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The Paradigm of Curriculum Differentiation in Higher IT Education

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ABSTRACT

The subject of the work is the paradigm of curriculum differentiation in higher IT education; the object of the work is differentiated curricula in higher IT education; the purpose of the work is to ensure the improvement of the quality of higher education in the IT field; to achieve this goal, the following tasks are solved in the work: the provisions of the theory of curriculum differentiation are formed, the elements of the curriculum differentiation paradigm are described, discussion of methodological issues of the formation of the curriculum differentiation paradigm, description, and analysis of risks in the differentiation of curricula in IT education.

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1. INTRODUCTION

The relevance of the article is determined by the need to ensure customization and/or customer-oriented curricula. This is necessary to ensure: the diversity of the workforce in the national economy and improve the quality of higher education. The analysis shows that such a double effect can be obtained based on the differentiation of curricula in higher IT education. The hypothesis of the article is the assumption that through the creation and practical application of the curriculum differentiation paradigm, two effects can be achieved at once: the diversity of the workforce in the national economy; and the growth of the quality of higher IT education.

The study of scientific publications on the topic of the work shows the following. Differentiation of universities is observed. The prospect of economies entering a new technological order depends on the quality of education (Pacheco, 2021). Analysts believe that the project approach has great potential in higher education (Bovill, 2020). Experts believe that project education should be studied within the framework of the philosophy of education (Alam, 2020). The problem of the development of project education has an international character, for example, it is used in the Republic of Uzbekistan (Gulamov et al., 2022). Scientists are investigating the structure and methods of curriculum development (Sukhomlin et al., 2020). Experts note the great influence of hidden curricula on the professional qualities of university graduates (Kelly, 2020). Analysts consider the curriculum as a methodological basis for SMART education (Cebrián et al., 2020).

Scientists pay great attention to the study of differentiation in higher education (Chernikova et al., 2020). The development of a new technological order gives additional relevance to the problem of curriculum differentiation (Glushchenko, 2023). A client-oriented approach in the work of universities can be a way to improve the quality of higher education (Bryndin, 2021). Scientists believe that it is necessary to develop a methodology for creating effective curricula (Glushchenko, 2023). Experts believe that the differentiation of curricula can be an important tool for obtaining effective curricula (Muñoz et al., 2022). The analysis of the literature shows the relevance of this work.

2. METHODS

This study is a literature survey that is compared to current situation. The literature survey was done by taking data from articles published in international journals that are compiled, comprised, and concluded.

3. RESULTS AND DISCUSSION

3.1. Results

Under the differentiation of curricula in higher IT education, we will understand a way to ensure the customization or customer orientation of the curriculum. The curriculum in this article will be called a comprehensive document of methodological and organizational content, the objectives of which are: a description of the educational process; and growth of the quality of higher education. Structurally, the curriculum consists of two parts: the first part is called an explicit curriculum, which is identical to the concept of an educational program; the second part includes a hidden (implicit) curriculum.

The hidden curriculum may contain the following elements: the organizational culture of the training program; the motivation system of students; a description of the key characteristics and structural elements of the student ecosystem at the university, and others. The differentiated curriculum in this work will be understood as such a curriculum, which has

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its fundamental differences from the unified generally accepted curriculum in a particular specialty. As factors of differentiation of curricula in higher education, the following can be considered: international division and specialization of labor; sectoral division of the national economy; clustering of the economy; methodology of education (subject and project); technical means used in the educational process (with the personal participation of the student and distance education); by place in the education system (basic and additional education) and other things. At the beginning of the 21st century, two factors had a particularly strong influence on the need for differentiation of higher education: the restructuring of the international system of division and specialization of labor during the global crisis; and the clustering of global and national economies. The customization of the curriculum will be called the adaptation of the educational process at the university to short-term (current) work problems and the staffing needs of key partners of such a university from the real economy (basic enterprises). The client orientation of the curriculum will be called the focus of such curricula on solving the strategic tasks of industrial partners (base enterprises) of such universities. In this work, the paradigm of curriculum differentiation can be called the systematic unification of such elements: the philosophy of the development of differentiated curricula; the ideology of the formation of curricula; the policy of creating curricula; and the organizational culture of the formation of differentiated curricula. In the process of forming the paradigm under consideration, the harmonization of all elements of this paradigm of curriculum differentiation should be ensured.

The creation of a curriculum differentiation paradigm provides a conceptual view of the process and result of curriculum differentiation. The conceptual approach means considering the process and results of curriculum differentiation from a single systemic perspective. The philosophy of the development of differentiated curricula will be called the most general wise view of the differentiation of curricula as an important tool for ensuring the quality of higher education in a new technological order. The practical expression of the philosophy of curriculum differentiation can be the principles of such differentiation: the scientific validity of differentiation; customization of curricula; client-oriented curriculum; improving the quality of education; minimizing losses (lean education) and others. These principles become the values of the organizational culture of differentiated curriculum projects.

The ideology of curriculum formation can be called: firstly, the basic idea of such differentiation; secondly, the way power is distributed among stakeholders in the process of such differentiation. The following ideas can be considered as the main ideas of curriculum differentiation in higher IT education: improving the quality of higher education; ensuring the necessary diversity of the workforce in the national economy; minimizing losses in the process of using labor in the national economy; increasing the level of satisfaction of stakeholders and others. At the same time, the way power is distributed among stakeholders in the process of curriculum differentiation can directly affect: the content of the explicit curriculum; the composition of the hidden curriculum; the assessment of the quality of education; the level of losses in the economy in the process of practical use of the results of educational products, and more. The way power is distributed among stakeholders in the process of such differentiation implies the formation of certain institutional relations between stakeholders of curricula and educational products created as a result of their implementation. Such stakeholders of the curriculum can be considered: students; employers; public authorities; and university administrations. The curriculum formation policy can be defined as a set of activities at the university aimed at creating effective differentiated curricula.

The organizational culture of the project for the formation of differentiated curricula will be called a systematic combination of such elements: stereotypes of behavior of developers

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of differentiated curricula; employee values; ways to respond to opportunities and threats of the external environment; methods of conflict resolution of stakeholders and more.

Such an organizational culture performs two functions: the function of adapting the project of creating differentiated curricula to the external environment; and the function of integrating elements of the internal environment of the project of creating a differentiated curriculum into a single whole. To ensure effective differentiation of curricula, scientific support for such differentiation of curricula should be formed. We describe the methodological provisions of the theory of curriculum differentiation by analogy with the work. The theory of curriculum differentiation can be called a scientific discipline aimed at the formation and effective use of curricula in higher IT education. This theory includes a complex of scientific problems, philosophy, ideology, politics, motives, methods, methods, tools, technologies for the formation of curricula, and methods of studying the life cycle of curricula. The scientific method in the theory of curriculum differentiation will be called: a set of principles and techniques that provide objective knowledge of the processes of curriculum differentiation in higher IT education; and methods for assessing the socio-economic results of educational activities within such curricula. It is possible to distinguish such functions of curriculum differentiation.

The methodological function of the theory of curriculum differentiation consists in the formation of the conceptual apparatus; theoretical foundations of scientific research; formulation of the laws of this science; development of categories of this scientific discipline; development of methodology for the study of phenomena and processes; synthesis of research management tools in the field of curriculum formation, etc. The cognitive function of the theory of curriculum differentiation covers the processes of accumulation, description, study of facts of reality in the field of curriculum differentiation, analysis of specific phenomena, and processes within the framework of the process of scientific research in this area. The instrumental (regulatory) function of the theory of curriculum differentiation is practical and consists of: identifying factors of curriculum differentiation; evaluation of curricula by stakeholders; synthesis of methods and tools for managing scientific research on the effectiveness of curricula; formation of recommendations to university administrations on the modernization of curricula and others.

The legislative function of the theory of curriculum differentiation is manifested in the process of substantiating the need and developing legal norms that contribute to: the development of the theory of curriculum differentiation; and the expansion of the practice of creating and using differentiated curricula in higher education. Such legislation should cover all stages (creation, use, modernization, and withdrawal from the educational process) of the curriculum life cycle. The optimization function of the theory of curriculum differentiation consists in the synthesis or selection of the best (from a certain point of view criterion) variants of customized curricula. The predictive function of the theory of curriculum differentiation includes assessment of the state of project IT education programs; and analysis of the impact of curriculum on the economy and society in the future. At the same time, the need and the possibility of developing certain types of client-oriented and/or customized curricula in higher IT education should be taken into account.

The preventive function of the theory of curriculum differentiation can be reflected in the implementation of proactive and preventive measures to prevent crises of such differentiated education and negative consequences for the economy and society. Such preventive measures should be formed based on the results of the forecast of the development of the theory and practice of differentiated curricula. The psychological function of the theory of curriculum differentiation is to explain to the subjects of the educational process the need for

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financial and other costs for the continuous development of the psychological aspects of higher education by forming a pedagogical and psychological mechanism for improving the quality of higher IT education. The function of socialization of knowledge in the field of curriculum differentiation theory is to disseminate knowledge in the professional and social environment about the functions and roles of curriculum differentiation in the development of higher IT education, economics, and society.

The system-forming function of the theory of curriculum differentiation consists in the accumulation of knowledge aimed at system integration of these curricula with processes in the economy and society; ensuring the creation of customized and/or client-oriented curricula; creation of life cycle management processes of such curricula, etc. The roles of the theory of curriculum differentiation can be recognized as adaptation of the development processes of higher IT education to changes in the external economic and social environment; reduction of risks in the formation of curricula; growth of competitiveness of IT universities, etc. The laws of the theory of curriculum differentiation can be called stable cause-and-effect relationships between the methods of curriculum differentiation and the results in the education system, economy, and society, which are associated with the implementation of the proposed curriculum.

The following laws of the theory of curriculum differentiation can be formulated:

(i) The development of the theory of curriculum differentiation is stimulated by the process of realizing the impossibility of achieving high-quality higher IT education without scientifically based differentiation. This is due to the fact that the process of specialization and division of labor leads to a constant increase in the number of professions (approximately 500 per year) and the lack of adequate resources for the creation of new educational and scientific directions.

(ii) The differentiation of curricula is aimed at using the resources of the education system in those areas that are most relevant to the national economy and society.

(iii) The differentiation of curricula reflects the need for a diverse workforce for dynamic development in the economy; the complexity of the practice of life and the complexity of science, economics, education, and public life.

(iv) The differentiation of curricula may be associated with different rates of aging of knowledge and moral aging of IT curricula based on this knowledge.

(v) Factors of curriculum differentiation can be: clustering of the economy; sectoral division of the economy; international division of labor; methodology of education (subject and project); technical means of implementing the educational process (with the personal participation of the student and distance education); by place in the education system (basic and additional education) and others.

(vi) In pedagogical terms, the differentiation of curricula leads to the formation of independent directions in pedagogical science.

(vii) To assess the effectiveness of curriculum differentiation, development as an independent direction of analytical pedagogy is required and others.

3.2. Discussion

The differentiation of curricula in higher IT education can play an important role in the development of a new technological order. The differentiation of the curriculum has its own goals and specifics at all stages of the curriculum life cycle: preliminary studies; the formation of the curriculum; the use of the curriculum; the modernization of the curriculum; and the removal of the curriculum from the educational process. The need for regional differentiation of universities is determined by the clustering of the economy. At the same time, it is the

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regional economic clusters that will act as "basic organizations" for universities located in these regions. The second driver of curriculum differentiation may be the need to ensure the necessary diversity of the workforce. The third incentive for the differentiation of curricula may be the restructuring of the system of international division and specialization of labor as a result of the global crisis.

The study of the history of the development of differentiation in higher education shows that the previous "wave" of interest in the differentiation of curricula in higher education in the USA took place in the period of the 1970s-1990s (Yu and Jen, 2020). This corresponds to the beginning of the previous 9th technological order. One of the special features of higher education in the conditions of a new technological way of life is the development of pedagogy and practice of project IT education. By project-based IT education, it means a form of higher education that provides for the inclusion of educational projects in curricula (explicit curricula). At the same time, such educational projects are considered an independent structural element (the volume of project educational activities is at least 20% of the academic load) of the learning process at an IT university. In such universities, there may be project activity centers that deal with the implementation of educational projects. The project Activity Center may exist separately from the faculties or be part of the faculties of the university. The growth of attention to project-based IT education is determined by the intensification of innovation activity. Innovation activity becomes practically permanent in the new 10th technological order and is implemented mainly in the form of innovative projects. Scientists predict the transition of economic enterprises and universities to the project model of the organization's activities.

In 2023, the theory of technological structures makes it possible to determine that the period of intensification of differentiation in higher education (1970-1990) coincides with the period of transition of the US higher school to functioning in a new technological order. It was the 9th technological order, the previous one concerning the present time and technological order. That previous technological order was called "microprocessors". It lasted from 1970 to 2010. This gives grounds to propose a particular hypothesis of this study that the spasmodic growth of new technologies was at that time (1970-1990) the source and cause of the need for intensive differentiation in higher education in the USA. It should be noted that customization has long been considered one of the main development trends during the previous technological order. The need for customization is growing as a result of the inability to achieve a high-quality educational product in the absence of customization of education. The lack of customization leads to the dispersion of educational resources without a chance to get an increase in the quality of education.

The creation of the theory of technological structures opens up additional opportunities to determine the causes and factors of differentiation in higher IT education. In the interests of optimization in the differentiation of curricula, methods of such theories can be used: the theory of technological structures; the theory of complex systems; the general theory of pedagogy (education); the theory of didactics (teaching); the theory of differentiation of curricula in higher IT education, etc. In the process, it should be taken into account that in 2023 the situation in the IT sector of the national economy may be aggravated by the following: international sanctions against the IT sector of the national economy lead to the need to develop IT products independently; some scientific and pedagogical personnel are often accustomed to working as users of foreign IT products. These are new introductory, working conditions and a relatively new task for the domestic economy and the entire system of higher IT education. The study of the situation in higher IT education shows that due to the development of a new technological order, it may be necessary for universities to switch

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to client-oriented differentiation in the field of IT education. Such a need may be caused by the constant growth in the number of professions. For this reason, it is necessary to form a differentiation mechanism in higher project IT education.

At the same time, trend analysis shows that the following main trends will be inherent in education in the 10th technical order: the formation of lean education; unification of education (Bologna process); differentiation (customization and consumer orientation); further development of intellectual education, and much more. The analysis shows that differentiation can take two forms: customization of the work of IT universities; and their client orientation. The customization of the functioning of IT universities will be called the adaptation of the work of individual regional and sectoral universities to the short-term (current) staffing needs of key subjects of the regional economy and/or an important branch of the national economy.

The client-oriented nature of IT universities will be called the ability of these universities to support the development strategy of partners and to prepare such personnel for enterprises that will be able to create and implement plans (programs) for the strategic development of the basic enterprises of such a university. Based on the current situation, it can be predicted that in the period from 2023 onwards, all IT developments in the real economy should be carried out at all levels of the technological pyramid in the IT sector under study. This means the need to differentiate the curricula with their orientation to a certain level of the "technological pyramid". The "Technological IT pyramid" includes the following hierarchical levels: conceptual (1st) level; technology development level (2nd); design level of means of production (3rd); implementation level of production processes (4th); the level of technical service and personnel training (5th) (Glushchenko, 2023).

The lack of methods of scientifically based curriculum differentiation can lead to such risks not only in the education system but also in the national economy. The risk of a decline in economic growth due to insufficient diversity of the workforce will lead, in particular, to a decrease in the economic efficiency of innovative projects. The risk of significant losses of resources in the process of interaction between the national economy and the higher education system. For example, it is known that at the beginning of the 21st century in Russia, a significant number of university graduates did not find a job in their specialty. This can be considered as losses that occur due to insufficient customization of the work of universities. For this reason, part of the public expenditure on higher education does not lead either to an increase in output or to an increase in the quality of products in the economy. Therefore, such costs can be considered losses.

In addition to all this, such a situation can create social risks and stress for university graduates and others. It is also important to carry out an analysis of the risks associated with the process of curriculum differentiation. Such risks may include risks determined by the process itself and the methodology of analyzing the mechanism of interaction of curriculum disciplines with the quality of higher IT education, and more.

4. CONCLUSION

The paper formulates and discusses the paradigm of curriculum differentiation in IT universities. The paper discusses the methodological provisions of the theory and practice of curriculum differentiation and describes the factors of curriculum differentiation in higher IT education. The issues of risk analysis in the differentiation of curricula are considered. The results of the article suggest that the differentiation of curricula will develop during the period of a new technological order.

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5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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