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Variety of Engineers’ Needs in the Foreign Language Usage as a Basis for their Training Diversification

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Abstract

The variety of conditions for use of a foreign language within the engineers’ professional activities leads to diversification of their foreign communicative needs and the necessity of improving their foreign language comprehension. Diversification of foreign communicative needs with the engineers has been confirmed during the study. The results of the latter show that the needs of engineers in using the foreign languages vary depending on the types of engineering activities implemented and the types of organizations they are employed at. The variations of needs according to types of engineering activities are mostly connected to the speech genres utilized in spoken and written texts used by engineers. This requires from the engineers professional communicative competence in a foreign language of various content. Differences in needs of engineers depending on types of organizations can first of all be seen in the various levels of engineer’s communicative competence in a foreign language required for the purpose of speech activity in a foreign language in organizations of different types. Diversification of foreign language communicative needs with engineers is one of the principles explaining the necessity of foreign language training diversification in the course of engineer training which can be viewed as one of the directions for its development and a condition for ensuring its continuity.

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1. Introduction

Globalization processes, as well as internationalization of economies and Russia being integrated into the global community promote the international contacts in the engineering labor sphere. Temporary and permanent international teams appear in the Russian economy, and the professional activities within such groups are carried out not only in the native language, but in a foreign language as well. The role of foreign language communication in the activities of engineers is increasing, and the professional communicative foreign language competence of an engineer is becoming more and more significant and important component of the engineer's professional competence. Consequently, the requirements towards the foreign language comprehension level of engineering specialists are becoming stricter.

Meanwhile, versatility of conditions for technical higher education institutions graduates to use foreign languages is particular for the modern phase of development of the society. The current variety of conditions for an engineer to use a foreign language is determined by a number of factors: specific character of the economy branches, particularities of various engineering activities, growing number of foreign manufacturers, joint ventures and transnational corporations.

The variety of professional conditions for use of a foreign language leads to diversification of existing professional foreign language communication needs of modern engineers. Under the professional foreign language communication needs we understand needs of performing a foreign-language speech activity which are related to the solution of professional problems when satisfied. Given this, if a particular engineer gets promoted or changes the place of occupation due to occupational mobility, the new individual communication needs arise, which requires further improvement of professional foreign language communicative competence. The desire of engineers to improve its level is one of prerequisites for the necessity of continuous training in a foreign language. This provision is confirmed by the data of our research which has revealed that over 50% of respondents with various work experience find it necessary to raise their level of professional foreign language comprehension.

However, the foreign language training currently available in the Russian engineering education in spite of the attempts made by some higher educational institutions to introduce a multilevel approach is unified and ignores the diversification of engineers' foreign language communication needs. The results of foreign language training demonstrated by students during final exams at the end of the basic course keep remaining at a rather low level. This requires improvement of the foreign languages training system in technical higher education institutions.

Further improvement of foreign language training system in engineering education, on the one hand, has to take into account the diversity of the utilization conditions of a foreign language by the engineers and, on the other hand, has to ensure the continuity of such training. Under these conditions, one of the areas of foreign language training upgrade in engineering education can be diversification thereof.

Diversification of higher education is among the fundamental global trends of its development (Towards an Agenda 21 for Higher Education, 1998; Bajdenko, 1999; Lomakina, 2006). Under diversification an “expansion of activities of the educational system and the acquisition of new forms and functions previously not familiar to the system” is understood (Lomakina, 2006, p.74). This trend is directly related to the diversity of manufacturing activity conditions in the broadest sense of the word and, as a consequence, with a vast range of social needs for experts in different fields.

Diversification of higher education covers various educational levels and is expressed in a variety of institutional structures and forms as well as the models of higher education, curricula. It should be emphasized that the diversification of education is closely linked to its flexibility, i.e. to the ability of higher educational institutions to respond quickly to new demands of society (Towards an Agenda 21 for Higher Education, 1998). It is the diversified education that can provide freedom of choice for an individual and the conditions to better meet his cognitive needs. Diversification of higher vocational education while influencing all its levels can also be extended to the training of engineers in a foreign language as a subsystem of engineering education. It can ensure a variety of training programs depending on the various needs of students.

Diversification of higher vocational education is closely connected to other global trends of high school development, in particular, with lifetime education. Diversification is viewed as the principle of development of continuous education system in modern social and economic conditions, as it is diversification that allows creating
the conditions for a variety of educational paths ensured by unlimited quantity of educational programs tailored to the individual's opportunities, needs and abilities (Lomakina, 2006).

In its turn the diversification of professional training in a foreign language which manifests itself in a variety of programs creates the conditions for enhancement of communicative competence of engineers and thus provides its continuity.

2. Objectives, methodology and research design

2.1. Objectives

According to the theory of diversification of professional training in a foreign language in engineering education proposed by us, diversification is regarded as one of the main directions of its further improvement (Polyakova, 2010). It is stipulated by the existing diversification of professional foreign language communicative needs of engineers and is a necessary condition for ensuring its continuity. Diversification of continuous professional training in a foreign language in engineering education provides for differentiation of academic and educational programs in accordance with the variety of use of a foreign language by engineers. Diversification creates conditions for the fullest possible satisfaction of the various needs of studying the foreign language on the basis of the participants of the educational process' choosing their educational paths with an unlimited number of combinations of educational programs. With regard to this, diversification of professional training in a foreign language in engineering education is regarded both as a process and the result of its development.

One of the hypotheses underlying the theory developed by us has been expressed as follows: professional foreign language communication needs of engineers are objectively diversified depending on the types of activities performed by them, as well as depending on the types of organizations in which they are employed.

In order to verify this hypothesis a study was conducted, the goal of which was to justify the existence of diverse needs of engineers in using foreign languages in their professional activities. To achieve this goal, the following objectives had to be attained:

- identification of types of professional activity of an engineer;
- identification of types of organizations in which the use of a foreign language by an engineer takes place;
- identification of differences in typical foreign language communication needs of engineers depending on the type of their professional activities;
- identification of differences in typical foreign language communication needs of engineers depending on the types of organizations where the professional activity of engineers takes place.

2.2. Methodology

Solution of the first research problem required an analysis of theoretical research works in the theory of operations, engineering, and engineering pedagogy. It has been found that modern understanding of engineering activities refers to these as one of the areas of professional activity which involves work aimed at discovery (search), setting, and solving engineering problems, as well as the implementation of the relevant results in production and industrial relations (Kirsanov, 2000).

Making distinction between the types of engineering activity depending on the goals and problems solved by experts is extremely important for this study. In the usual sense based on the long historical experience, engineering practice is characterized as one of the aspects of human activities associated with creation (research, design, manufacturing) and exploitation of technical facilities meant to help achieve the determined goals which indicates the organic heterogeneity of the engineering work (Bahur, 2004). Depending on the nature of the object of work, the following types of engineering activity are traditionally distinguished: production and technology, design and engineering, scientific and research, organization and management ones.

In all kinds of engineering activity, the role of information is so important that it gives grounds to argue that the main subject and the result of engineering work is information. This information is recorded in various documents.
The specific features of various activities of engineers influence the conditions of their using a foreign language and determine the objectively existing diversity of such conditions. During the study, it was supposed that the professional foreign language communication needs of an engineer varied depending on the type of engineering activity, which influences the content of the professional foreign communicative competence of engineers. At the same time, this study refers to professional foreign communicative competence as to the ability to carry out communication in a foreign language in the course of professional interaction with other participants of communication.

In order to solve the second problem of the study, types of organizations that employ engineers had to be defined in terms of the use of a foreign language. The analysis of literature provided no opportunity to identify such typology. For the purposes of this study, a principle for elaborating such classification of organizations has been proposed. The classification is based on the degree of development of international contacts. Depending on the level of development all entities can be divided into several types (Polyakova, 2006). Within the classification thus elaborated, they are generally referred to as organizations. Taking into account the forecast development of professional mobility of experts that increases the employment opportunities for local engineers abroad, the classification also included the enterprises and institutions located abroad. As a result, all organizations were divided into ones operating in Russia and ones operating outside the country. The latter were conventionally called "foreign organizations" (foreign companies). Furthermore, the organizations operating in Russia have been subdivided into:

- organizations having no constant international relations;
- organizations with permanent international relations;
- transnational organizations.

Organizations having no constant international relations are represented by enterprises and institutions that either do not support international contacts or support these only occasionally, from time to time. Organizations having permanent international contacts are the enterprises and institutions that have permanent foreign partners. These may be suppliers of equipment, buyers of the products, contractors, creditors, etc. Organizations conventionally referred to as transnational combine the international companies operating within our country, multinational corporations and joint ventures in which foreign shareholders (co-founders) hold significant stakes in the authorized capital. These organizations are characterized by the presence of temporary or permanent international teams.

The validity and feasibility of identification of the above types of enterprises and organizations is directly related to the language in which they carry out professional activities. Joint activity in the multinational teams leads to the fact of a foreign language being used by engineers not only in order to extract information from a written source, but in the current conditions, to perform their activities partially or completely in a foreign language.

The solution of the third and fourth problems required identification of typical communication needs of engineers. The object of research was verbal activity of a specialist carried out in a foreign language, and the subject was the professional communication needs in the course of implementation of foreign-language speech activity.

In order to achieve the set goal, primary sociological information has to be collected for which scientific research uses the survey method (Yadov, 2003). As the main method of surveying, questionnaire survey has been selected. Interviewing the experts was used as a supplement and validation method for the resulting information and for evaluation.

2.3. Research design

The questionnaire survey technique used included the following phases:

- preparation;
- factual evidence collection;
- analysis and generalization of the information obtained.

At the first, preparatory phase of the questionnaire survey, the problems of authenticity and reliability of the
information obtained were solved and, therefore, so were the ones of providing ground for the resulting conclusions. At this phase, the questionnaire was elaborated, the number of objects and observation units was determined, a project of data processing was created, and a pilot survey was conducted.

The questionnaire consisted of an introductory part, basic and final ones. The introductory part of the questionnaire revealed the purpose of the interview and the rules of filling in the questionnaire. The basic part of the questionnaire contained 16 semi-closed type questions which imply answer options and the opportunity to give one's own viewpoint. The survey was conducted anonymously, but the final part of the questionnaire included six questions concerning the status of the respondent. Respondents had to specify their position, profession, work experience, country of residence, native and foreign language which they used in professional activities. The questionnaire took 7 to 15 minutes to be filled in.

In the second phase, the collection of information was carried out selectively. The objects of observation were the specialists with higher technical education using a foreign language (orally or in writing) in their professional activities and at the same time sufficient representativeness of the sampling was ensured. The professionals working in the research, design, organizational and management, production and processing at the enterprises of different types were subjected to questionnaire survey. In addition, experts with wide variety of experience from a few months to 35 years were also surveyed. As a result, 201 engineers were surveyed during the study. Collection of factual information was carried out in 2004-2005. Representativeness of sampling allowed extrapolating the results onto all engineers.

In the same phase the experts were interviewed. The experts were specialists with higher technical education and work experience of at least 20 years using a foreign language in their professional activities. A total of 27 interviews were held.

Thus, in order to determine the diversified foreign language communicative needs of engineers the method of questionnaire survey was chosen. Inclusion of test questions into the questionnaire, parallel interviewing, data processing relevant to the survey tasks, the representativeness of sampling and conduction of pilot questioning ensure the validity of the information obtained as a result.

3. Results and discussion

The study confirmed the diversification of professional foreign language communicative needs of engineer depending on the types of engineering activities. Thus it was found that in various activities engineers used a variety of verbal and written sources of information (oral and written texts of various genres).

Diversification of needs can be quite convincingly traced in reading various texts. The difference in needs for reading popular science literature, books, patents, presentations, reference books, reports, essays, equipment manuals differ more than 2 times. Scientific workers show no interest for the equipment manuals (0%). With the product designers, the frequency of reference to industrial advertising (20% of respondents) is explained by the need to find ready-made rational design solutions.

A significant difference (1.5 times) in the incidence of engineers referring to non-textual sources of information (tables, charts, drawings, diagrams, etc.) in a variety of activities can be noticed. Thus, such sources of information are required by 35% of product designers and 20% of scientists, due to the prevalence of drawings, tables and specification sheets in these activities.

The dramatic differences can be traced in the use of texts in organizational and management activities if these are compared to other professional activities. The most varied needs are those for reading contract documents (7 times), business correspondence (3 times). Managers read the foreign language scientific articles 2 to 5 times less often and read normative literature more than 2 times less often. They show a considerable interest in personal correspondence (14.9%). At the same time, engineers and scientific workers have not expressed the need for this kind of texts in a foreign language (0%).

The greatest differences are found when considering the need for reading in the production and technological activities when compared to the other three types of activities. Reading foreign language periodicals on science and technology is found to occur among the production engineers 5 to 10 times less than among the scientists and product designers. No interest in foreign-language monographs, reports, industrial advertising, personal
correspondence (0% of respondents) is shown. The most relevant sources of information are the foreign-language equipment manuals.

The needs of engineers in translation of professional literature were analyzed separately. In engineering design and research and development, the needs for the translation of scientific and technical published and unpublished texts (50%), manuals, regulations, drawings, diagrams and tables (from 25% to 45%) prevail. Virtually no need for translation of the political literature and orders exists.

Natural differences in these activities are revealed when the translation of written texts is performed. Thus, the need for the translation of reports (on the research work), monographs, and presentations is about 3 times differing, and almost 2 times – one for the translation of scientific articles, textbooks, patents. The need for these genres is much more expressed in the scientific research activities in comparison to the project activities. In their turn, the product designers have a greater need for translations of data sheets (about 4 times as much).

The translation needs of the engineers working in the field of industrial and organizational activities do not only radically differ from the previously mentioned two activities, but also differ from each other.

The production workers and managers as compared to the scientists and designers have a significantly reduced interest in scientific and technical texts (from 14-59% to 0-22%). At the same time managers, unlike the experts in other activities, show a natural interest in administrative documents (orders, etc.) (50% of managers vs. 0-3% of other categories of engineers). An interestingly low need for translation of technical documentation in the organizational and management activities (up to 3%) against 45-60% in other activities can be noticed, as well as a significantly greater interest of managers in translations of personal letters (about 45% vs. 0-5%).

The specific character of production activity is also manifested in the engineers' need in translation. Most significant is the need for translation of manuals for appliances and equipment (55%), which is naturally provided a wide application of imported special equipment in the enterprises. The interest shown by the production engineers for translation of technical documentation according to which the production is performed (40%) is also explicable.

Comparing the needs of engineers in translation we can observe an interesting trend of their gradual change in accordance with usual interaction of four kinds of engineering (scientific idea – project – production). At the beginning of the technological chain (scientific research activities) the interest shown by an engineer is due primarily to scientific publications (articles, reports, presentations). The research results are transferred in most cases to product designers. As a consequence, the interests of research engineers and design engineers in the translation should be similar. However, the design activities show the trends typical for industrial activity into which the designers transfer the results of their labor. This is reflected in the decrease of interest in journals, textbooks, monographs, conference programs. At the same time there is an increase in the need for translation of data sheets and reference books. Design activity which occupies an intermediate position in the process chain demonstrates the coincidence of interest in translation with either scientific or production activity. Naturally, the interest of design engineers in translation of technical documentation remains the same.

The management and administration which hold a special place in the process chain show a growing interest in translating patents (patent clearance is an important criterion during making decision about production), correspondence, administrative documents, as well as a lower interest in translating articles (except popular science ones), technical documentation, and manuals.

The study also confirms the diversification of needs of engineers for the use of speech in a foreign language, depending on the types of professional activities.

The analysis of engineers' needs in speaking shows that in the product design activity the most common need is the one in dialogue (56%). At the same time presentations (7%), orations (0%), coaching (0%) have proved to be the least demanded. In the research activities, the needs in dialogue (almost 70%) and questions and answers (40%) are mostly prevalent. At the same time the same kinds of speeches as in the design activity are not popular. However, the significant difference is that the researchers have completely no need in phone calls in a foreign language (0%) while among the designers 30% of respondents have experienced such need. The engineers engaged in production and technological activities show a smaller variation of needs. Required are all the forms of oral presentations considered above. Moreover, coaching in a foreign language is required by almost 23% of respondents using a foreign language for their professional duties, while the engineers and scientists do not experience such need (0%). The needs of engineers in the field of organizational and management activities display distinct characteristic
features: a leading position is occupied by the need in dialogue – 68% due to its central role in negotiations with the foreign partners. For managers, telephone conversations also play an important role (57%) which is 2 times as much as the same figure in other activities except for the scientists (0%). Dialog held in the "question and answer" mode is also important (49%). Unlike other kinds of engineering activities the managers reveal an appreciable frequency of making presentations (19%).

The course of the study revealed differences in the needs of engineers in listening comprehension (listening). The design engineers find it most important to understand the speech of the interlocutor (67%), particularly during the dialogue of the "question and answer" type (54%). Much less often they need to understand coaching by listening. These figures are similar to those in the scientific and research activities. As for other parameters, the differences in frequency of listening for these activities can reach 1.5-2 times with varying prevalence. The needs of engineers working in the field of organizational and management activities are generally similar to those of design engineers and researchers in understanding the speech of the interlocutor (70%), "question and answer" dialogue (42%). In the organizational activity, discussion (38%) is just as important as in science (41%). In the design process discussion occurs twice as less frequently (21%). Traditionally, listening to an interlocutor on the phone (64%) is important in management, while in the other two kinds of the above mentioned activities this figure only reaches 33% (designers) and 23% (scientists) which makes the difference less than 2-2.8 times. In the production process, as expected, the leading need is for listening to instructions – 48%, which is more than 2 times more often than in other activities. The need for listening to the interlocutor is found in the production workers more than 1.5 times less often (only 43% compared to almost 70% in other activities).

Thus, various types of engineering activities show significant differences in professional foreign language communicative needs. In some cases, the differences in the demands may be up to 10 times; more often they are only 1.5-2 times.

The study results confirmed the differences in foreign language communicative needs depending on the types of organizations in which professional activities are carried out. In accordance with the classification developed, only the enterprises operating in Russia have been subject to the study. Concerning the activities of domestic experts outside the country, it was assumed that they were distinguished by the presence of a foreign language both at the medium level of the working staff and at the level of the general social environment.

First of all, a trend was revealed according to which under the modern conditions the foreign language was used by engineers not only to extract information from written sources, but also in some types of organizations for the purpose of professional activities (partially or to a full extent). From 15.3% to 40.8% of respondents (depending on the type of enterprises) say that their professional activity is carried out both in their native and in a foreign language.

In organizations having no permanent international relations professional activities are usually performed in the native language and a foreign language is used by a limited number of specialists only sporadically for the implementation of information activities which are a structural component of the professional activity. So, the majority of respondents (51.7%) carry out their professional activities exclusively in their native language without having to use a foreign language; less than a half of the total number of the respondents (44.8%) carry out the activities in their native language with only occasional reference to a foreign language in order to solve specific professional problems. Only 3.4% of the respondents in these organizations carry out their activities in both foreign and native languages.

As for organizations having permanent international connections, the majority of experts (58.4%) there carry out their professional activities in their own language, occasionally referring to foreign language for professional problems. As compared to organizations having no permanent international relations, this type of organizations has twice as smaller quantity of professionals engaged in professional activities exclusively in their native language without the need in foreign language (24.6% vs. 51.7%). Almost 5 times was the increase in the number of engineers engaged in professional activities in two languages (native and foreign): 15.3% of respondents compared to 3.4% in organizations having no permanent international relations.

In organizations conventionally referred to as "transnational organizations", the professional activity is carried out in two languages, foreign and native. In these organizations, as compared to ones having no regular international contacts, the quantity of respondents engaged in professional activities in two languages (native and foreign) is 12 times greater, and as compared to organizations with permanent international connections – over 2, 5 times greater (40.82%, 3.4% and 15.3% respectively). At the same time the number of respondents who do not use a foreign
language in their professional activity as compared to organizations without permanent international relations is over 3 times less and almost 2 times less as compared to international organizations with permanent connections (14.3, 51.8 and 24.6% of respondents respectively).

The study has demonstrated that almost none among engineers working in different types of organizations in Russia carries out the professional activities entirely in a foreign language.

Engineers' carrying out the professional activity in organizations of different types also influences the frequency of their using a foreign language, which indirectly confirms the validity of distinction of different types of organizations. So, in multinational organizations around half of the respondents (42.86%) use a foreign language on a daily basis which is almost 2 times higher than the same figure for the organizations with regular international connections and more than 5 times higher than the figure for ones without permanent international connections.

The number of respondents using a foreign language 2 times a week in the organizations without permanent international relations is 3.44% which is almost 5 times less than that in the organizations with regular international connections (16.9%) and transnational organizations (18.37%). It seems apparent that working abroad in a foreign team requires daily use of a foreign language. At the same time, in organizations having no permanent international relations, the vast majority of respondents (81.5%) use a foreign language either rarely, as appropriate (57.4%) or not at all (24.1%). With regard to this, by contrast, in the transnational companies almost the same number of respondents (73.47%) uses a foreign language as often as either daily (42.86%) or two times a week (18.37%) or 1-2 times per month (12.24%). As for organizations having international connections, a little more than a half of the respondents (50.67%) use a foreign language on a daily basis (23.07%) or 2 times a week (16.9%) or 1-2 times a month (10.7%).

So, in organizations having no permanent foreign relations only less than a half of respondents (39.1%) feel the need in reading in a foreign language, while in the transnational organizations this type of speech activity is used by almost all respondents (93.9%). The data correlate with the need in translation or utilization of its results: in transnational organizations, the need in translation is 87.88% and 45.5% respectively, and in the organizations without permanent international relations these figures reach 55.1% and 31.03%.

The above trend is even more convincing if we consider speaking in a foreign language: oral communication is necessary for all those working in transnational companies (100%) against 24.8% of the respondents employed in organizations having no permanent international relations. Participation in oral communication in the transnational organizations determines the demand for listening comprehension (listening) by virtually all employees surveyed (93.9%) compared to 28.7% of respondents working for organizations with no permanent international relations.

The data quoted characterizing the choice of the language by engineers for their professional activities and the frequency of its use indicate the various scope of professional foreign language communication and varying degrees of demand for foreign language in professional activities of engineers in a particular type of organization. Differences in the amount of foreign language professional communication in different types of organizations determine the ones in professional communication needs of engineers. These differences manifest themselves primarily in the different levels of professional foreign communicative competency of engineers required for performing a foreign language speech activity in different types of organizations.

The results of the study show that working in transnational organizations requires a higher level of professional foreign language competency (45% of respondents with the above average level) than working in the organizations with regular international contacts (29%) and in ones without permanent international relations (15%).

Concerning the proficiency in a foreign language, the opinion of respondents in organizations with no permanent international relations was that only 2.29% can show this level of speaking in a foreign language. This is almost 4 times less than the number of respondents with the same self-assessment in the organizations with the permanent international relations (9.2%) and 12 times less than the number of respondents in transnational companies (28.57%). Meanwhile, in the organizations without permanent international relations, the majority of respondents (39.08%) rate their level of knowledge of a foreign language as low, which is more than 1.5 times than the quantity of respondents with the same self-assessment in the organizations with regular international connections (23.07 %), and almost 2.5 times as much as in the transnational companies (16.33%).

Thus, the professional foreign language communication needs of engineers are objectively diversified depending on the types of organizations that differ in the degree of development of international relations. The validity of the
proposed classification for the organizations has been experimentally confirmed. The said differences manifest themselves primarily in the different levels of professional foreign communicative competency of engineers required for performing foreign-language speech activity in different types of organizations.

4. Conclusion

Diversification of foreign language training in the engineering education can be regarded as one of the main directions of its development. It is stipulated, on the one hand, by the corresponding trend in the development of higher education, and on the other hand, by diversification of professional foreign language communicative needs of engineers. Professional foreign language communicative needs of engineers are objectively diversified considerably depending on the type of professional activities, which is confirmed by the differences found in the pilot study the most significant of which are related to various speech genres of oral and written texts used by the engineers. This requires from the engineers to have professional foreign language communicative competence with varied content.

Professional foreign language communicative needs of the engineers are objectively diversified depending on the types of organizations that vary in the degree of development of international relations. The validity of the proposed classification for organizations has been confirmed in the course of an experiment. The said differences manifest themselves primarily in the different levels of professional foreign communicative competency of engineers required for performing foreign language speech activity in different types of organizations.

Meeting the diverse foreign language communicative needs of an engineer requires forming the professional foreign language communicative competency varying both in its level and its content with students during foreign language training.

The diversification of continuous professional training in a foreign language in engineering education provides for differentiating the academic and educational programs based on the identified typical foreign language communication needs of engineers. The diversification creates conditions for satisfying most completely the various needs during learning on the basis of educational paths selected by participants of the educational process by means of an unlimited quantity of educational programs combinations. It is also a necessary condition to ensure its continuity.

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