UDC 004.09

Structural model of the non-formal education system

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The basic principles of creation of non-formal education systems are reviewed. Its structural model is proposed and grounded on the basis of the conducted analysis. Decomposition of the system structural model into the interconnected particular ones has been carried out. The basic interrelations between them are defined using the method of structural analysis. The conducted researches have allowed to allocate the purposes and problems of functioning for each structural element of the considered structure model.

Key words: non-formal education system, information-communication technologies, structural model, decomposition.

Рассмотрены основные принципы построения системы неформального образования. На основе проведенного анализа предложена и обоснована ее системная структурная модель. Проведена декомпозиция структурной модели на взаимосвязанные частные модели. С помощью метода структурного анализа определены основные взаимосвязи между ними. Проведенные исследования позволили выделить цели и задачи функционирования каждого структурного элемента рассматриваемой структурной модели.

Ключевые слова: система неформального образования, подсистема, информационно-коммуникационные технологии, структурная модель, декомпозиция.

Розглянуто основні принципи побудови системи неформальної освіти. На основі проведеного аналізу запропоновано і обґрунтовано її системна структурна модель. Проведена декомпозиція структурної моделі на взаємопов'язані приватні моделі. За допомогою методу структурного аналізу визначені основні взаємозв'язки між ними. Проведені дослідження дозволили виділити цілі та задачі функціонування кожного структурного елементу розглянутої структурної моделі.

Ключові слова: система неформальної освіти, підсистема, інформаційно-комунікаційні технології, структурна модель, декомпозиція.

1. Introduction

Currently, the society has entered a new phase of its development – the phase of global informatization.

Informatization is the process of society life-sustaining activity conversion based on continuous intensive use of reliable, comprehensive and timely knowledge in all key types of human activity, requiring creation of a system consisting of means for saving, storing, processing and transmitting information. [1]. Consequently, the information in this case is the most important public resource playing a leading role in education, economy and other fields.

Informatization of education must constitute an important part of the process of society informatization. Introduction of modern information technologies into the educational system will enhance the efficiency of the system and will ensure its full cycle of functionality. Ideas for creation and promotion of modern educational technologies, that are formed on the basis of the universal computerization and informatization of the educational system are determined by the following global trends [2]:

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- development of the worldwide production infrastructure;
- informatization and automatization of all sectors;
- global changes in the occupational structure of society and in people's views regarding labor;
- informational integration of education into the world system.

Thus, the prospects of modern education are largely linked to the improvement of information and communication technologies, and to the creation of innovative teaching methods that are based on their implementation into one form of education – the non-formal education.

The aim of this research is the analysis of the basic principles of construction of the non-formal education system; justification of its structural system model, decomposition of system model into certain model subsystems and definition of processes that should be performed by each structural element.

2. Non-formal education system

The bill "About Amendments to Some Laws of Ukraine" dated 12.02.2015, has defined the traditional form of education and its two kinds: "non-formal" and "informal" (self-education) [4]. As a rule, formal education is organized in the classical form, with the use of information technologies to conduct classes traditionally as well as remotely. Non-formal education is independent of other educational programs and qualifications, i.e. it is an alternative or an addition to formal education, and should continue throughout trainee's career path.

Analyzing trends in the development of the information society, we shall note that non-formal education system can be characterized by the following key features:

1. Functioning in strong correlation with global information technologies development.

2. Tracking the opportunities and needs of each trainee due to his/her education individualization.

3. Focusing on results that will ensure high level of practical skills.

4. Creating of continuous education trends i.e. advanced training throughout one's life.

One more of the key features of non-formal education is its focus on practical applications. This pragmatic orientation of non-formal education and the opportunity to study remotely tends to attract adults rather than students of undergraduate age.

In this situation, education becomes individual-oriented, flexible and, most importantly, continuous. Educational activities of non-formal education are [3]:

- short-term group lessons;
- individual lessons with concentration on practical objectives;
- training courses.

Such educational activities are organized and conducted beyond the formal system of education using distant learning. The efficiency of this system, therefore, depends on the use of advanced information technologies.

The global objective for introduction of universal informatization into education is to improve its quality and ensure compliance with new requirements of the post-industrial society. Undoubtedly, such aim is multi-factorial and includes a plurality of sub-goals [5]:

● retraining learners for their effective employment within the information society;

● verification of quality of the education provided;

● expansion of the boundaries and the degree of access to education;

● informational integration of the non-formal education system into the world infrastructure.

In order to understand how informatization affects the entire system of non-formal education, it is necessary to develop its structural model and carry out decomposition of the model system into certain model subsystems and units.

3. Structural model of the non-formal education system and its decomposition.

A modern non-formal educational system, that is based on new information and communication technologies may include the following main interrelated subsystems: economic, pedagogical, technological, organizational, theoretical and methodological (Figure 1.) [1].
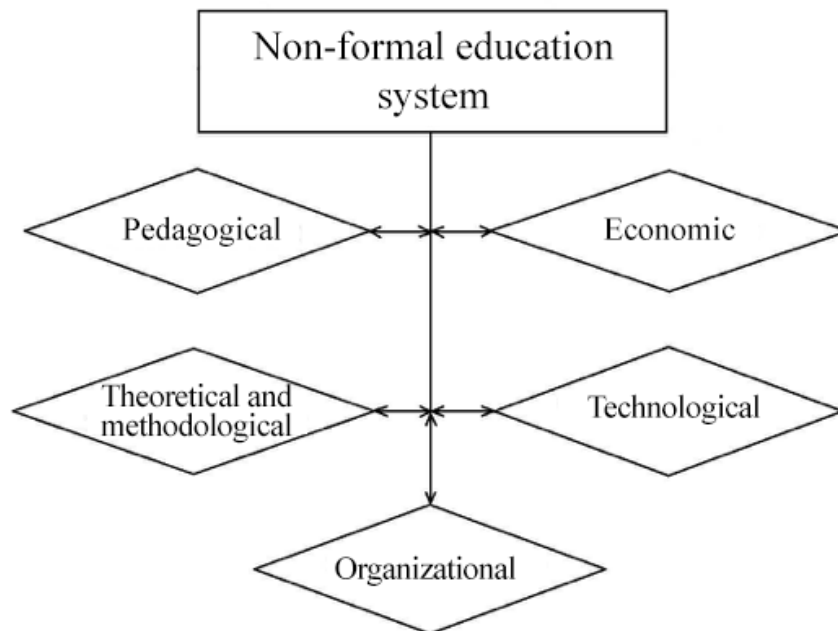
Fig.1. Structural model of the non-formal education system

Let's consider the subsystems included in the system of non-formal education, and formulate the main tasks solved by each subsystem.

The development of pedagogical subsystem can be divided into three generations. The first one is characterized by disciplinary-oriented approach where informational technologies of education are considered as a complete learning process based on the traditional content, forms and methods of teaching. It is supported by classical textbooks, problem-books and teaching editions. In this model, computer is used to represent acquired knowledge and to increase the control of its assimilation. An

important and distinctive feature of the traditional education system is its educational and disciplinary structure.

Thus, the first generation of information technologies proved to be unstable due to existing contradictions between the demands of traditional educational system and unused capacity of information systems.

The transitional approach belongs to the second generation. Here, educational information technologies are represented as contradictory educational compositions based on the traditional content, which, nevertheless, uses unsystematic combination of classic and advanced teaching forms and methods. It is supported by traditional textbooks, problem-books and teaching editions, as well as modern computer programs and educational environment, mainly oriented toward the comprehensive study of processes in the real world models. Second generation of the informational education technology is unstable since, according to its foundation, it is made for disciplinary-oriented system, but according to its add-on, it leans towards interdisciplinary object-oriented educational system. The presence of such educational technologies, however, shows that there is a natural "sprouting" of new object-oriented educational models.

The third generation includes a project-oriented approach. Here educational technology is regarded as a single educational process based on interdisciplinary non-traditional content, forms, methods, and tools of education. Information technologies of the third generation, according to its foundation and add-on, are designed for a project-oriented educational system, in the process of which it is important to not only control the amount of knowledge acquired but, above all, to insure the active use of such technologies creatively and within the educational process.

Information systems in this educational model are the most important composite elements, making it possible to not only form a person's figurative representations of reality around him, but also to participate actively in the creation of such systems.

The structural model of the pedagogical subsystem can have the following appearance (Figure 2). It is a set of blocks, which interacting with each other provide the non-formal education process for trainees.

The main elements of the pedagogical subsystem model of the non-formal education are the following blocks:

●   "Subject and content of the course"- defines a set of knowledge and skills that can be mastered by the trainee;

●   "Design and development of training courses"- provides tools for the implementation of all kinds of courses and monitoring the results of their design;

●   "Delivery and presentation of courses" – uses the platform of distant learning and the computer network for communication;

●   "Organization of educational process" – establishes and maintains the relations between all subjects involved in the educational process.
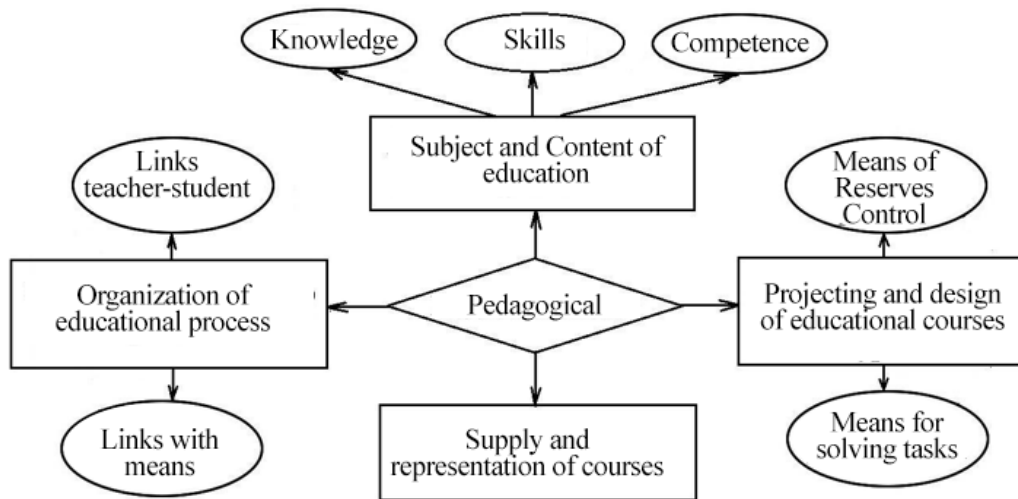
Fig.2. Pedagogical subsystem of non-formal education

At the moment, there are many distant learning platforms and database management systems (DBMS), which can be used in such subsystem. Each of these information technologies has its own advantages and disadvantages, so it is the paramount to solve the problem of the rational choice of appropriate information technologies.

The economic subsystem within the non-formal system of education provides the following functions: social and financial management, foreign economic relations, material and marketing services.

Thus, the economic subsystem architecture consists of eight blocks, which implement all of the functions described below (Figure 3).

The function of social and financial management is represented by units - "Financing of personnel", "Reward scheme provision" and "Payment system control". Automation of these functions can be implemented with the help of modern information technologies, namely by using an electronic billing system and an on-line banking system.

Provisioning of foreign economic functions is performed by the unit "Provision of foreign economic relations." With the help of this function the system interacts with universities and companies that specialize in the presented areas of training, as well as with coachers providing their services around the world.

The third function – material and marketing services – is aimed at ensuring the continued support of facilities, quality of services, and promotion of the system. This function is implemented in the form of 4 units: "Development of material and technical base", "Technical Means Control", " Service Quality Management" and "Marketing means".
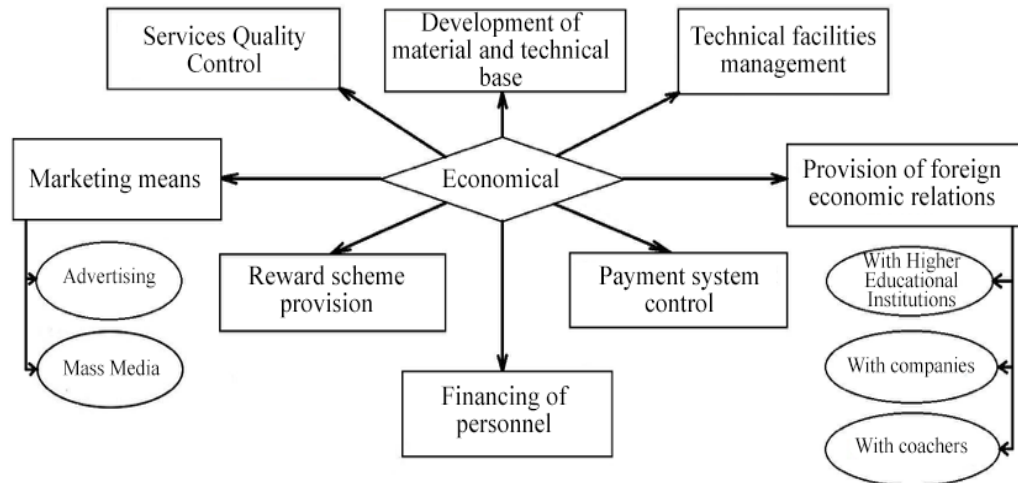
Fig. 3. Economic subsystem of non-formal education

Efficient work of this subsystem ensures the growth of the financial component of the whole system; so, it is necessary very thoroughly select the information technologies to be used for its implementation.

Organizational subsystem provides interconnection of all subsystems into a unified informational network, while using electronic documents management, databases and other computer technologies. During the research, this subsystem model was decomposed into blocks and tasks, which are displayed in Figure 4.
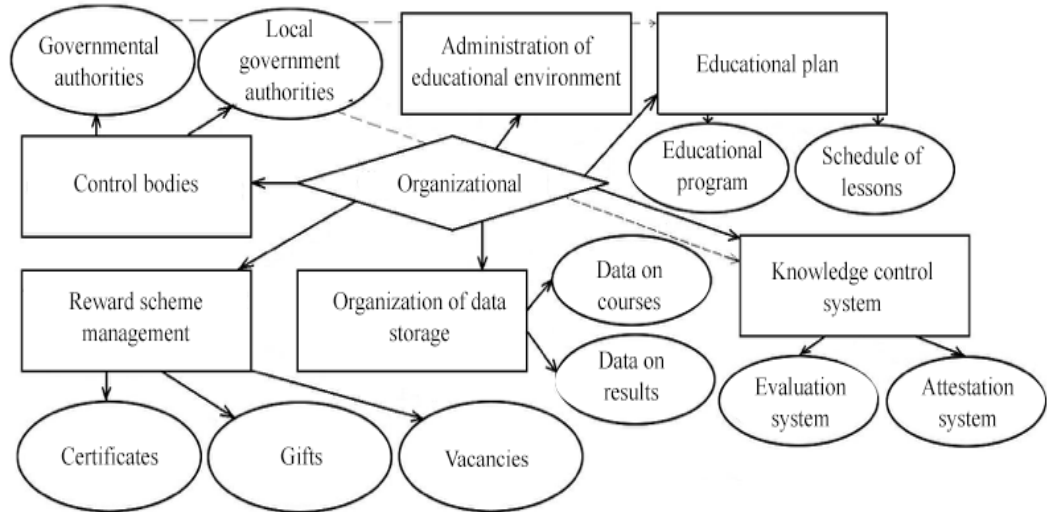

Fig. 4. Organizational subsystem of non-formal education

Organizational subsystem is linked to the economic subsystem by "Reward scheme management" block, and to the pedagogical subsystem by "Educational Plan", "Knowledge control system", and "Organization and of data storage" ones. Additionally, it has the separate direction – "Control bodies" – that provides automated exchange and approval of documentation for the provision of educational services.

The existence of non-formal education system is not possible without the presence of a methodological base, containing a well-written procedure of a variety of functions.

Offered here is a structural model of theoretical and methodological subsystem, based on several directions, that are shown using blocks (Figure 5.):

● "Databases of knowledge and materials" – is used by educational subsystem;

● "Methods of Data Representation" – is responsible for interaction with distant learning platforms for convenience of the trainees;

● "Methods of knowledge evaluation and control" and "Knowledge testing" – are used in the pedagogical subsystem using the tools of the technological subsystem;

● "Methods of knowledge accumulation" – provides methodological principles for organization of the training courses, implemented in the distant learning platform;

● "Methods and criteria for the selection of teachers" - implements the principles of appointment of course supervisers.
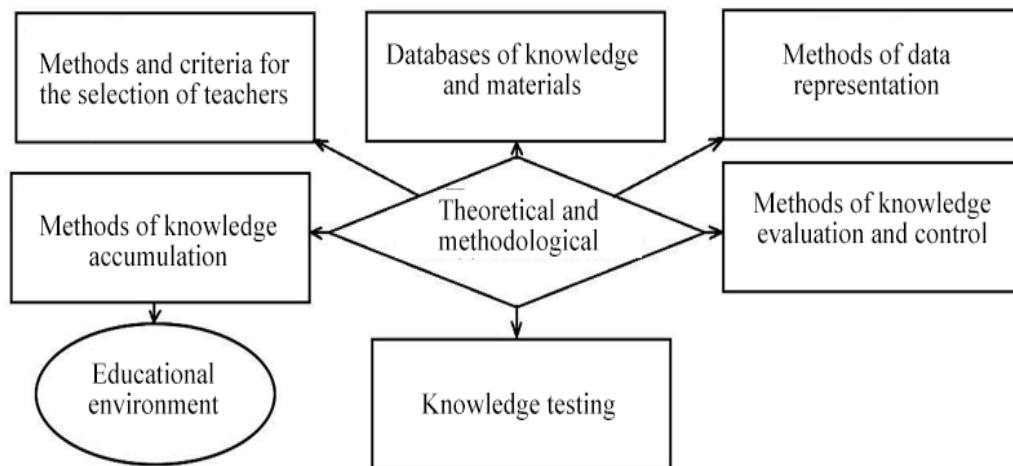

Fig. 5. Theoretical and methodological subsystem of non-formal education

The role of technological subsystem in the modernization of education lies in constant use of new informational technologies. At the same time, the development of the technological subsystem of education is accompanied by radical changes in all other subsystems: pedagogical, organizational and economic. It also significantly affects the theoretical and methodological foundations of the educational system. In other words, the development of technological subsystem results in the establishment of a radically new educational system that can ensure the delivery of educational services to millions of people, while reducing the educational unit cost.

The principal difference between non-formal education system and the formal one is complete dependence of the former on the technological subsystem. While the technological subsystem is barely implemented within the classical education, which is mainly based on "face-to-face" learning and printed materials, within non-formal education, it is the key basis for all the other subsystems. It organizes the work of all information technologies being used on all levels.

Thus, the development and application of information technology allows for the creation of a fundamentally new educational system.

The structural model of the technological subsystem, shown in Figure 6, represents blocks that provide the functionality for all subsystems of the non-formal part of education system.

Main elements of the technological subsystem of the non-formal education are the following:

● "Educational platform" –responsible for functionality of the distant learning platforms operating within educational subsystem;

● "Data storage area" – support of DBMS used in pedagogical, theoretical and methodological subsystems;

● "Ensuring of quality delivery channel" – computer network with a constant flow routing control;

● "Methods of communication (teacher-student)" – support of the on-line interaction between all subjects;

● "Knowledge control system" – interaction between theoretical and methodological, pedagogical and organizational subsystems in order to assess the quality of training;

● "Area of search and exchange of data and resources" – using of cloud technologies for storage, sharing and search of information;

● "Billing system" – technical implementation of the billing function – a key function in the economic subsystem.
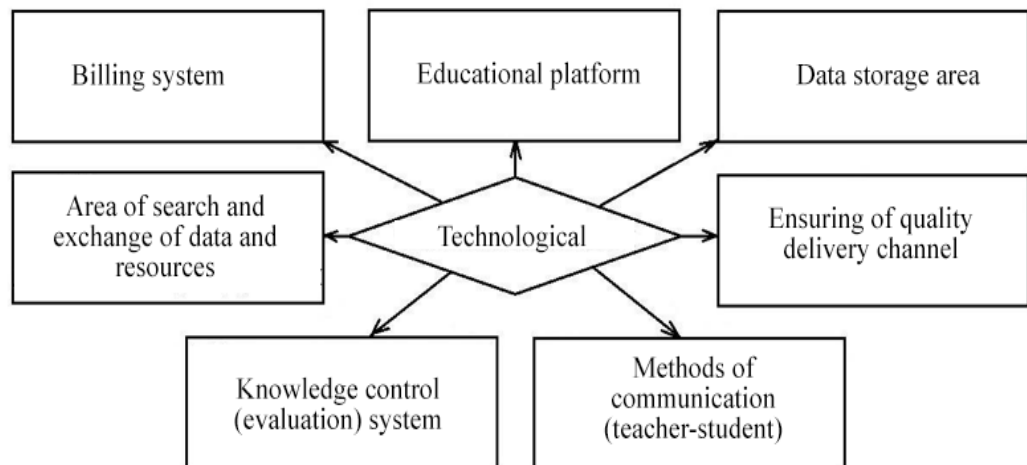

Fig. 6. Technological subsystem of non-formal education

4 Conclusions

Proposed in this article is the justified structural system model of the non-formal education system, based on analysis of such system principles. Using the basic principle of system analysis, we completed the decomposition of the system model into particular model subsystems. This allowed us to formulate the basic functional tasks for each structural element of the system. We also have shown that the technological subsystem is one of the key subsystems and, thus improving its efficiency will improve the functioning of the entire system.

Further research will focus on formalization of the model for the non-formal education system.

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