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Organizing functional processes of information system for the advanced training of medical personnel on the basis of IDEF methodology

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ABSTRACT: Nowadays, information technologies have expanded the area of applications and are being introduced in all areas of society. The concept of e-medicine has emerged internationally. Development of models and concepts of information systems in medical institutions facilitates the management and transparency in this area. In the article, a business process model, namely the IDEF model of medical education organization has been developed. Currently, different methodologies are used for the development of the models. One of these methodologies is IDEF. Developing a system model based on any methodology facilitates discussion, and understanding of authors, programmers, reviewers, experts, and users involved in the development of an information system, which ensures the perfect design of the software system. At the same time, the educational process in the medical field was compared with the traditional educational process.

KEY WORDS: model, IDEF, IDEF0, business process model, Data, medical information system, educational, traditional learning process.

I. INTRODUCTION

A business process is a system of sequential, focused and regulated activities in which, through control and resources, process inputs are converted into outputs, process results that are valuable to consumers. The key properties of a business process are that it is a finite and interconnected set of actions defined by relationships, motives, limitations and resources within a finite set of subjects and objects that are combined into a system for the sake of common interests in order to obtain a specific result, alienated or consumed by the system itself. Business modeling is the activity of identifying, describing, analyzing existing business processes, as well as designing new business processes. Business modeling is also called discipline and a separate sub-process in the software development process, which describes the activities of the enterprise and defines the requirements for the system (those for processes and operations that are subject to automation in the developed information system) [1]. Information system is a system built on the basis of computer technology, designed to store, search, process and transmit significant amounts of information, which has a certain practical scope. Education is also one of the fields trying to attract information systems and solutions [12] for the automation of educational business processes.

Medical Information System (MIS) is a set of information, organizational, software and hardware designed to automate medical processes and (or) organizations. A feature of the theoretical basis for the evaluation of software for MIS is the



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specificity of the object of evaluation. The development of MIS relates to the field of engineering in the field of information technology. In addition, it is necessary to take into account the consumer characteristics in these information systems that is the health sector. The global development of MIS backs to the 50th of the last century, from the support of medical decision-making on a computer basis to the creation of a worldwide wireless communication using cloud technologies. Differences in the levels of the territorial structure of health care, the level of computerization of MIS, the purpose and functionality of MIS leave their mark on the interpretation of this concept. Scopes of MIS have a wide range, which is constantly expanding. The properties of the software for MIS as an object of evaluation is that it can be evaluated either as a set of programs presented in various forms, or as an alienated work. The alienation is ensured by the presence of the attached documentation and data [4]

In Uzbekistan consistent measures are being taken to modernize national medical education, to introduce international educational standards in this area, to conduct comprehensive scientific research on actual issues of public health, as well as to create an effective system of moral and spiritual education for students.

Creation of integrated information systems and databases on the basis of national standards mentioning the provision of population with access to information on medical organizations and medical services, electronic queues, including remote queues are mentioned according to the concept of development of the health care system of the Republic of Uzbekistan for 2019-2025, approved by the Decree of the President and the Strategy of Actions for the five priority areas of development of the Republic of Uzbekistan for 2017-2021, which aims the further improving the system of medical education and science, integrating it into practical health care and increasing the level of medical care [10]. The following tasks are set:

- Introduction of a credit-module training system of medical personnel and the process of continuous professional education;
- Eliminating the centralization of the system of training and retraining of medical personnel, ensuring the full coverage with continuing professional education;
- Monitoring of the educational process and provision of personal records for the training of medical personnel;
- Development of clinics, educational and training facilities of medical and pharmaceutical institutions in order to ensure continuity of training, integration of education, science and practice [9].

According to the regulatory bases that are mentioned above the information models and the systems for the training and retraining processes of medical personnel using the opportunities of the information resources and technologies have been suggested.

II. RELATED WORK

Research for developing, modelling, and designing the algorithms for the education management information systems is being conducted around the world. One of the important tasks for the development of educational process management information system is based on Entity-Relationship Diagrams (ERD) models, algorithms that relies on relational algebra, as well as software developed by SMART (Social, Mobile, Access, Regulated) and Business Process Model and Notation (BPMN) methodologies. At the same time, it is necessary to optimize the logical and physical models of data based on E. Codd's 1,2,3-normal forms and to develop data description formats and information retrieval algorithms in distributed information resources [8].

In this paper the work on the development of a medical education information system has been focused. Prior to the creation of this information system, a number of existing research were analyzed on the topic of information systems of medical education systems and the educational process. These research are: Fam Van Tan "Algorithmic and software tools for data integration when creating electronic medical records" PhD dissertation, Tomsk-2011 [5], Makhmanov Orif Quadratovich, "Development of methods and models for monitoring the scientific potential of higher education institutions and research institutions", PhD dissertation Tashkent – 2017 [6], O.S. Beznos "Development of a methodological apparatus for creating a medical information system of a medical institution" PhD dissertation Krasnodar 2008 y [7]. Djamshid Sultanov in his PhD thesis suggested the model of information system for educational information sharing and approach for the raising of professors and teachers [11].

Scientific researches on the development and implementation of models and algorithms of information systems, conducted by Uzbek scientists, mainly in search of information and security are studies by T. Bekmuradov, H. Igamberdiev, M. Aripov, R. Aloev, D. Mukhamadiev, S. Gaynazarov, Study under the guidance of A. Nishanov, A. Saidov, M. Narzullaev [8].

III. SCOPE OF RESEARCH AND PROPOSED METHODOLOGY

The information system is designed to manage and monitor the educational process of the Institute for retraining medical personnel. It is devoted to the organization of the training schedule and training process, the contingent of teachers and trainees, their performance and attendance rates, as well as the provision of interactive services. The actions performed by each user of the information system are also divided into several processes. All these processes are organized into functional processes based on the IDEF0 methodology

IDEF (I-CAM Definition or Integrated Definition) is the methodology of the ICAM family (Integrated Computer-Aided Manufacturing) for solving the problems of modeling complex systems, allows to display and analyze models of the wide range of complex systems in various sections. At the same time, the breadth and depth of the inspection of processes in the system is determined by the developer, which allows not to overload the created model with redundant data [2]. According to the source in [2, 3], the group of standards include followings:

- IDEF0 - multifunctional modeling methodology
- IDEF1 - a methodology for modeling information flows within a system that allows you to display and analyze their structure and relationships (DFD methodology)
- IDEF1x - methodology for constructing relational structures (entity - relationship, IR diagram)
- IDEF2 - methodology of dynamic modeling, system development, description of the dynamics of model changes
- IDEF3 - methodology for documenting processes occurring in the system
- IDEF4 - methodology for building object-oriented systems
- IDEF5 is an ontological research methodology for complex systems. The ontology of the system is described using a specific dictionary of terms and rules, on the basis of which reliable statements about the state of the system in question can be generated at some point in time, based on these statements, conclusions are drawn about the further development of the system and its optimization is made [3].
- IDEF6 - Design Rationale Capture
- IDEF7 - Information System Auditing
- IDEF8 - User Interface Modeling
- IDEF9 - Scenario-Driven IS Design
- IDEF10 - Implementation Architecture Modeling
- IDEF11 - Information Artifact Modeling
- IDEF12 - Organization Modeling
- IDEF13 - Three Schema Mapping Design
- IDEF14 - Network Design [2]

IV. EXPERIMENTAL RESULTS

Based on the aforementioned processes, an information model of functional processes based on the DEF0 methodology a system for the medical training and retraining has been built. Regarding this model, the trainee must first obtain a referral for advanced training. With the help of e-referral part of the system a trainee can choose remote training process that corresponds to its specialty and then trainee provides the necessary documentation.

After the documents are reviewed, a trainee ticket is issued and recruited for a trainee's admission. On this basis, the contingent of trainees is formed and their groups are divided. The department has formed a contingent of teachers and a trainees that is attached to the teacher. Training is conducted in two types: grant (scholarship) and contract (non-scholarship). Scholarship holders will be trained on a government-approved basis. The contract base the trainee can request for the retraining programs and participate in training classes. Another aspect of the system is the rankings of faculty members based on scientific and methodological work. Which is the source for the encouragement of faculty.

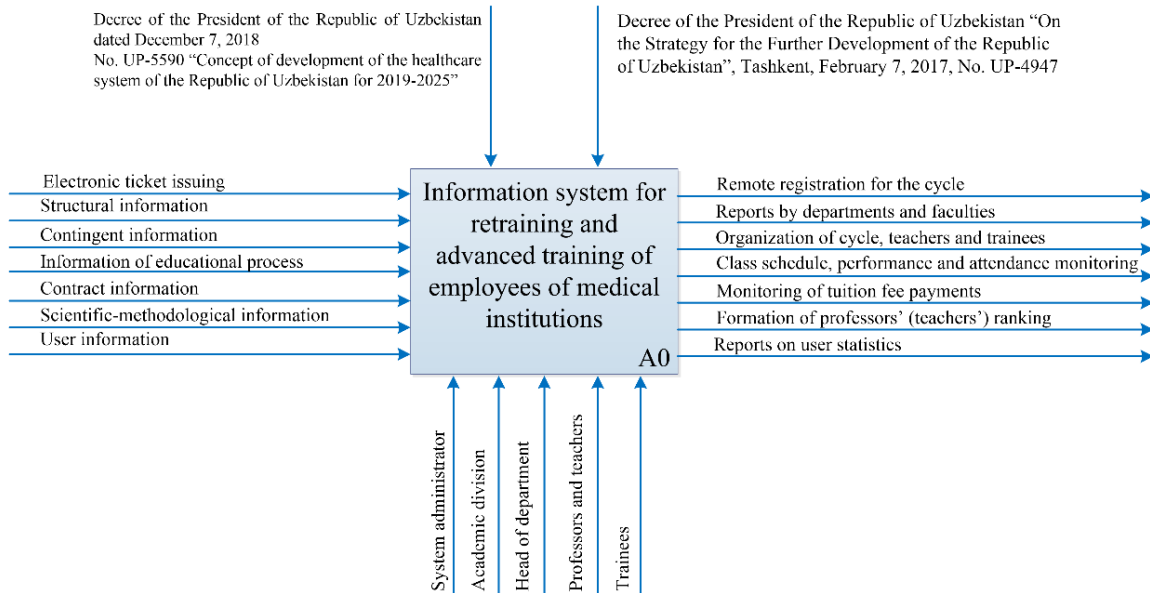


Figure 1. IDEF model of Information system for retraining and advanced training of employees of medical institutions

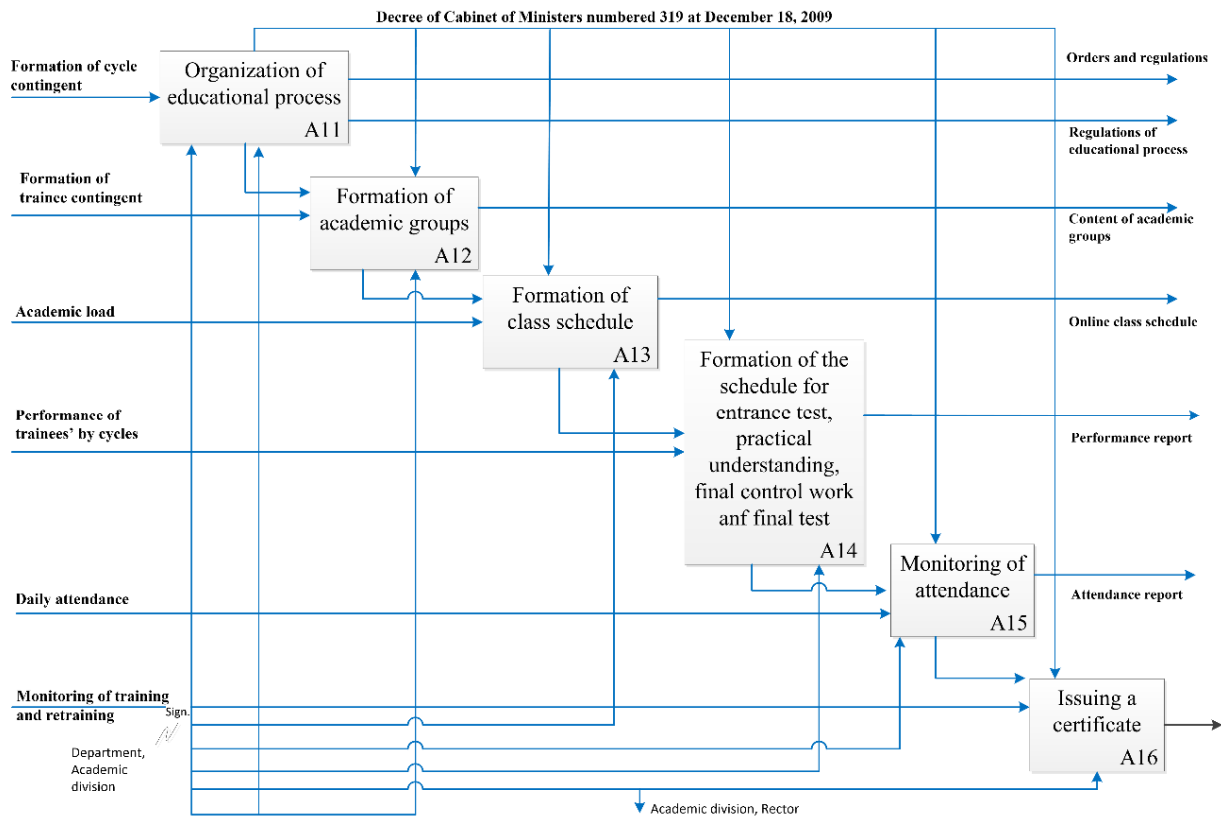


Figure 2. IDEF model for the organization of educational process

Based on the above developed processes the following tasks and information services are implemented:



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- electric ticket issuing
- Organizing a trainee contingent (faculty, cycle, or group);
- Organizing a contingent of teachers (in the faculties and departments);
- The organization of the learning process (cycles, annual calendar plans, group schedules);
- Continuous monitoring of trainees (lesson schedule and electronic journal);
- Monitoring of trainees' progress - cycle-based control (in each class), test (initial and final test), qualification practice (practical skills assessment, qualification, examination and final assessment), rating sheet.
- Formation of contract information
- Teachers evaluation (teacher ratings, reports)
- Formation of electronic reports (contingent, attendance, mastering, reception, payments, groups, cycles)
- Getting information about system users
- Interactive online services (cycles, study schedules, trainees, teachers)

The participants of the system are administrators, academic department, faculty and trainees. The figure 2 represents the IDEF models of the learning process modules.

Based on this model, the learning process is organized, for this purpose, a cycle of contingencies is formed on the ground of one semester. The cycle includes a group of trainees and a timetable of the classes. The classes are provided to the trainees at the set time. At the end of the course the trainees' knowledge is assessed. The trainees are given certificates at the end of the course, if they are successful in fulfilling all requirements of training program.

VI. CONCLUSION AND FUTURE WORK

Several literature and scientific research work of relevant information systems in the field of medicine and education have been studied in the creation of this information system. As a result of the study, information models and systems for the processes of retraining and advanced training of medical personnel have been developed. This system facilitates the all processes being interactive. The information system organizes and manages the information on the Contents, Annual Calendar Schedule, Class Schedule, Group Records, Rating Score in an electronic form. In the future, this information system will integrate with other systems and can have a single database. The result can be economically effective as a result of the implementation of low-cost systems in document exchange

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