physical activity,
3. applied technical teaching aids when performing extracurricular independent work.

In terms of methodology, an ergonomic approach to the education of students having psychopedagogical specialty in a modern higher educational establishment, is aimed at:

1. knowledge of education ergonomics basics,
2. knowledge of ergonomic requirements, properties, laws, conditions, indicators, ergonomic support for selecting information content,
3. ability to create convenient, favorable and safe workplace and learning environment,
4. ability to preserve health,
5. ability to optimize educational process when arranging work with Internet resources,
6. ability to develop an ergonomic design of the workplace and learning environment,

7. preparation of reasonable training schedule.

With a close contact of the ergonomic system with a person, the human factor becomes the determining factor in the functioning of ergonomic system. Thus, student interacts with the technical teaching aids in the educational process. The properties of the human factor pose its cumulative qualities, which are formed under the influence of psychological, physiological, anthropometric, hygienic and other components. The 'student – technical teaching aids – learning environment' ergonomic system is interconnected with such important criteria as: performance, reliability, efficiency and aesthetics.

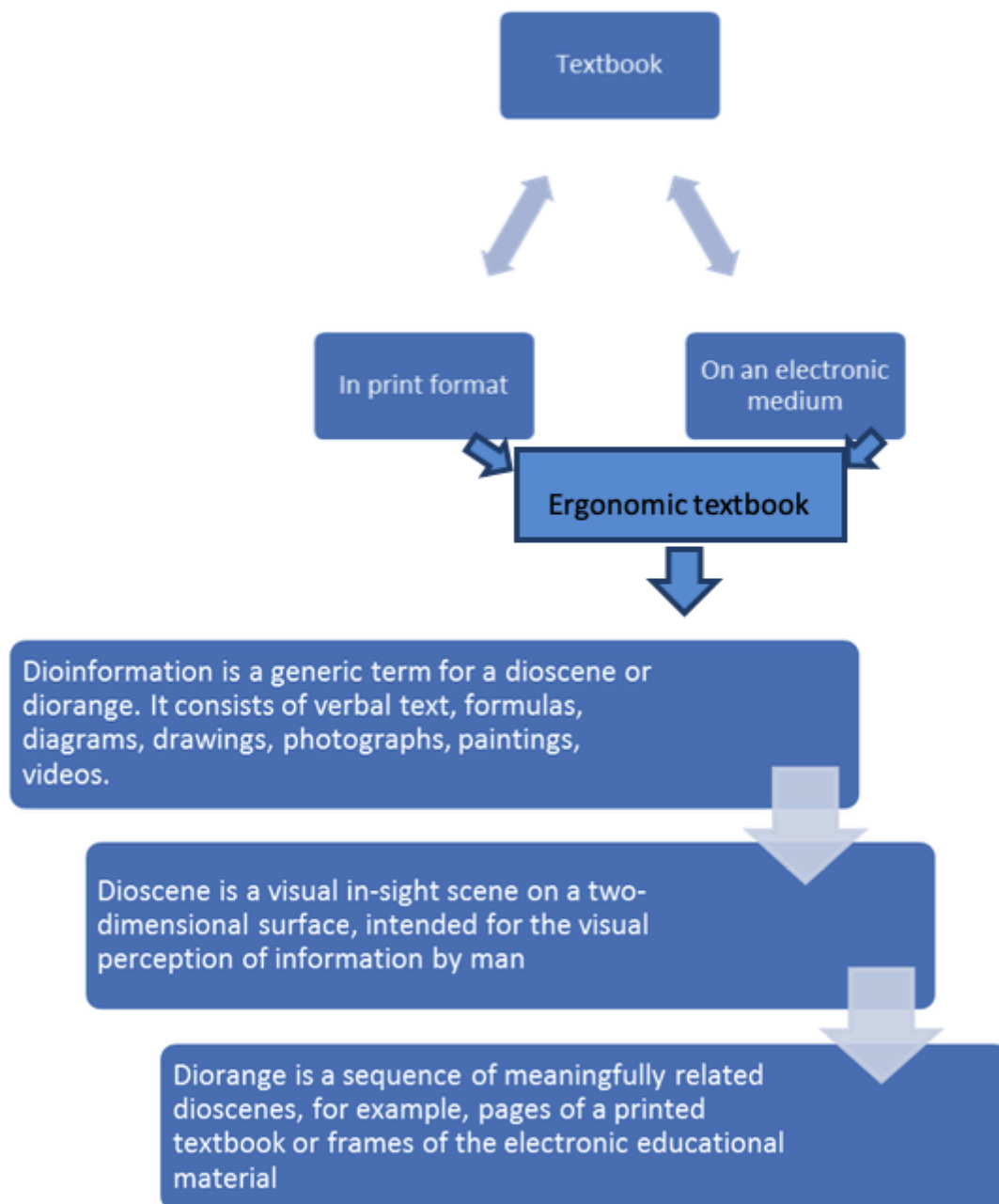
In the process of learning, it has been noticed that the need to repeat an interactive lecture arises, therefore, depending on the degree of mastering of the lecture material, the teacher can suggest different courses of the lecture repetition as part of the independent work. Teacher can proceed to training the practical skills with students in the classroom, after he made sure that the student had fully mastered the theoretical lecture material based on the passed tests results. In the branch of Udmurt State University, the Federal State Budget Educational Institution of Higher Education in Votkinsk, the path of student's learning as part of independent work, bases on formation of learning motivation to perform individual activities. When working with Internet resources, a student must realize what he does not yet know, formulate the result, plan his work to achieve the result and understand why he needs it and identify the sources for obtaining additional information.

Working with Internet resources, in particular familiarization with lecture material, is based on basic principles of cognitive ergonomics:

1. creating a learning environment that ensures elimination of all stress-forming factors of educational activities;
2. creative nature of independent work performance;
3. providing motivation for learning activities;
4. building educational activities in accordance with the principles of mental functions formation;
5. student's awareness of success in independent work, as a form of educational activity;
6. rational arrangement of workplace and motion activity;
7. ensuring adequate recovery of mental energy;
8. ensuring lasting memorization, thinking, attention, maintaining high performance and efficiency of mental work.

When choosing a teaching technology, we proceeded from the experience in using Moodle system for the rational arrangement of the lecture material. When developing lecture material in the distance mode, a number of ergonomic requirements should be identified for methodological, software and hardware support: as a didactic tool, it implies requirements to accessibility, clarity, convenience; as a means of information and computer technology – individuality, interactivity, adaptability of learning, systematic and structural and functional coherence of educational material presentation. Electronic textbooks, simulators, virtual laboratories, electronic libraries, etc. can be used as educational means to work in the electronic information environment of a university. To ensure the system of informational and educational interaction between the student and the teacher, consulting sessions and seminars can be also conducted. Thus, the established learning management system forms an automated workplace of the teacher and the student. For this purpose, the future teacher must be able to use skills based on an ergonomic approach, including knowledge of information technologies – web servers, multimedia, hypertext and hypermedia, file transfer schemes, audio and video conferencing, etc. An ergonomic textbook is presented in Figure 1

Figure 1
"Student-textbook" system (authors' elaboration)



Each student of the UdSU branch in Votkinsk before starting work in a distant mode, must independently provide himself with a minimum set of equipment for his automated workplace, including a gadget with free access to the Internet. During the period of work in the Moodle system from 2014 to 2018, 15% of students failed to provide themselves with their own automated workplace as 5% of students had no access to the Internet at home and 10% of students had no sustainable skills in distance learning. Therefore, automated workplaces have been created for these students in the classrooms. Therefore, currently the overall implementation of ergonomic approach is hampered by the lack of not only elementary basic PC skills, but also the lack of appropriate infrastructure.

The teacher requires appropriate methodological aids and methodological materials as means of the teaching process. Lecture material in distance learning should be presented to the student in a convenient, understandable and flexible form. When working independently with the lecture material, the teacher can maximize his abilities, which contributes to a better mastering of the material being studied. Therefore, the method of arrangement of work with Internet resources which is carried out by students as extracurricular independent work when they study the lecture material, is a special kind of educational material and a special way of learning, that facilitates the future use of the theoretical knowledge gained in practical exercises. This method was tested in the period from 2017 to 2018 academic year and engaged 40 students having psychological and pedagogical specialties. Students of the 3rd studying year showed a high level of preparation for the perception of new material and knowledge acquisition when working with a book in Lan and Yurait electronic library systems and others according to a given pattern in the Moodle system method of learning process arrangement in the framework of independent distance study of

lecture material. To increase this level, such methods to stimulate students' interest in learning have been created: weekly academic discussions in the Moodle chat system, creation of emotional and ethic situations; method of self-control has been also applied.

The application of this method should be ergonomically justified and provided as distance learning. It is necessary both at the level of extracurricular independent work planning in the electronic form of studying in general, and at the level of the student's ergonomic workplace arrangement. The disadvantages of using this method as a way of arranging an educational process in a higher educational establishment can involve the lack of warranty that the student will comprehensively study the lecture material, since even test and examination tasks can be accomplished by searching for information on the Internet without learning lecture material. Thus, in the framework of the next scientific study it will be necessary to find such a motivational approach to the compulsory study of lecture material by a student in extracurricular work that would certainly involve the student into independent e-learning, enhancing his sense of personal involvement in the learning process and the formation of responsibility for his own learning results.

After the incorporation of this methodology into a distance learning course, our research revealed that this technique can be used as an effective component to achieve goals of students pursuing degrees in psychology and pedagogy in modern higher educational establishment with regard to the ergonomic requirements for educational process arrangement. This is confirmed by the results of our research on the level of adaptation of teaching aid for student's use and mastering of Moodle system conducted in the 2018-2019 academic year. So, the same experimental group of students in the amount of 38 people was asked to answer questions about the ease of mastering the Moodle system and working in the system after the implementation of this method. As a result, 36 students indicated absolute ability to use computer and mastering the Moodle system. Two students experienced difficulties when working in this system, as they did not use it on a regular basis but occasionally and at long intervals, and therefore the skill automation for operating the Moodle system has been lost, so previously completed learning method required refresh.

5. Discussion

The influence of the learning environment on the efficiency and quality of the student's activities, performance, physical and psychological well-being and preservation of health are important components of the ergonomic system. One of the efficient ways to create convenient learning environment in the educational organization is to eliminate or weaken unfavorable factors of the learning environment in the very source of their generation, i.e. technical teaching aids. The implementation of Moodle system in the branch of UdsU in Votkinsk in 2014 revealed a key problem of the students – the difficulty in mastering Moodle system and a gadget used in the learning process (mobile phone, computer, etc.), as technical teaching aids that help to operate this system. Currently, before the commencement of the training, students are instructed in the system operation and logging in. But even now, having guidelines for arranging work in Moodle system available, every fourth student experiences difficulties when working in the Moodle system. A survey of 40 students having psychological and pedagogical specialty of the second studying year in 2016-2017, who logged in and studied in this system, showed that success in mastering this system depends on student's advanced knowledge and skills in computer technology, i.e. practical experience in using the Internet and ability to use various gadgets in learning. Thus, the process of adaptation of technical teaching aids for students' use takes a long period of time. To speed up this process, we have attempted to develop a method to arrange work with Internet resources concerning familiarization with lecture material in extracurricular independent work. Ergonomics of education as a scientific discipline, which is lectured to students having psychological and pedagogical specialty at the branch of Udmurt State University in Votkinsk, becomes a popular practical component of student interaction with the ergonomic system with the aim of developing ergonomic motivation, knowledge and skills. We propose to use ergonomic approach based on the implementation of the method for arranging work with Internet resources as a productive method of distance learning, since the number of classroom lecture hours is constantly decreasing.

6. Conclusions

During the implementation of the method (familiarization with lecture material), future teachers have reinforced their skills in arrangement of convenient educational environment based on the ergonomic approach. This will help their future professional activities, and the future teachers will

be able to create comfortable and safe workplaces and learning environments. The experience in implementation of methods for arrangement of work with Internet resources within students' extracurricular work shows that the ergonomic approach is relevant for practice of future teachers in the learning process, since its application contributes to the practical implementation of ergonomic competence of future teachers. The ergonomic approach allows to replenish their methodical ergonomic and pedagogical tools, develop skills for meta-activity, which refers to activities to develop convenient and safe learning environment and workplace for schoolchildren. In order to ensure regular implementation of ergonomic approach to the vocational education in the branch, we propose to establish a resource ergonomic and pedagogical center focused on work with the students. A scientific group that acquaints psychology and pedagogy students with the basic provisions for the implementation of pedagogical and ergonomic conditions in educational institutions operates successfully.

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