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TÍTULO: Inteligencia Artificial. El área de posibilidades adaptativas para innovaciones metodológicas en educación pedagógica.

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RESUMEN: El artículo muestra que la solución del problema requiere la creación de nuevas tecnologías educativas basadas en la ciencia, en innovaciones con contenido transformador, potencial tecnológico y didáctico. La efectividad de las tecnologías se confirma por la mejora de la calidad no solo de la enseñanza sino también por la productividad del proceso educativo, y la posición activa de los estudiantes en el estudio de la disciplina. La inclusión de estudiantes en nuevas actividades, activando habilidades, formando un fenómeno real de inteligencia natural demostró la promesa de ALT. Como resultado de su introducción, el nivel de preparación de los estudiantes para trabajar en el desarrollo de entornos educativos inteligentes ha aumentado.

PALABRAS CLAVES: professor, actividad professional, inteligencia artificial, interdisciplinariedad, adaptación.

TITLE: Artıfıcıal Intellıgence. The area of adaptıve possıbılıtıes for methodologıcal innovatıons in pedagogic education.

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ABSTRACT: The article shows that the solution of the problem requires the creation of new science-based educational technologies based on innovations with transformative content, technological and didactic potentia. The effectiveness of technologies is confirmed by the improvement of the quality not only of teaching but also by productivity of the educational process and the active position of students in the study of the discipline. The inclusion of students in new activities, activating abilities, forming a real phenomenon of natural intelligence proved the promise of ALT. As a result of their introduction, the level of students' readiness to work in developing intelligent educational environments has increased.

KEY WORDS: teacher, professional activity, artificial intelligence, interdisciplinarity, adaptation.

INTRODUCTION.

In the 21st century, higher education acts as a fundamental component of the sustainable development of the human community, in which teacher education plays a key role. The digital economy determines the new requirements for the younger generation, among which the demands of systemically organized intellectual, communicative, reflective, self-organizing principles are gaining increasing priority. They allow for the successful organization of professional activities in the context of dynamic and adaptive development.

The vector of transformations of pedagogical education in the direction of preparing a graduate who is not just knowledgeable, but who knows how to dispose of this knowledge in the context of a pedagogical situation, is becoming ever more apparent. This requires the preparation of a future teacher with critical thinking, ready for self-education, self-determination, and self-development. The success of such training will depend on how focused, mobile and active in pedagogical universities will be to move from knowledgeable to activity type of educational content, where the main idea is to acquire students in various ways of working to solve the set educational tasks.

It is also necessary to consider the influence of intellectual systems on enlightenment since they can combine extra-personal and personal knowledge. Moreover, as a result, they can contribute to raising the average level of intellectuality. Creating symbiosis of the intellectual system - the student can contribute to the strengthening of their mental activity and rational behavior in solving problems.

The educational potential of IS is not limited to their use. It is much broader and more diverse. For professional pedagogical training, of considerable interest are the tasks of constructing fact bases and knowledge bases of intellectual learning systems that imitate various learning situations adapted to the school education system. When performing these tasks, the position of the student changes. From the passive object of learning, the recipient of the complete educational information,

it passes into the position of an active subject of the exercise, independently extracting the necessary information and constructing the necessary methods of action.

For several years, Herzen University and NEFU carried out experimental work to improve the professional pedagogical training of future teachers using ALT, focused on students solving the problems of designing FB and KB of various ILS types. Undergraduates of various faculties of the Herzen University and NEFU (direction "Pedagogical Education"), teachers of schools in St. Petersburg and Yakutsk, students of career enhancement training (CET) at the St. Petersburg Center for Assessing the Quality of Education and Information Technologies participated in the experiment.

DEVELOPMENT.

Literature review.

Achievements in the field of AI, expert training systems are still little implemented in education. At the same time, researchers from different countries conduct multidimensional studies on the study and development of AI in the educational segment. The authors study both general (Osipov G.S. Lectures on artificial intelligence, 2014; 15, 2018) and particular issues of the use of AI in learning (Angela E, 2019; Bialik M., Fadel C., 2018; Keith D. Foote., 2017). Special attention is paid to the study of psychological (Luxton, David D., 2014) and cognitive (Osipov G. S., Chudova N.V., Panov A.I., Kuznetsova Yu.M., 2018) problems that are important for the design of knowledge bases - the main structural ILS components (Emmanuel C. Ogu, Adekunle Y. A, 2013).

Issues of KB development are crucial and investigated both from a technical and humanitarian point of view. In particular, the author of the article (Ihsan Sarita, Sri Hartati,, 2013) draws attention to the need to use effective models for the acquisition of knowledge. Scientists from Australia note that AI will change the nature of higher education in the world and has already become an integral part of modern universities (Stefan, 2017). Examples of the use of AI for the development of e-

learning are didactically significant (Patrick CAMILLERI, 2017). This, in turn, contributes to innovative changes in educational environments (Schulz, Renée, Ghislain Maurice Isabwe, and Frank Reichert., 2014; Pathak, B.K., 2016), motivation for new educational activities (Clark, Ruth C., and Richard E. Mayer., 2016, M. Rani, K. V. Srivastava, and O. P. Vyas, 2016) in them using new tools. Confirmation of this is found in (7, 2017). Its authors study the attitudes of teachers, their involvement, and support for online professional development.

Many researchers suggest using adaptation ideas and AI methods in e-learning. These include work (Uvarov, 2018) on the importance of adaptive behavior for the educational process. Of practical interest are the works by (Eremeev, A.P., Kozhukhov A.A., Golenkov V.V., Gulyakina N.A, 2018). Its authors propose algorithms for adapting mathematical educational content and options for integrating them into the e-learning system. Their ideas are complemented by the suggestions of the author of the article (Sérgio R. I. Yoshıoka, Lucila Ishıtanı, 2018) about adaptive tests relevant to machine learning.

At the same time, the analyzed works do not adequately reflect the problem of studying innovative methodological training of students of pedagogical universities with the use of adaptive learning technologies in an educational environment enriched with means, methods and technologies of AI.

The theoretical basis of the study was the work of Russian authors in the use of adaptive (Vlasova E.Z., Goncharova S., Aksyutin P., Barakhsanova E.A., Prokopyev M.S., Kuzin Z., 2018; Barakhsanova E. A., Savvinov V. M., Prokopyev M. S., Vlasova E. Z., Gosudarev I. B., 2016), e-learning (Prokopiev M.S., 2015) and learning using AI (Eremeev, A.P., Kozhukhov A.A., Golenkov V.V., Gulyakina N.A, 2018; Uvarov A.Yu., 2018).

Materıals and methods.

In the period from 2010 to 2019, two research teams, which included representatives of the scientific and pedagogical schools of the Herzen University and NEFU, a joint study was

conducted, carried out according to a consistent and relevant topic for the modern system of Russian education. Joint distributed work was carried out based on multiple coordinated interactions, using modern tools for the transfer of relevant complex information obtained during the study. It was the joint work that made it possible to effectively use the scientific and pedagogical potential of the whole group; due to the synergy effect, comprehensively study the problem taking into account the theoretical and practical knowledge and experience of researchers in the field of computer science, artificial intelligence, pedagogy, and methodology. Cooperative work of scientific and pedagogical teams was organized to carry out pedagogical research and practical, methodical work on the possibility of applying in the educational process various content and methodological innovations based on the academic potential of the scientific field of knowledge - artificial intelligence.

As a result of the analysis of the methods used for professional training and retraining of future teachers, monitoring the educational process in a number of pedagogical universities in Russia, conversations with fellow teachers of pedagogical universities, a general conclusion was made about the need to develop innovative options for working with students of pedagogical universities for active inclusion them in the process of obtaining professionally significant knowledge, the formation and development of active types of practical methodical activity. Besides, it was found that in the practice of the teachers of the higher pedagogical school, there are fragmentary variants of adaptive work with students, orienting them to professional activities in intellectual, educational environments. The study was based on the results obtained in the dissertation research of Vlasova E.Z., devoted to the study of the possibilities of using artificial intelligence for professional training of students of pedagogical universities. In the subsequent works of this author, the topic was developed in the context of the need to update the training of future teachers in terms of their work

in electronic information and educational environment enriched with AI elements (3, 2017; 22, 2017).

In the works on the scientific and methodological and practical level, it was proved that the use of adaptive learning technology based on the design of ILS by students and its main architectural elements of the fact base and knowledge base allows the methodological assets of teachers of higher pedagogical school to be expanded with fundamentally new learning and teaching technologies synthesis of knowledge on pedagogy, methodology, psychology, subject knowledge, and AI. The research ideas were used and implemented in the organization of teacher development (2010–2019) and are reflected in the authors 'work (Vlasova E.Z., Avksentieva E.Y., Goncharova S.V., Aksyutin P.A., 2018; Goncharova S.V., 2017; Karpova N.A., 2012).

Students and trainees of advanced training courses (taking into account their core subject area) when designing FB and KB were offered to perform complex tasks focused on the implementation of activities that contribute to their professional self-development. Namely: the selection of essential in pedagogical knowledge, the formulation of educational objectives and the choice of means to achieve it, adaptation to the educational situation, the formation of generalizations and learning from examples, the synthesis of cognitive procedures, evaluation of educational knowledge.

The initial methodological prerequisites for research are currently as follows: 1) the content and technological transformation of the educational process of training future teachers in order to master their knowledge and technologies that are adequate to the digital stage of development of education, enriched with elements of AI; 2) understanding that the training of future teachers should be open to innovations and productive solutions, which are based on the didactic potential of AI and ILS and are aimed at enhancing the mental and activity of students; 3) the training of future teachers for work in intelligent educational environments, including through the implementation of tasks for the

design of relevant ILS FB and KB. The second-year undergraduates of the Herzen State Pedagogical University of Russia and the Ammosov North-Eastern Federal University and students of the St. Petersburg Center for Evaluation of the Quality of Education and Information Technology. 57 teachers and 294 undergraduates participated in the experiment.

Every year, undergraduates who completed the study of the discipline "Artificial Intelligence in Education" and students of advanced training courses who completed the program on "Intelligent Information Technologies and E-learning in teaching school subjects" were asked to answer the question: “Do you think that the fulfillment of the tasks for the construction of ILS FB and KB contributes to your self-education, professional self-determination, development, and self-development?”

To study the tendencies of students' attitudes to the performance of tasks for the construction of FB and KB for their professional growth and self-development, the method of mathematical statistics was used - time series analysis. A statistical description of the development of the studied pedagogical process in time using a time series (Table 1) was performed. The obtained series of observations with the values of the investigated trait is ordered in chronological order (the variable t is the time parameter increases from 2010 to 2019). The levels of the series were obtained as a result of an annual survey of students studying at the Herzen University and NEFU.

The study was attended by undergraduates of two universities and advanced training students who purposefully carried out assignments for the construction of ILS FB and KB. That and other categories of students were asked to answer the question: "To what extent are abilities (36, 2018) that are developed in the process of completing tasks for designing ILS FB and KB affect the development of students' readiness for innovative professional work of a teacher in intellectual, educational environments?" The assessment was made on a 10-point scale when interviewing teachers who studied at CET and on a 20-point scale when receiving individual indicators of

specific undergraduates. Ranking allowed to translate both scales of measurement into a single scale, where the unit of measurement is 1 rank, and the maximum value is 18 ranks. The hypothesis was tested that the correlation between the individual profile of the undergraduate student S-v and the reference profile constructed according to the evaluations of CET students is statistically significantly different from zero (i.e., the opinions of a particular undergraduate S-v and students of advanced training on the studied issue are similar to each other). To process the results, the Spearman's rank correlation method was used for the case of finding the correlation between the individual and mid-group profiles.

Results.

Based on the theoretical analysis and study of the trends in the development of modern Russian education, the expediency of using an adaptive learning technology based on the construction of ILO FB and KB has been proved. Undergraduates and students of the teachers CET acted as students.

Its effective use in the educational process is confirmed by specific results obtained after processing the experimental data. The results of surveys by year are presented in Table 1.

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Number of the respondents	29	26	31	33	43	51	32	44	57	61

The obtained moment time series satisfies the requirements that are imposed on the initial information for sampling by the indicated method. Namely: row levels are equidistant from each other; row levels are comparable; time series has a sufficient length; there are no missing observations in the time series; time series levels do not contain abnormal values.

After analyzing the initial information for compliance with the requirements, calculations and analysis of development dynamics indicators were carried out, a model for predicting interest in the performance of tasks for designing ILS FB and KB to improve the training of future teachers, which is expressed in the readiness of students for self-education, professional self-determination, and self-development.

In the coordinate system Yt0t, where Yt is the number of students who responded positively to the tasks on the design of ILS FB and KB, t is the serial number of the year. The dynamics of positive responses are presented in Figure 1.

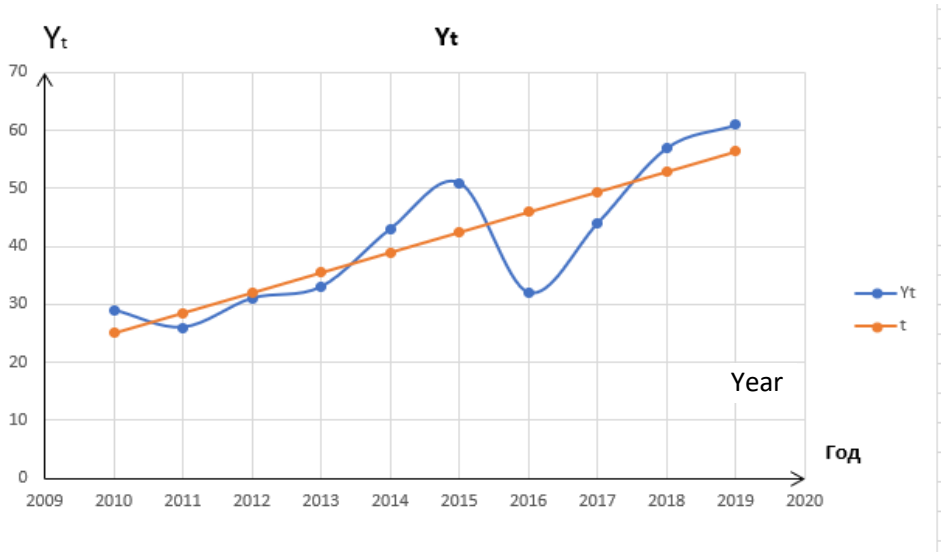

Figure 1. Dynamics of positive responses

Next, the autocorrelation coefficient of the levels of a series of the first order was determined by the formula:

$$r_t = \frac{\sum_{t=2}^{n}\left(Y_t - \overline{Y_1}\right)\cdot\left(Y_{t-2} - \overline{Y_2}\right)}{\sqrt{\sum_{t=2}^{n}\left(Y_t - \overline{Y_1}\right)^2 \cdot \sum_{t=2}^{n}\left(Y_{t-1} - \overline{Y_2}\right)^2}} = 0{,}645\,,$$

Where $\overline{Y_1} = \frac{\sum_{t=2}^{n} Y_t}{n-1}$

$$\overline{Y_2} = \frac{\sum_{t=2}^{n} Y_{t-1}}{n-1}$$

The obtained value of the autocorrelation coefficient and the graphic image of the time series allows for concluding that the interest contains a tendency close to linear. Therefore, a linear function can be used to model its trend.

$$y = a + bt$$

The least squares method was used, and the following system was solved to calculate the parameters of the linear trend a and b:

$$\begin{cases} na + b\sum t = \sum Y \\ a\sum t + b\sum t^2 = \sum Yt \end{cases}$$

Using formulas derived from the system, the parameters were found:

$$b = \frac{\overline{Yt} - \overline{Y} \cdot \bar{t}}{\overline{t^2} - \bar{t}^2}$$

$$a = \overline{Y} - b\bar{t}$$

The result is a trend of the form

$$Y_t = 21.53 + 3.48t.$$

This confirms the results of an experiment conducted with undergraduates from two universities and CET students. On average, annually the number of students who believe that the fulfillment of tasks for designing ILS FB and KB contributes to professional development and effective preparation for solving problems of professional activity increased by more than 3 people.

In the process of the study, averaged estimates of CET teachers' for individual types of new educational activities and individual indicators of the undergraduate were obtained. Further, a separate ranking was conducted for each series of values.

Table 2.Ranking indicators of the characteristics of abilities developed in students in the design of ILS FB and KB

Ability	**Average grades of CET teachers**	**Individual performance of a student**	**d^2**
Ability to highlight the essential in educational knowledge	8.62	14	0.25
Ability to goal-setting and planning of the educational process	7.79	7	1
Ability to choose knowledge	8.40	12	1
Ability to extract consequences from existing knowledge	6.94	6	2.25
Ability to reasoned decision making using ordered knowledge	8.26	13	4
Ability to assess knowledge	9.55	18	1
Ability to find explanations	8.10	12	4
Ability to synthesize cognitive procedures	8.42	17	9
Ability to create a holistic picture, which combines knowledge relevant to the goal	8.00	19	100
Ability to adapt depending on the learning situation	8.69	9	56.25
Ability to set goals and ask questions to reduce uncertainty in knowledge	7.73	14	110.25
Ability to learn	7.87	9	0.25
Ability to rationalize ideas	8.20	11	1
Ability to adapt in conditions of changing knowledge (level of students)	9.01	12	36
Ability to evaluate actions	8.72	8	110.25
Ability to organize knowledge	7.82	6	12.25
Ability to develop conceptual models	7.63	4	4
Ability to reason	7.22	8	12.25

The following hypothesizes were checked:

H0: The correlation between the individual profile of the C-va undergraduate and the reference profile, constructed according to the estimates of the CET students, does not differ from zero.

H1: The correlation between the individual profile of the student S-v and the reference profile, built according to CET students' estimates, is statistically significantly different from zero.

Since there are groups with the same values in both matched rows of answers, before calculating the rank correlation coefficient, corrections were made for the same ranks of Ta and Tb:

To calculate the empirical value of the Spearman correlation coefficient rs, the formula was used.

The critical values are determined according to the table of critical values of the sample rank correlation coefficient rs at n = 18:

Hypothesis H0 is rejected. The correlation between the individual profile of the students S-v and the reference profile, constructed according to the CET students' estimates, is statistically significantly different from zero and is positive at the 5% significance level.

The most significant results include: 1) the development of a fundamentally new content of the discipline "Artificial Intelligence in Education" for undergraduates enrolled in the direction of "Pedagogical Education" and the program of advanced training for teachers "Intelligent information technology and e-learning in teaching school subjects"; 2) the development and successful implementation of adaptive learning technologies, involving the multivariance of methods, forms and means of working with students; the activation of their cognitive abilities, the development of a set of abilities characteristic of natural intelligence and self-organizing activities; the use of interdisciplinary tools in the process of solving learning problems by methods that are used in the construction of ILS FB and KB.

The content is adapted to the professional activity of the teacher in the changing conditions of teaching and learning in intellectual, educational environments; filled with theoretical and practical issues of using technologies, methods, and tools of AI, relevant for education.

Dıscussıon.

The facts base and the knowledge base are the essential structural elements of the intellectual system of education. The knowledge engineer is engaged in Its development. Until recently, their main task was to acquire the knowledge of an expert in the subject area and to upload them into a computer. Taking into account the new development paradigm of ILS, based on actions, the knowledge engineer (the student acts in this role) must analyze, synthesize and find ways to present additional information in the computer related to the structure of the educational process. This includes the following: 1) the semantic structure of the educational activities of the student and teacher, taking into account the dynamics of the development of the educational process; 2) the interrelation of educational activities modeled for organizing the full-fledged assimilation of knowledge; 3) multivariate scenarios for the achievement of learning objectives, taking into account adaptation to the level of training and learning of the student.

Summarizing what has been said, we note that at the present stage of development of AI systems, the idea of intellectual behavior based on the activity-related interaction of stakeholders is dominant. As the well-known psychologist, J. Piaget, emphasizes [Piaget, Jean., 1994], the emphasis is on modeling not only and not so much cognitive, as regulative processes and not so much structure, as the evolution of the intellect. Moreover, it is quite natural that additional requirements are imposed on the developers of these systems, namely, knowledge in the field of regulatory and communicative processes.

Such knowledge will allow an adequate approach to the modeling of the intellect in a particular form of interaction between the subject and the object, as "specific activity, which, being derived from external objective activity, appears as a set of internalized operations coordinated among themselves and forming reversible stable and simultaneously mobile integral structures" [Piaget, Jean., p.28]. We must form the knowledge structures with such characteristics in students, strengthening this activity with the help of ILS. In reality, this is possible if the IL, like an expert, manipulates knowledge and imitate learning activities based on them; that is, they implement the cognitive process in dynamics.

The development of effective intellectual systems that imitate the learning process in dynamics requires the use of our knowledge of human problem-solving mechanisms. Knowledge of these mechanisms, in turn, puts the creator of an intellectual system before the need to expand their information field with new knowledge from various subject areas. First of all, they should include knowledge in the subject, pedagogy, psychology, methods of teaching the relevant academic discipline, gnoseology, linguistics, methodology, etc. That is, the very formulation of the task of creating a facts base and a knowledge base requires an interdisciplinary synthesis of knowledge. Moreover, its creator appears as a system open to update their professional knowledge.

Moreover, acquired in the form of individual elements, this knowledge in the course of the student's work on FB and KB (that is, its special learning activities) interact both with each other and with the external learning environment (students, teachers, experts, schoolchildren, various sources of verbal knowledge). As a result, scattered, unstructured knowledge based on interconnection and coordinated use (as part of the solution of the set learning task) forms new knowledge structures with a higher level of development of their carrier. This development appears in dynamics. It consists in modeling various options for organizing knowledge in the knowledge base, developing

various scenarios for learning activities, taking into account their adaptation to the system user, modeling the student and teacher activities through their analysis and synthesis.

In the course of this activity, the student interacts with the external environment, constantly changing the structure of his knowledge. This reveals the properties of openness of our system - the student and the growth of their capabilities to a new level of professional knowledge. Thus, the conscious and purposeful integration of the elements of the subject, pedagogical, methodical, psychological and other knowledge into the system leads to the emergence of new professional qualities among students and to increase the effectiveness of its functioning as a system.

Additionally, it should be noted that the professional development of students described in the course of work on the FB and KB is possible based on the continuity of their educational activities. Obtained earlier subject knowledge is the basis for its development, and the authors can talk about the process of student evolution from his existing knowledge to that arising through the development of a fact base and knowledge base of an intellectual learning system.

The development of any system occurs at the expense of internal mechanisms, that is, as a result of the process of self-organization, as well as at the expense of external control actions. In the proposed adaptive technology, such an external impact is the very formulation of the learning task - the development of ILS FB and KB.

A distinctive feature of such a statement of the problem is that the elementary learning influences on the student in the course of their work on the knowledge base will each time be coordinated with the student's motivational properties in terms of the necessary knowledge for their future profession. In this case, we can speak of a directed coherent impact, which initiates the process of self-organization of the future teacher. In the process of working on the facts base and knowledge base, the future teacher should continuously refer to the knowledge they already have, and intensively use them in their practical training activities.

The intensity of knowledge use plays the role of an organizer in the system and provides a transition to a new qualitative level of the structural organization of knowledge, that is, the process of self-organization in the system is initiated — knowledge from theoretical turns into operational. The subject of the doctrine itself is placed in an activity position, and the academic subject is transformed from a purely academic to a professionally oriented one.

An additional stimulus to the professional-pedagogical self-organization and student's reflection is the multivariate modeling of educational scenarios in the process of creating a KB. The work on scenarios makes relevant subject knowledge already relevant, valuable from an informational point of view since they are in demand and used in student learning activities. However, own experience of working on knowledge bases (Vlasova E.Z., Goncharova S.V., Luknova V.A., 2019; Ilina T.S., 2016) and a summary of the opinions of specialists in this field shows (Finn V.K., 2018; Osipov G.S., 2018; Osipov G. S., Chudova N.V., Panov A.I., Kuznetsova Yu.M., 2018) that theoretical knowledge obtained directly in class is not enough.

The variety and multivariance of solving educational tasks are achieved by studying various alternative approaches to organizing and conducting the educational process. For this purpose, students study the experience of work of experts in subject areas, become familiar with alternative solutions to the same educational or methodological problem, analyze various ways of deploying the thoughts of experts, and the multiplicity of their decisions. That is, they are introduced to nonlinearity variants in solving single-type problems as representatives of the Russian synergetic school V.Yu. Krylov, S.P. Kurdyumov, G.G. Malinetskiy in [Krylov V.Yu.,, p.4], "it is nonlinearity that provides great opportunities for adaptation".

The authors can assume that the activities of students in the process of working with experts adapt them to the future teaching profession, developing divergent thinking, that is, the ability to identify diverse approaches to solving the problem, develop them and identify the original. Academician

N.N. Moiseev at the lecture "The Civilization of the 21st Century: the Role of Universities", delivered at the International Congress of Universities. He noted that "the most important thing that should be given to the future specialist, especially the researcher, - and they will need more and more - not so much a set of facts that modern science has, how many ideas about the features of the creative process, about how he went to the statement of a fact" [Moiseev N.N., p.120].

In addition, students explore the changes in various learning control actions at the micro level (that is, at the intermediate stages of learning a particular issue) and analyze the macrostates into which the system can (the potential user of an intelligent system), that is, study the possible mechanisms of self-compiling and self-organization of students. This helps to develop a model of possible ways for the development of trainees in the learning process. As a result, future teachers acquire experience in studying students as objects and subjects of the educational process, choosing educational management mechanisms, and designing methodologically sound student influences. In connection with this activity of students, the authors can talk about the development of their abilities for such activities as designing, constructive, communicative, diagnostic, and organizing activity. Besides, students develop the ability to reflect, mobility in decision making, professional self-organization. Abilities that characterize natural intelligence are developed as well.

Working with experts involves the use of unique methods of acquiring knowledge from them. The theoretical acquaintance with these methods and their practical implementation require students' specific training in the field of pedagogy, psychology, linguistics, the subject area, etc. Thus, the solution to the problem of acquiring knowledge from an expert by a future teacher implies an interdisciplinary synthesis of the scattered knowledge that the student has.

The systemic coordination of sought-after knowledge, the positive correlation between them in direct activities, establishes a new, higher rate of development of the student's professional qualities. This is due to the "launching" of the internal mechanisms of self-organization of subjects

of learning. The use and study of just such control parameters aimed at accelerated development of systems are characteristic of synergetics. As a result, the student self-organizes and enters own development trend and, ultimately, self-compiled with a focus on the future profession.

One of the ways to create this adaptation may be an activity approach to learning. In particular, students' modeling of learning and teaching activities in the design of intelligent learning systems as a means of learning management.

CONCLUSIONS.

As a result of the study, it was shown that successful training and retraining of teachers for professional activities in the context of the intellectualization of the professional environment and filling the electronic information educational environment with AI elements requires their focused preparation for the implementation of updated professional activities that require an interdisciplinary synthesis of their knowledge and practical skills, ability to develop models of possible ways of development of trainees, understanding, and didactically correct use of the mechanisms of self-development and self-organization of students.

To this end, adaptive learning technologies have been developed for the training of future teachers (undergraduates enrolled in the direction of "Pedagogical Education") and already working teachers, contributing to 1) the development of their aggregate abilities, increasing their level of intelligence in general, and in the professional aspect, in particular; 2) the formation of their methods of mental and practical activities that ensure the coordinated use of knowledge from different subject areas to solve the set professional problem effectively; 3) preparation for professional activities in a developing in the direction of the intellectualization of electronic information and educational environment. The basis of adaptive learning technologies is interdisciplinary synthesis, which presupposes an organic combination of knowledge, practical actions, forms, methods and means used in the educational process; cooperative, dynamic and

flexible work of students on the task in order to prepare a specialist with professional qualities relevant to work in the modern educational space.

The analysis and generalization of the activities of the students' teaching in the process of designing the ILS FB and KB showed that it is productive, brings them to a new level of professional knowledge and actions. Students master the strategy of forming a system of knowledge, skills, and abilities of students in the subject being studied; methods of self-organization and self-development; nonlinear technology organization of the educational process. This corresponds to a productive and highly productive level of teacher activity. This forms a new installation of education on the development of thinking and student activity.

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