

Using Distance Learning In Collaboration With Social Networks In Teaching Photonics And Optoinformatics

Eshchanov Bakhodir Khudayberganovich, Gaipov Djurat Normat Ugli, Egamberganov Izzatbek Shavkat Ugli

Abstract : This article was written with the aim of to develop a technology for teaching photonics and optoinformatics using distance learning in collaboration with social networks. The following problems are considered in the article: application of social networks and distance education as a means of teaching photonics and optoinformatics. The hypothesis is verified: to use social networks like "VKontakte", "Facebook", "Odnoklassniki" and "Telegram" when teaching photonics and optoinformatics in physics courses at universities, then students' interest in science will increase, and the level and volume of work can also be optimized, which will contribute to improving the quality of physics education; whether teachers' interest in using distance education in physics lessons will increase. To achieve the goal of the study, the following tasks were verified: to analyze the state of the problem of using distance learning complete with social networks in the educational process as a whole and in teaching physics, in particular; to develop recommendations for their use in teaching physics; to offer productive areas for teachers to use social networks and distance learning physics. The methodological basis of the study was the work on the theory, methodology and practice of teaching physics, photonics and opto-informatics. The article analyzes the basic concepts of creating courses in the platform of distance education, including the creation of interdisciplinary courses in physics, mechanics and chemistry. At the end of the article, recommendations are developed and conclusions are given.

Keywords: media resources, photonics, optoinformatics, distance learning, social networks, interdisciplinary courses, ontology.

1 INTRODUCTION

The construction of individual learning paths, depending on the starting possibilities, personal preferences and personal pace of studying the material, at all stages remained an urgent task of education management systems, both in the traditional school and in the era of innovation and computer technology. Creating the core of such a system on the basis of an ontological knowledge base brings us closer to solving the problem of individual trajectories in mass learning. However, the first attempts to implement this approach have not been successful. As it turned out, the thing was, first of all, in the insufficient depth of the hierarchy of the content graph and ignoring the quality and quantity of the necessary "horizontal" links. As soon as subject ontologies with five to six levels of the structure of concepts were generated, based on complex queries to the knowledge base, it was possible, as a first approximation, to build individual educational trajectories combining retrospective analysis, a geographic information component, and intra- and interdisciplinary communications. It was shown that the ontological expert system for managing distance learning, being a subset of information semantic systems, obeys the basic principles of their topology, goal setting, communication and logical interpretation. A large number of literary sources on the "theoretical" use of ontologies in education does not compensate for the lack of practical recommendations and algorithms in this area. In relation to the task of automating the management of the educational process, the ontological approach is considered relevant not only for structuring the subject content of the studied disciplines, but also for the automated formation of regulatory documents in the educational field: work programs, individual plans, elements of the educational complex. And if work on a training course in a distance form encourages students to communicate in social networks in a specific way, then specific issues of managing the DO system (distance learning) should lead to the self-organization of a professional network of teachers. Thus, the research topic should be recognized as relevant and developed only from the point of view of theoretical pedagogy, and not knowledge engineering. In teaching photonics and

optoinformatics at physics and astronomy courses, you need to use distance learning complete with social networks. This allows you to conduct classes in an exciting, interesting, and significantly reduces the time. Including, the use of ICT allows you to optimize the entire process and gives you more time to prepare and think. In the end, quality training will increase.

2. MATERIALS AND METHODS

The aim of the study was to determine the widest possible range of ontological approaches to the construction of automated education management systems, including distance learning systems (DL).

The objectives of the study were formulated as follows:

1. To substantiate the applicability of subject ontologies for creating educational systems that combine the properties of mass learning with the implementation of individual trajectories for the development of educational material.
2. Demonstrate the performance of special programs - intelligent agents - in the automatic generation of physical or simulation models, test task templates, rubrics of multimedia complexes and MOOC courses with an ontological core as an expert system.
3. To conduct a comparative analysis of the management systems of subsidiaries for the mechanism of their interfacing with the services of social networks. Particular attention should be paid to the development of algorithms for collective filling by students of the content part of the ontology of the training course, the structure of which was set by the teacher.
4. In general terms and on the example of a specific subject area, study the methodology for automatically combining the wordings of the Federal State Educational Standards in terms of the competency model and professional requirements with the structure of the concepts of the ontological knowledge base built for the chosen educational direction.

Scientific novelty. It consists in considering the ontological

expert system for managing distance learning as a subset of information semantic systems that obeys the basic principles of their topology, goal setting, communication and logical interpretation. For the first time, it was shown that the ontological expert system automatically implements individual educational trajectories, depending on the starting capabilities and dynamic learning outcomes. A review of global trends in the field of engineering science of science revealed that the existing tools for creating and visualizing ontologies in the field of education should be classified based on the criteria of open software architecture, expanded functionality, and the possibility of collective and remote editing. It was first proved that the use of special programs - intelligent agents allows you to build a system for assessing the level of material development for students, which will be based on semantic search, optimal ontology visualization and interactive dialogue. For the formation of individual educational trajectories, it was first proposed to provide at least 5-6 levels in the structure of the concepts of the ontological core of the studied subject area, reflecting retrospective and geoinformation components, horizontal intersubject communications, and special means of individualizing interactive tasks. Literature Review. addressed by Andreev A.A. [3], Gurkin B.F. [36], Evdokimov M.A. [11], Lobachev C. T. [28], Solodukhin O.A. [33], Trainev V.A [36], Schennikov C.A. [32] and others; Technologies and models of distance learning were studied by Polat E.S. [31], Solovov A.B. [34], Spassky S.A. [35] et al; Olshevskaya A.V. [29] studied the use of distance learning programming on the basis of optics and photonics; the use of ICT and computer tools in teaching physics was studied in the works of Antsiferova L.I. [2], Izvozchikov V.A [20], Kondratyev A.S. [26], Laptev V.V. [27], Eshchanov B.Kh [9, 10], Otadzhanov Sh. [9, 10, 30], Isamatov A. [9] and others. The methods of organizing an educational physical experiment using a computer are devoted to the work of Klevitsky V.V. [25], the methodology of using computers as a means of developing students' thinking in teaching physics - a study by M. Chekulaeva [6]. The methods of teaching physics using information technology are devoted to the study of Abrosimov P.V. [1]. Methods of using computer and physical equipment in a school laboratory in the study of physics was considered in the study A. A. Ezdov [12]. The theoretical basis of the study is the study of the use of information technology in teaching physics Belostotsky P.I. [4], Butikov E.I. [5], Gomulina N.N. [13, 14, 15, 16, 17], Kavtrev A.F. [22, 23, 24], Grigoriev I.M. [19], Chirtsov A.S. [7, 8]). The relevance of this study is due to the increasing role of informatization and computerization at the present stage of development of education and their insufficient use in improving the quality of student learning in teaching photonics and optoinformatics in physics and astronomy courses of universities. Theory and Discussion. On the example of the subject field "Optics and Photonics", the possibilities of applying the ontological approach to the implementation of variable distance learning are considered. The applied aspects of the study were tested using the Optics knowledge base created by the team of developers of the National University with the active participation of the author of this work. The depth of elaboration of this ontology in various private fragments was different, but nowhere did it become less than 6-7 conceptual layers. Algorithms are compiled and the results of complex queries are shown that automatically update a wide range of information modules that are applicable for educational purposes: a retrospective analysis of a specific conceptual

chain, interconnected content streams with chronology and personalization, thematic geo-information data, etc. Naturally, a complete visualization of even a 6-level ontological structure with all the many essential connections is not possible. Therefore, for a clear presentation of the principles of the creation and application of ontology, narrower areas (for example, applied optics) were chosen as the core of the expert system for controlling the learning process or the structure of concepts and relationships was significantly reduced (Figure 1). The work of creating an ontological model was divided into three main stages. First of all, on the basis of the analysis of library classifiers and rubrics of metadata of scientific and educational Internet portals, the basic hierarchical structure of subject ontology was compiled. At the second stage, using expert assessments, a system of horizontal heterogeneous connections between concepts at all levels was formed. And in the end, it became possible to implement a mechanism of structural and complex queries to represent the private ontology components that are in demand in the field of education - thematic, geoinformation, retrospective, personal, etc. The choice of visualization format for these results has become a separate task, determined by a specific data type. Thematic queries to the ontological knowledge base allow us to present narrower areas of knowledge and automatically compose educational materials. There are many significant links covering the subject field "Applied Optics". There are only about a hundred of them on the structure, but in fact this number increases many times if you try to track secondary interdependencies. But even this abundance of connections allows you to build individual learning paths, and, therefore, takes the distance learning process to a new level. The time and labor costs for studying the material are reduced, since the user himself chooses what he needs to study. The interest of users is growing and as a result their number is increasing. So, the ontological representation of the subject field "Applied Optics" according to the given model was successfully tested when compiling the textbook of the same name, which was highly appreciated by the professional community. The ontological presentation of the subject area allows us to approach a completely different level to the automated creation of integrated educational resources of a new generation. This approach made it possible to create a series of algorithms for multimedia collections of educational resources in optics, examples of which are considered in the works of A. Chirtsov. The ontological core of special designer programs allowed to automatically generate a set of computer demonstrations on the following conceptual branches: "Basic laws of geometric optics", "Centered optical systems", "Fermat principle", "Optical devices", "Aberrations", "Second order surfaces", "Optical fibers", "Optical resonators", "Optical illusions", "Optical phenomena in the atmosphere. "The basic version of the Optical Designer program, intended for modeling optical systems within the framework of geometric optics approximation, due to the ontological structure, turned out to be significantly different from its many analogues - Java applets, which represent the possibility of visualizing the ray paths in simple optical systems. The ontological version of the program allows the learner to independently construct three-dimensional systems of optical elements, which are combinations of arbitrary reflecting and refracting surfaces of the second order, optically homogeneous gaps and media with a variable refractive index. A study was conducted on the

possibility of applying models and principles of subject ontologies to enhance the interdisciplinary orientation of the educational process. The course "Optics and Optoinformatics" was chosen as the testing subject, combining basic optical knowledge with questions of physics, mechanics, and chemistry. The combination of three conceptual nodes (sciences and technologies) seems almost optimal for the formation of interdisciplinary educational projects. The knowledge transfer process taking place in this scheme both clockwise and counterclockwise dynamically connects all three peaks. The following successions are easily traced in the information flow: technological innovations open up new opportunities for representatives of both specialties, and scientific discoveries become technologies over time. The opposite flow illustrates, firstly, the role of engineering solutions in critical scientific experiments, secondly, the generation of original solutions under the influence of new scientific concepts and, thirdly, the scientific basis of the best design developments. The central position occupied by the educational space in this scheme allows us to propose a new concept for the construction of interdisciplinary courses based on an ontologically unified representation of all three components (scientific, technological and media). The presence in the ontologies of the maximum number of typologically different relationships between concept objects easily ensures the unity of this scheme as the central link of an interdisciplinary educational project. Ontologically constructed interdisciplinarity allows the use of many ideas and approaches inherent in various sciences and arts, but at the same time does not form chaos from them, but, on the contrary, gives rise to a qualitatively new knowledge. In this case, interdisciplinarity can be understood as a modern way of interaction between sciences, arts and technologies in the process of ontological knowledge of the reality surrounding us. In the ontologically constructed course "Photonics and Optoinformatics", the dominant feature is the connection between optical science and visual technology. The structure of the course, the upper levels of which are presented in Figure 3, was available to students on the distance learning portal. Here, as usual, it is impossible to show the whole multitude of "horizontal" connections between one-level concepts, although it is they that make it possible to combine such diverse fields of knowledge into a single whole. The result of the training was the multiple complication and enrichment of the ontology created by the teacher due to the content elements (texts, illustrations, video clips, multimedia inserts, etc.) found through the activities and independent research of students. A real synergistic effect was created in the minds of future masters of theatrical art, and two most important educational tasks were solved semi-automatically; the increase in individual motivation and the strengthening of technologically optimized are connected between dissimilar subject areas. The study presents the results of applying the methods of knowledge engineering to the analysis of modern trends in science and education (using the same subject area as "optics and photonics" as an example). The analysis was carried out on the basis of open data on the structures of three European scientific and technological platforms - Photonics, Photovoltaics and Nanomaterials, interfaced with data on the structures of European university education in the relevant areas of training over the past decade. The paper presents an automatically generated final geographic information component of a compiled knowledge base with its dynamic link

to a chronological chain. Objective data were obtained on trends in this subject area, for example, on the growing dominance of telecommunications and opto-information components. Such trends are manifested not only in the emergence of new conceptual nodes in the structure, but also in the briefly increasing number of generated links between old and new ontology nodes. By means of complex queries, associative maps of content of traditional concepts corresponding to the modern level of development were compiled. Using the proposed methods for European education, private divergent trends in the conceptual nodes of the subject ontology have been identified in recent years, and, on the other hand, convergent trends for three technological platforms have been automatically identified that demonstrate the unity of the final concepts in the format of specific scientific and technical applications. The study examined the issues of constructing ontological expert systems (OES) as the core of the variational distance learning management system. In the first part, an approach is developed to create an ECO as a type of information semantic system. The stages of its development and the forms of presentation of semantic information are highlighted. Particular attention is paid to multimedia M-forms. To reduce labor costs, minimize development time, as well as increase the accuracy of pedagogical measurements, a new technology for creating test tasks was applied, which is based on the concepts of template and feedback. The template defines a class of test tasks, and each specific task is an instance of this class. A class in the form of a logical construction is formed on the concepts of ontology, and creates a new data type. After definition, the new type can be used to initialize objects of this type, i.e. instances of this class. The construction of templates occurs using variables that can replace the elements of all structural units of the test task. The mechanism for the implementation of templates can be illustrated by an algorithm. At the first stage, the variables are declared and initialized, each of which must have a unique identifier associated with the ontology conceptual node. At the stage of task formation, following the topology of the ontological graph, variables are added to the structural units of the test. At the stage of preliminary processing of the response received from the subject, there is a semantic analysis of the user's response. The step of analyzing the response involves checking certain conditions. Depending on the condition, the values of the variables change, after which it is possible either to exit the test frame or go to the stage of generating a new task (feedback). For greater clarity of the hierarchy of ontological concepts, a DOM (Document Object Model) representation of the XML description of templates was developed, a detailed description of the fragments (variables, attributes, elements) of which are presented in the dissertation. The provision of individual trajectories in the framework of distance learning is directly related to the development of recommendation services for independent work of students. The ontological approach turned out to be effective for implementing the basic principles of open education, among which an alternative mechanism of traditional knowledge acquisition appears. The main objective of this approach is to adapt and personalize training for the needs of students. The initial data were user activities: not only educational activities, but also activities that are indirectly related to learning, for example, search queries and forum posts. Data was recorded from all types of teaching aids: static, interactive, social. The main types of activity used in the

module:

- mouse clicks on course elements;
- search queries within the course;
- forum posts;
- incorrect answers in training tests and surveys;
- incorrectly completed practical tasks.

When interacting with a particular knowledge base concept, the user indicates that this element has a meaning for him. If the interaction with the element of the course occurs more than once, then only in this case it can be assumed that it is this element that has some value for the user. It follows that the measure of the value of the concept (or its connections) will be the weight that is obtained from the quantitative interaction of the user with the course element. The result of the module is a set of training materials, formed on the basis of the user profile, which contains information about his activity. According to the type of information source of each activity, weights are set. All words are recorded in the user profile; it is an XML file structured according to the APML standard. A so-called user profile is compiled, which contains information such as: type of user activity; activity body (sentence) with weights; keywords with weights; identification numbers of training materials from the profile of training materials. In addition to user activity, the input data for the module are the training materials of the course (ontology concepts). Creates a list of training materials and creates from them a profile of training materials, which is an XML file. The profile of training materials contains information such as:

- concept identification number;
- its name;
- course name;
- type of training material;
- set of keywords;
- list of significant relationships.

The described algorithm was successfully implemented in PHP for the Moodle learning management system and tested on a group of beta testers. To receive recommendations, the user needs to create his own profile of preferences in the recommendation system by evaluating a number of objects. Further, the system compares the same type of data in user profiles and automatically provides a set of potentially interesting resources for each network member. A recommendation algorithm based on a comparison of user profiles of recommendation systems using the Fourier analysis is proposed. In the general case, the profile of user preferences can be represented in the form of an image that is formed on the basis of integrated user ratings of objects corresponding to certain interests. Based on the degree of similarity of preference profiles, it is advisable to provide each specific user with a specific set of recommendation groups. A group whose members have the most similar preference profiles with the profile of a particular user will be the first priority when making recommendations. A group of experts whose recommendations will be taken into account in the second place will differ in a lesser degree of similarity of the profiles of participants to the profile of a particular user. Accordingly, when moving to a group of experts, the degree of similarity of preference profiles which will be the least

compared to other recommendation groups, the significance of the recommendations will also be the least. When compiling a list of recommendations, the significance of each recommendation is taken into account on the basis of which member of the group of experts it received from more significant to less significant. The described technology was applied to the analysis of statistically processed "collective profile". The material for such testing was the results of work on the formation of an information system for advanced training and internships for scientific and pedagogical workers, graduate students and doctoral students of the National University. The study outlines the interaction of management systems of subsidiaries and social networks. The results of surveys of Vkontakte, Facebook, Odnoklassniki, and Telegram audience surveys regarding the preferences and motivations of network communication with teachers, participation in distance learning courses and their effectiveness are presented. A comparative analysis of the responses of students at the National University and Urgench University with open data from world statistics was carried out. The analysis showed a significant growth dynamics of interest in MEP courses (Massive Open Online Courses), which requires the implementation of the very multidimensional feedback that is implied in the construction of a subject knowledge base. The organization of interaction of a large number of participants in the educational process is ensured by the inclusion of social networking services. A complete automation of the procedures for assessing learning outcomes and the use of multichannel (multimedia) methods for transferring knowledge provides motivating properties. Based on the degree of similarity of preference profiles, it is advisable to provide each specific user with a specific set of recommendation groups. A group whose members have the most similar preference profiles with the profile of a particular user will be the first priority when making recommendations. A group of experts whose recommendations will be taken into account in the second place will differ in a lesser degree of similarity of the profiles of participants to the profile of a particular user. Accordingly, when moving to a group of experts, the degree of similarity of preference profiles which will be the least compared to other recommendation groups, the significance of the recommendations will also be the least. When compiling a list of recommendations, the significance of each recommendation is taken into account on the basis of which member of the group of experts it received from more significant to less significant. The described technology was applied to the analysis of statistically processed "collective profile". The material for such testing was the results of work on the formation of an information system for advanced training and internships for scientific and pedagogical workers, graduate students and doctoral students of the National University. The study outlines the interaction of management systems of subsidiaries and social networks. The results of surveys of Vkontakte, Facebook, Odnoklassniki, and Telegram audience surveys regarding the preferences and motivations of network communication with teachers, participation in distance learning courses and their effectiveness are presented. A comparative analysis of the responses of students at the National University and Urgench University with open data from world statistics was carried out. The

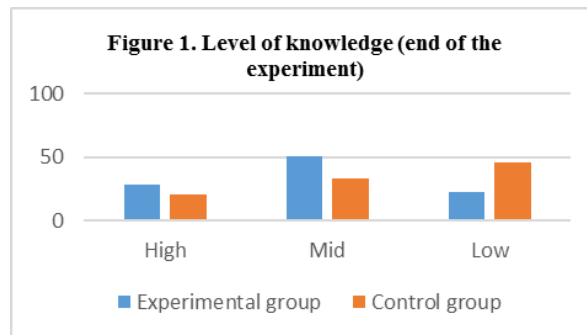
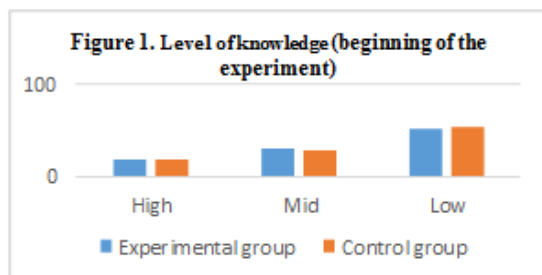
analysis showed a significant growth dynamics of interest in MEP courses (Massive Open Online Courses), which requires the implementation of the very multidimensional feedback that is implied in the construction of a subject knowledge base. The organization of interaction of a large number of participants in the educational process is ensured by the inclusion of social networking services. A complete automation of the procedures for assessing learning outcomes and the use of multichannel (multimedia) methods for transferring knowledge provides motivating properties. All this involves the use of combinations of the ontological core of the system, interactive technology platforms and social activities. The paper presents data on the comparison of several major social networks with a view to interfacing their services with DO systems according to the following parameters: the mechanism for registering and protecting data, the formation of user groups, the technologies for placing multimedia files and applications, and the options for interaction between students and a teacher. In conclusion, the results of approbation of the author's MEP courses constructed using the ontological approach are presented. Examples of connection tables compiled to form the ontological core of the course, the structure of the ontologies themselves, and the algorithmic features of multimedia collections of educational Internet resources are given. It is shown that the use of the latter allows to provide the required variability of the training course in the MEP format.

3. EXPERIMENTAL RESULTS

The experiments were carried out in three stages. Students from the Faculty of Physics and Astronomy of the National University and Urgench State University were selected to conduct the experiments. In experimental trials involved 202 students.

Table I. Dynamics of the level of knowledge of students'

Groups Number of respondents	Arithmetic expression	Level indicators					
		At the beginning			In the end		
		High	Mid	Low	High	Mid	Low
Experimental $n_i=102$	X_i	19	31	52	28	5 1	23
Control $n_j=100$	Y_j	18	29	53	21	3 3	46



A comparative analysis of the experimental work showed that the level of knowledge of the experimental group is higher compared to the level of the control group, which indicates the effectiveness of the study. Thus, using the mathematical-statistical method it was confirmed that the distance learning methodology recommended by us is more effective than the traditional teaching methodology. Studies have confirmed the validity of the promoted scientific hypothesis about the need to use social networks and distance learning in the classes of photonics and optoinformatics

4. CONCLUSION

It is proved that subject ontologies as the structural foundations of knowledge bases make it possible to realize the principles of mass variable learning and are able to provide individual educational trajectories. Using special programs - intelligent agents allows you to build systems for assessing the level of development of the material, which will be based on semantic search, optimal ontology visualization, and interactive dialogue. A comparative analysis of modern distance learning management systems has shown the possibility and prospects of developing algorithms for their integration with social networks. The preferences of active users of social networks registered in various distance learning systems turned out to be on the side of MEP resources providing non-linear learning. The ontological approach proved to be useful not only for structuring the subject content of the studied disciplines, but also for the formation of individual plans of teachers and work programs. The combination of these two tasks naturally generated a kind of network community of teachers and students. The formation of subject ontologies with five to six levels of the structure of concepts allows, based on complex queries to the knowledge base, to a first approximation, to build individual educational trajectories that combine retrospective analysis, a geographic information component, and interdisciplinary connections. It is shown that the ontological expert system for managing distance learning, being a subset of informational semantic systems, obeys the basic principles of their topology, goal setting, communication and logical interpretation. During the study, a method for automatic verification of created subject ontologies based on a semantic analysis of the reduced structure of concepts in conjunction with the student's competency model was found and tested. Testing of the conclusions and results of this work was carried out in several directions. First, using the subject knowledge base on optics, multimedia collections of educational resources were developed. Secondly, the correction of basic and additional educational programs in optics and photonics was carried out

using dynamically changing ontologies. Two particular problems of building distance learning control systems with a core in the form of ECO were solved: automatic phased generation of test task templates based on DOM representations and XML descriptions, as well as a mechanism for automatically selecting recommendation services for a student to work independently, taking into account his individual profile. Further prospects of work lie in the plane of extended testing of developed approaches to other subject areas, the use of more advanced visualizers of ontological structures and in the integration of MEP-like distance courses with social networking services.

5. REFERENCES

- [1] Abrosimov P.V. Metodika izuchenija volnovykh processov v optike s primeneniem JeVM v kurse fiziki srednej shkoly. Avtoref diss.kand. Ped. nauk. – M., 1998. –p. 16.
- [2] Anciferov L.I. Zadaniya po fizike s primeneniem programmiruemykh mikrokal'kuljatorov: didakticheskij material: 9 klass. M., Prosveshhenie, 1993. – p. 94.
- [3] Andreev, A.A. Didakticheskie osnovy distancionnogo obuchenija v vysshih uchebnykh zavedenijah [Text].: diss.d.p.n.: 13.00.02. M., 1999. — pp. 289.
- [4] Belostockij P. I., Maksimova G. Ju., Gomulina N. N. «Komp'juternye tehnologii: sovremennyj urok fiziki i astronomii». — Gazeta «Fizika» No.20, 1999. — p. 3.
- [5] Butikov E.I. «Laboratorija komp'juternogo modelirovanija». Zhurnal «Komp'juternye instrumenty v obrazovanii», No. 5, Sankt-Peterburg, Informatizacija obrazovanija, 1999. - pp.24-42.
- [6] Chekulaeva M.E. Ispol'zovanie JeVM kak sredstva razvitiya myshlenija uchashhihsja pri obuchenii fizike. Diss. ... kand.ped.nauk. M., 1995.— pp. 159-163.
- [7] Chircov A. S. ««Informacionnye tehnologii v obuchenii fizike». Zhurnal «Komp'juternye instrumenty v obrazovanii», No. 2, Sankt-Peterburg, Informatizacija obrazovanija, 1999. - pp.3-12.
- [8] Chircov A. S., Grigor'ev I. M. i dr. «Informacionnye tehnologii v obuchenii fizike. Ispol'zovanie setevykh tehnologij». Zhurnal «Komp'juternye instrumenty v obrazovanii», No. 6. Sankt-Peterburg, Informatizacija obrazovanija, 1999. - pp.23-27
- [9] Eshchanov B., Otajonov Sh., Isamatov A. On Possible Models of Thermal Motion of Molecules and Temperature Effect on Relaxation of Optical Anisotropy in Bromine Benzene. Ukraine Journal of Physics, 2011, Vol.56, No.11, pp.1178–1181.
- [10] Eshchanov B., OtajonovSh., Solieva N., IsamatovA. Intensity Distribution in the Spectrum of Molecular Light Scattering and Relaxation Effects in Liquids. Ukraine Journal of Physics, 2015, vol.60, No.8, pp.792–795.
- [11] Evdokimov, M.A. Distancionnoe obrazovanie kak fenomen jekonomicheskikh, social'nyh, tehnologicheskikh uslovij jepohi [Text]. / M.A. Evdokimov. Moscow.: Mashinostroenie-1, 2005: Otdel tip. i OP Samarskogo gos. tehn. un-ta, 2005. – pp. 141.
- [12] Ezdov A. A. Kompleksnoe ispol'zovanie informacionnyh i kommunikacionnyh tehnologij v prepodavanii fiziki v shkole. : Diss. ... kand. ped. nauk. M., 1999. – pp. 172-176.
- [13] Gomulina N. N, Mihajlov S. V. Metodika ispol'zovanija interaktivnykh komp'juternykh kursov s jelementami distancionnogo obrazovanija. – Gazeta «Fizika», 2000, No. 39. Gomulina N. N. Komp'juternye obuchajushhie i demonstracionnye programmy. – Gazeta «Fizika», 1999, No. 12.
- [14] Gomulina N. N. Komp'juternye obuchajushhie i demonstracionnye programmy. Fizika: Prilozhenie k gazete «Pervoe sentjabrja», No. 12/1999. – p. 2.
- [15] Gomulina N. N. Komp'juternye tehnologii obuchenija fizike.. Fizika v shkole. Moscow.: No.8/2000. – pp.69 – 74.
- [16] Gomulina N. N., Mihajlov S. V. Metodika ispol'zovanija interaktivnykh komp'juternykh kursov s jelementami distancionnogo obrazovanija.. Fizika: Prilozhenie k gazete «Pervoe sentjabrja», No. 39/2000. – pp.11 –13.
- [17] Gomulina N.N., Belostockij P. I., Maksimova G. Ju.Komp'juternye tehnologii: sovremennyj urok fiziki i astronomii v avangarde., ZAO, Moskva. <http://competentum.ru/articles/academic/256>.
- [18] Gorkin, A.P. Rossijskaja pedagogicheskaja jenciklopedija [Text].: V 2 t. / A.P. Gorkin; gl. red. V.G. Panov. Moscow.: Bol'shaja Ros. jencikl., 1993-1999.
- [19] Grigor'ev S.G., Grinshkun V.V. Uchebnik - shag na puti k sisteme obuchenija "Informatizacii obrazovanija".. V sbornike nauchnykh trudov "Problemy shkol'nogo uchebnika". - 2005. - pp. 219-222.
- [20] Izvozchikov V. A. Didakticheskie osnovy komp'juternogo obuchenija fizike. Uchebnoe posobie. Leningradskij gos. ped. in-t im. A. I.Gercena. — L.: LGPI, 1987. – p. 90.
- [21] Jekzamenacionnye zadachi po fizike dlja postupajushhih a vuzy. V.V.Mozhaev, V.I.Chivilev, A.A.Sheronov. 4th edition., stereotip. MOSCOW.: Drofa, 2002.
- [22] Kavtrev A. F. «Komp'juternye modeli v shkol'nom kurse fiziki». Zhurnal «Komp'juternye instrumenty v obrazovanii», No. 2, Sankt-Peterburg, Informatizacija obrazovanija, 1998. pp. 41-47.
- [23] Kavtrev A. F. «Komp'juternye programmy po fizike v srednej shkole». Zhurnal «Komp'juternye instrumenty v obrazovanii», No. 1, Sankt-Peterburg, Informatizacija obrazovanija, 1998. - pp. 42-47.
- [24] Kavtrev A. F. Broshjura «Metodicheskie aspekty prepodavanija fiziki s ispol'zovaniem komp'juternogo kursa «Otkrytaja fizika 1.0». – OOO "Fizikon", Moskva, 2000. www.college.ru/booklet/1st.html.
- [25] Klevickij V.V. Uchebnyj fizicheskij jeksperiment s ispol'zovaniem komp'jutera kak sredstvo

- individualizacii obuchenija v shkole. : Diss. ...
kand. ped. nauk. M., 1999. – pp.247.
- [26] Kondrat'ev A. S., Laptev V. V. Fizika i komp'juter. —
L: izd-vo Leningradskogo Universiteta, 1989. – pp.
300-328.
- [27] Laptev V. V, Nemcov A. Uchebnye komp'juternye
modeli. INFO, No..4, 1991. – pp. 70 – 73.
- [28] Lobachev, S. L. Teoreticheskie osnovy i principy
postroenija informacionno-obrazovatel'noj sredy
otkrytogo obrazovanija i ee prakticheskaja
realizacija [Text]:. diss. .d.t.n.: 05.13.1.3, 05.13.10.
- [29] Ol'shevsckaja A. V. Razrabotka predmetnyh
ontologij i sistem upravlenija distancionnym
obucheniem vo vzaimodejstvii s social'nymi
setjami. Avtoreferat dissertacii kand. tehniceskix
nauk. Sankt-Peterburg, 2014. – pp.5-17.
- [30] Otazhonov Sh. Optikadan masalalar va
laboratoriya ishlari tuplami, ukuv kullanma.
Uzbekiston Respublikasi Olij va urta mahsus talim
vazirligining tavsijasi asosida. – Tashkent, 2016. –
pp. 179-183.
- [31] Polat, E.S. Teorija i praktika DO [Text]. Informatika i
obrazovanie. 2001. No. 5. - pp. 37-42.
- [32] Shhennikov, S.A. Osobennosti uchebnyh
materialov v sisteme otkrytogo distancionnogo
obrazovanija vzroslyh. [Text]. Upravlenie
personalom. 2002. No. 9. - pp. 32-38.
- [33] Soloduhin, O.A. Logika [Text]:. Tutorial for
students. Rostov n/D: Feniks, 2000. – pp.376.
- [34] Solovov, A.B. Mify i realii DO [Text]. Vysshee
obrazovanie v Rossii. 2000, No. 3. - pp. 116-121.
- [35] Spasskij, S.A. Nekotorye problemy razvitija
Distancionnogo obrazovanija [Text].Social'no-
gumanitarnye znanija. — 1999, No.6. -pp. 17-28.
- [36] Trajnev, V.A., Gurkin V.F., Trajnev, O. V.
Distancionnoe obuchenie i ego razvitie [Text]:
obobshhenie metodologii i praktiki ispol'zovanija.
Moscow.: Dashkov i KO, 2007. - pp.291-294.

has published 1 journal and 2 papers in both national conferences.



Egamberganov Izzatbek Shavkat ugli
Inspector of Department Human Resource,
Chirchik State Pedagogical Institute, Tashkent
region, Uzbekistan. Email:
i.egamberganov@cspi.uz. He obtained his
Bachelors and Master's Degree in Physics from National
University of Uzbekistan named after Mirzo Ulugbek, 2017. He
has published 2 journals and 2 papers in both national
conferences.

AUTHORS PROFILE



Eshchanov Bakhodir Khudayberganovich
Docent, Head of Educational Quality Control
Department, Chirchik State Pedagogical Institute,
Tashkent region, Uzbekistan. Email:
b_eshchanov@cspi.uz. He obtained his Higher
Educational Degree in Physics & Economical
Sciences from The Tashkent State University. He received his
DSc degree from National university of Uzbekistan,
Uzbekistan, 2018. He has published more 150 scientific works
including 4 textbooks, 3 monographs, 70 Journals and 90
papers in both national and international conferences.



Gaipov Djurat Normat ugli Teacher of Physic
at Special School No. 110 of Mirobod district,
Tashkent city, Uzbekistan. Email:
j.gaipov@cspi.uz. He obtained his Bachelors
and Master's Degree in Physics from National
University of Uzbekistan named after Mirzo Ulugbek, 2019. He