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MODEL OF STUDENT PREPARATION IN HIGHER EDUCATION IN THE CONTEXT OF BIG DATA

Abstract: Developing a robust educational system across all domains is essential for providing contemporary educational programs. The aim of our research work is to identify and practically implement the theoretical foundations of preparing students in the field of big data in higher education, which is the cornerstone of training a modern, competitive future specialist.

Ensuring the high-quality organization of fundamental disciplines is crucial in developing specific competencies for future educators. Therefore, the main focus of the proposed article is on shaping an educated individual with a broad outlook and high culture of thought in preparing IT specialists at the L.N. Gumilyev Eurasian National University. The article provides a comprehensive definition of the model of student preparation in higher education in the context of big data, outlines and implements components, and discusses the model for achieving positive outcomes. Before considering the model for improving student preparation in the context of big data, let us briefly define big data and examine the concept of a model.

Keywords: pedagogical model, big data, data processing, goal-oriented block, content-organizational block, experimental-summarizing block.

Introduction

Presently, all developed nations have established a systematically structured framework for high-quality education. Generally, the primary goal of the education system is to create appropriate conditions for professional development and personality formation based on scientific and educational achievements, the digitalization of education, the implementation of new teaching technologies, and integration into international global communication networks. To establish a high-quality education system in all spheres of education in our country, it is important to offer modern educational programs. According to the Law "On Education" important issues such as "developing each learner in accordance with their individual abilities, nurturing their talents and abilities" are considered. To address these challenges, highly qualified professionals proficient in information technology, professionally seasoned, and adapted to the modernization of the education system are needed (Parliament of the Republic of Kazakhstan, 2007).

The aim of our research work is to identify and practically implement the theoretical foundations for preparing future educators in the field of big data related to information and communication technologies at the university level, which serves as the basis for the training of modern, competitive future specialists. Preconditions for training modern competitive professionals are provided in the national project "Quality Education - Educated Nation" (Government of the Republic of Kazakhstan, 2021).

Additionally, the typical operating rules for educational organizations outlined by the Ministry of Education and Science of the Republic of Kazakhstan include requirements for training competitive professionals in higher and postgraduate education (MES RK, 2013).

In recent times, there is a need in the training of specialists to monitor and supplement modern educational content in accordance with scientific, technical, technological, and informational changes. Due to the continuous growth of information, universal tools and solutions covering all areas are required.

One of such pertinent topics is related to the processing of big data. With the big data, information that cannot be processed using traditional data management methods can be processed quickly and securely.

The development of intensive technological innovations has facilitated the work of applicants in universities and colleges, as it has increased the desire to bring them to the market. To admit the largest number of applicants enrolled in higher educational institutions, they implement actions such as analysis, access to and management of large amounts of data.

Currently, educational organizations have complex ways of collecting data about students and responding to them, enabling them to clearly navigate their educational situation more than ever. Thus, amidst intensified competition and rising educational costs for students, the pool of prospective learners remains limited. Additionally, global leaders in the field of education utilize big data processing tools for business analytics, financial analytics, predictive analytics, and strategic management. All of this is driven by a specific motivation to enhance the personal achievements of learners. The primary aim of such actions is to expand the available analytical process and improve the management of its resources. These data sources include student test results, web pages and social media channels, cameras, website browsers, and mobile devices. To address these aforementioned tasks, big data are utilized. This, in turn, helps save time and avoid any errors. Various methods of utilizing big data in educational organizations are being considered (Utemov, 2018).

Prinz, A., Engebretsen, M., Gjøsæter, T., Møller-Pedersen, B. & Xanthopoulou Th.D. (2023).

Research methods and organization

Considering the provision of a methodical system in teaching big data. To do this, let's highlight the conditions for the functioning of the model of teaching methods for big data.

Modeling is one of the most relevant methods of scientific research and is widely used in various studies. The method of modeling allows for the integration of empirical and theoretical aspects in scientific research, i.e., integrating experiment, logical structure construction, and scientific abstractions in the process of studying a pedagogical object. The Philosophical Dictionary indicates that modeling is the representation of characteristics of a specific object in another object for the purpose of studying it (Van Der Valk et al., 2007).

Prinz et al. (2023) in their research stated that models, where a model is just a system that is analogous to another system, called a referent system . The similarity is typically brought about by using a matching perspective for the two systems. A model is an object that retains only the most important properties of a realistically existing object or system and is intended for their study.

Researcher Beshenkov (200) believes that a model is an artificially created object in the form of diagrams, physical constructs, symbolic forms or formulas that, being similar to the studied object, defines the structure, properties, and relationships between the elements of the object, both simply and complexly and demonstrates them in the form of symbolic forms or formulas.

A model defined by Kogalovsky (2009) is an abstract representation in a certain form (e.g.mathematical, physical, symbolic, graphical), intended to represent certain aspects of its real-world counterpart and to provide answers to the studied questions.

An educational model is a logically consistent system of corresponding elements, including the aim of education, content, pedagogical technologies, and management

technologies of the learning process, as well as curricula and programs. Dakhin (2003) asserts that in the process of studying education, educational models are created.

Kozyreva (2020) believes that pedagogical modeling determines the possibilities of clarifying the used scientific knowledge by teachers in the system of lifelong education and creating new scientific knowledge as a product of theorization, development of anthropologically determined relationships and focused on innovative and productive functioning of environments.

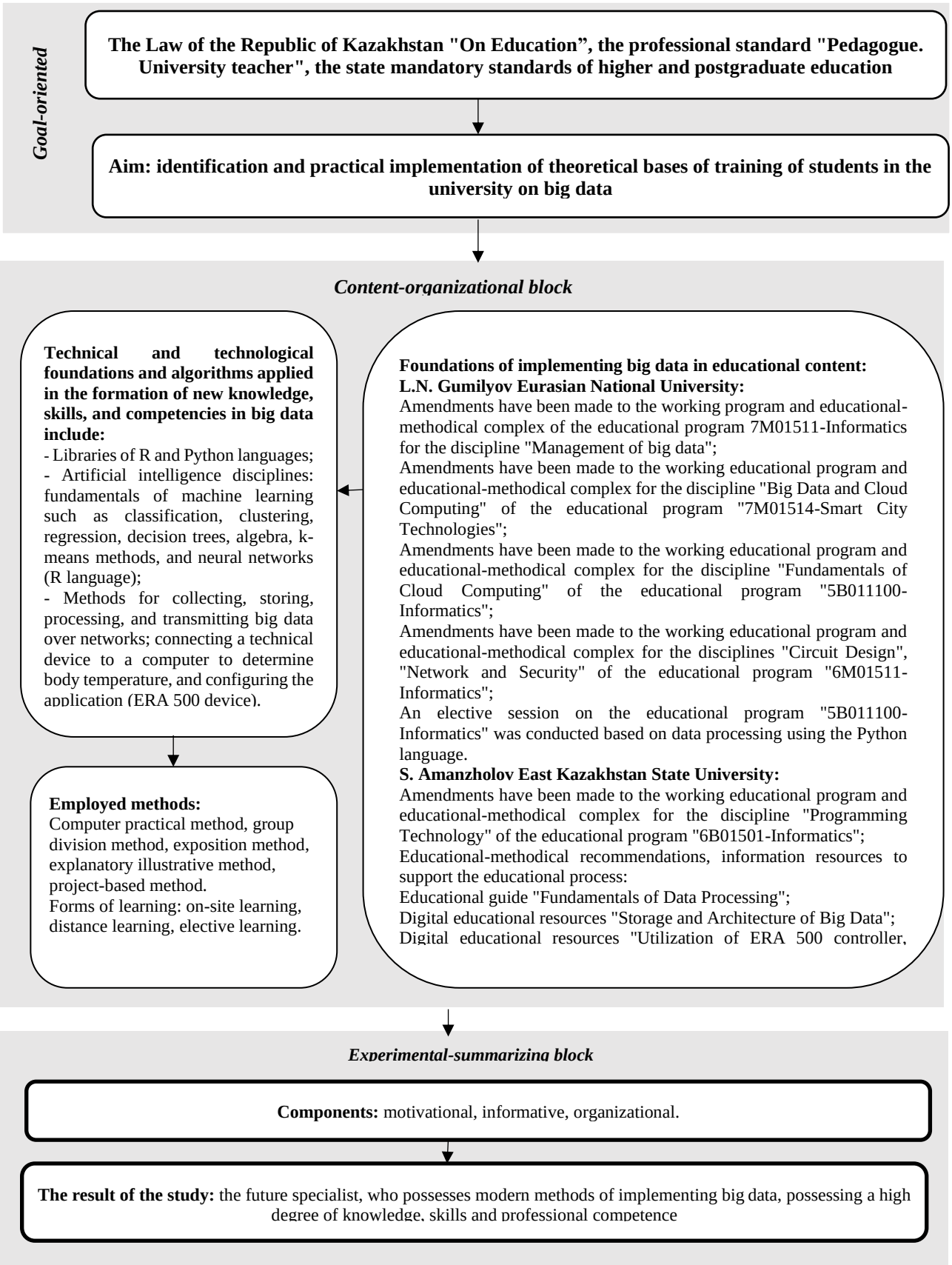
Systematizing the reviewed definitions, it can be stated that a model is a tool for representing information about a phenomenon or an object in the form of a diagram. The model for teaching big data comprises a set of components that characterize the level of teaching methods, their interrelationships, principles, tools, and organizational forms for teaching big data. Based on the analysis of big data, it is necessary to create an educational environment for all entities and subjects of a higher education institution in such a way as to develop the professional competence of a future specialist. Considering the concept of a model, the structure of the developed model includes elements of practically implementable situations that form the professional competence of the specialist. As a result of the analysis of scientific literature on big data, a deficit of national research on training future ICT specialists has been identified. Based on this, in accordance with the state mandatory standard of higher education of the Republic of Kazakhstan, a model necessary for this direction in higher education institutions has been developed and tested, and the need for practical conditions has been determined. Therefore, in accordance with this, a model for teaching big data has been developed and justified through a pedagogical experiment.

The results of the study and discussion

Before delving into the research work model, let us first consider the concept of big data. Big data refers to big data characterized by high velocity of accumulation or alteration, necessitating cost-effective and innovative data processing methods. These methods enable enhanced comprehension of information, which in turn facilitates decision-making and process automation (Abdalla, 2022). Based on the given definition, the components of the model developed in accordance with the aims and objectives of the research consist of: a goal-oriented component, a content-organizational component and an experimental-summarizing component. The foundation is built upon state programs that underscore the relevance of the topic, the Law of the Republic of Kazakhstan "On Education", the professional standard "Pedagogue, University Teacher", as well as the requirements imposed on modern information and communication technologies in the field of education (Figure 1).

The proposed model is based on and created from big data and is intended to enhance the preparation of students enrolled in the educational programs "7M01514-Smart-City Technologies", "5B011100-Informatics", "6B01511-Informatics", "7M01511-Informatics" at the L.N. Gumilyev Eurasian National University and "6B01501-Informatics" at S. Amanzholov East Kazakhstan University. The content and structure of the model have been developed by maintaining a logical coherence that encompasses the educational process and the entirety of the given specialization.

Figure 1
Model for improving student training of Big Data



A model was created to implement the research work, which includes theoretical, practical, educational-methodological and experimental foundations, were defined accordingly its structure and content. For this purpose, we classified the elements of the model into three blocks:

1. Goal-oriented block,
2. Content-organizational block,
3. Experimental-summarizing block.

Let's focus on the content of the specified blocks:

1. Goal-oriented block

This block considers regulatory documents on big data, programmatic needs of society for specialists:

– Law of the Republic of Kazakhstan "On Education".

– Specialization card "University Teacher", based on professional standard "Pedagogue".

– Educational-methodical complexes, working educational programs (syllabi).

– Taking into account the increased demand for specialists proficient in working with big data in society.

Based on the reviewed documents, the educational goal for big data was defined: to identify and practically implement the theoretical foundations of preparing future educators in big data in connection with information and communication technologies at the university level.

Content-organizational block

On the substantive basis of this block, the fundamentals of implementing big data in the educational process of L.N. Gumilyov Eurasian National University in educational content are provided, specifically, the following research work has been conducted:

- Amendments have been made to the working educational program and educational-methodical complex for the discipline "Big Data and Cloud Computing" of the educational program "7M01514-Smart City Technologies". This discipline has been integrated into the educational process based on the implementation of a project related to Smart City technologies under the Erasmus+ program. The total credit volume of the discipline is 5 credits (Lecture - 1 credit, Practical session - 2 credits, student's independent work- 2 credits). The discipline was conducted according to the educational program and schedule of classes; an analysis of its content was carried out and amendments were made based on a specialized course (Table 1).

Table 1

Lecture topics included in the content of the discipline "Big Data and Cloud Computing".

Lecture topics	Volume of hours
Big Data. Concepts of Big Data. Technologies for storing and processing Big Data.	1
Chronology of the formation of the concept of Big Data. Analysis of Big Data.	1
Applications of Big Data. Areas of application of Big Data.	1
Advantages and disadvantages of Big Data. Challenges in using Big Data.	1
Directions, principles, stages of Big Data management. Evolution of organizational fundamentals in managing large-scale datasets.	1
Collection, storage, processing of Big Data. Import and export of Big Data. Examples.	1
Total:	6

Based on practical sessions on lecture topics from a specialized embedded course, the formation of skills and abilities in handling Big Data among students has been achieved.

Experimentally-generalizing block

To assess the level of new skills and knowledge enhancement among students, motivational, substantive, and organizational components were selected. One of the tasks was to conduct surveys using identified indicators for each component and their criteria, and to provide evidence of the accuracy of the forecast generated from the research work. In our research work, we selected indicators and criteria for the motivational component as follows: interest in working with Big Data using organizational forms of education, fostering students' new knowledge through self-motivation; ability to work with Big Data in the university, programming through calculations using Python, R programming environments.

During the development of educational and methodological materials, instructional support for lecture and practical courses on Big Data was prepared. It is assumed that the proposed set of organizational and pedagogical conditions will contribute to the effective formation of the investigated qualities during their implementation in the pedagogical process.

The theoretical understanding of Big Data as indicators and criteria of the substantive component of our research is formed based on the target component and is implemented in the training of students as professionals in accordance with the Law of the Republic of Kazakhstan "On Education", the professional standard "Pedagogue. University Teacher", relying on the requirements of state programs for the development of education and science of the Republic of Kazakhstan (MES RK, 2022).

Indicators and criteria of the organizational component encompass forms, methods, and learning technologies designed to enhance students' knowledge levels and achieve the goals and objectives of education productively.

Conclusions

The criteria for the motivational, substantive, and organizational components, prepared to assess the levels of knowledge and new skills formation among students, are selected as follows:

–Mastery of Big Data within the motivational component and understanding its future importance.

–Criterion of high theoretical understanding of Big Data within the substantive component.

–Criterion of proficiency in action and mastery of methods, techniques, and forms of teaching related to Big Data within the organizational component.

Justified the rationale for the forecast set as a result of implementing the model for preparing students in Big Data in our research work, i.e., at the higher education institution.

Conflict of Interest Statement

The authors declare no potential conflicts of interest regarding the research, authorship, or publication of this article.

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