ANNOTATION
dissertations for the degree «Doctor of Philosophy» (PhD) in specialty
6D075100 – «Computer Science, Computer Engineering and Control»
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DEVELOPMENT OF AN INFORMATION EDUCATIONAL ENVIRONMENT FOR THE FORMATION OF OLDER CHILDREN IT-COMPETENCE

Relevance of the research topic. Kazakhstan is at the initial stage of the large-scale introduction of digital technologies into the activities of preschool education. The goals of the Government of the Republic of Kazakhstan are to accelerate the pace of economic development and improve the quality of life of the population through the use of digital technologies in the medium term, as well as create conditions for the transition of the economy of Kazakhstan to a fundamentally new development trajectory, ensuring the creation of a digital economy of the future in the long term. One of the important directions is the development of human capital. Supporting the digitalization of kindergartens and mini-centers, achieving qualitatively new conditions in the field of education and information culture is defined as a strategic task. According to the Concept of development of preschool, secondary, technical and vocational education of the Republic of Kazakhstan for 2023-2029, the current state of preschool education and training requires solutions for the development of the educational environment of preschool organizations and the creation of high-quality digital educational content for preschool children.

In this regard, the task of ensuring the manageability and accessibility of the entire complex of information resources and services, as well as determining the compliance of the information and communication infrastructure with the strategic goals of preschool education, becomes especially important and urgent. The educational space of modern preschool education should be formed as an open system with an intellectually developed interface for interaction between all participants in the preschool educational process.

An analysis of the current state of developments in this area has shown that the theoretical and conceptual foundations of portal management and design, technical and technological principles of their software implementation, are in a state of constant development. The main aspects related to the creation of a unified information space for preschool organizations, as well as methods and models of managing educational environments in the process of educational activities of a preschool organization, have not been sufficiently studied. At the same time, it is advisable to take into account the psychophysiological characteristics of older preschool children, which determines the orientation towards their personal qualities. In this regard, the use of modern information technologies is necessary to assess the level of competencies of older preschool children and support decision-making in order to form the required level of both general and IT competencies.

The relevance of the work is justified by the lack of developed models and algorithms for managing the information and educational environment in the formation of IT competencies of older preschool children in the process of educational activities of a preschool organization.

The purpose of the work is to research and develop new models and algorithms for managing the process of forming IT competencies of older preschool children in order to ensure control actions in an information and educational environment based on them.

To achieve this goal, it is necessary to solve the following main **tasks**:

- to carry out a systematic analysis of the subject area of the formation of IT competencies in a preschool organization, including an analysis of the regulatory framework of the Republic of Kazakhstan regulating the organization of the preschool education and training system and an analysis of methods and approaches to the development of information management systems that implement the functions of forming and monitoring the competencies of older preschool children;

- to formalize the task of managing the process of forming IT competencies of older preschool children; including defining requirements for the competence model of older preschool children; and to develop a system of targeted IT competencies;

- to investigate and develop models and algorithms for managing the information educational environment for the formation of IT competencies of older preschool children;

- to develop a knowledge representation model and a knowledge base of the information and educational environment of preschool education organizations;

- to develop a software structure for the information and educational environment of preschool education organizations.

The object of the study is the process of managing the formation of IT competencies of older preschool children.

The subject of the research is the information and algorithmic support of the information and educational environment of a preschool organization.

Research methods. In the course of the research, the following methods were used: system analysis; management theory; business process design; mathematical modeling, fuzzy logic; expert methods, methods of formalization of knowledge representation.

A scientific novelty. The scientific novelty of the study lies in the fact that:

- A functional model of the information and educational environment has been developed, structuring the description of the elements, functions and interactions of the information and educational environment;

- A semantic model of knowledge representation of the IT competence formation system is proposed, which is the basis for the implementation of digital management services within the framework of IOS;

- A production model has been developed based on the rules of fuzzy inference, which provides a decision-making procedure for managing the process of forming IT competencies;

- An algorithm for managing the formation of IT competencies based on the results of educational activities is proposed, which allows integrating the developed models into the existing processes of preschool education organizations.

The provisions **submitted for protection** include the following:

- a functional model of the information and educational environment structuring the description of the elements, functions and interactions of the information and educational environment;

- a semantic model of knowledge representation of the IT competence formation system, which is the basis for the implementation of digital management services within the framework of IOS;

- a fuzzy model for assessing the level of formation of IT competencies, a production model of knowledge representation developed based on the rules of fuzzy inference, providing a decision support process for managing the formation of IT competencies;

- An algorithm for managing the process of forming IT competencies, which allows integrating the developed models into the existing processes of preschool education organizations.

Practical and theoretical significance.

The developed model, algorithmic and information support can be used: in the development or improvement of information and educational environments for preschool education organizations in order to improve the quality of management of educational and educational processes; by teachers of preschool organizations in order to create a unified holistic semantic base for the implementation of pedagogical activities, optimization of the educational and educational process.

The information and educational environment of preschool education organizations implemented on the basis of the presented structure, which implements the function of managing the process of forming IT competencies of older preschool children, can be useful:

- to improve the monitoring process for the assimilation of the content of the standard curriculum of preschool education and training conducted by the Ministry of Education and Science of the Republic of Kazakhstan (including improving the quality of information provided at all levels, reducing labor costs, material costs);

- to ensure targeted transparency of the results of the educational process for all its participants: the Ministry of Education of the Republic of Kazakhstan, employees of preschool organizations, parents, which will contribute to the creation of favorable conditions and equal starting opportunities for full and high-quality preschool education.

The validity and reliability of the developed scientific provisions, models and algorithms is ensured by the correct application of mathematical methods and is confirmed by the results of implementation in production conditions with the analysis of real data in preschool organizations of the region.

Approbation and publications. The main results of the research are reflected in 15 scientific papers, including 2 articles published in international peer–reviewed scientific journals, 4 articles in scientific publications included in the List of scientific publications recommended for publication of the main results

of scientific activity, approved by the authorized body, 7 works - in the proceedings of international scientific conferences, in 2 copyrights (Appendix A), in 2 acts of implementation (Appendix B).

Personal contribution of the author.

The results presented in this work were obtained by the author personally, or in co-authorship with his direct participation. In all joint works, the author participated in setting tasks, developing research methods, conducting modeling experiments, writing articles, and also presented research results at scientific conferences.

The structure and scope of the dissertation.

The dissertation consists of an introduction, four original substantive chapters, a conclusion, and a list of cited literature.

The work includes 21 figures, 13 tables and 99 names of the sources used.

The introduction substantiates the choice of the research topic, reveals its relevance, formulates the purpose of the study, defines its tasks, presents the object and subject of the study, reveals the scientific novelty, theoretical and practical significance of the work, defines the provisions to be defended.

The first chapter provides an overview of methods and approaches to the development of information and educational systems that implement the functions of forming and monitoring IT competencies of older preschool children. The experience, problems and promising directions of technologies for the formation and monitoring of IT competencies of older preschool children are considered. The analysis of methods and approaches to the development of information and educational systems for preschool education is conducted.

The second chapter presents the research and development of models and an algorithm for management in the information and educational environment of the formation of IT competencies of older preschool children. The task of managing the process of forming IT competencies of older preschool children is formalized. A model of IT competencies of educational activities has been developed. A model for managing the process of forming IT competencies has been developed. A mathematical model for modifying the scale of assessment of the level of achievement of competencies is proposed.

The third chapter presents a system of targeted IT competencies, knowledge bases and rules of the information and educational environment of preschool education organizations. In particular, a system of targeted IT competencies for older preschool children has been developed, a database of rules and a knowledge base of the information and educational environment for the formation of IT competencies for older preschool children has been developed. An algorithm for filling in an individual card of the results of the educational process in a preschool organization has been developed and proposed.

In the fourth chapter, the issues of developing the structure of the information and educational environment of preschool education organizations are considered. The functional requirements for the information and educational environment of preschool education organizations are defined, the data structure of

the IOS is developed. A scheme for the organization of monitoring the level of competence formation, the structure and content of the IOS is proposed.

In conclusion, the conclusions of the study are presented.