THE PROCESS OF DESIGNING THE INFORMATION-ANALYTICAL MODEL OF UNIVERSITY MANAGEMENT IN THE ENTREPRENEURSHIP EDUCATION SYSTEM

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Abstract. The creation and implementation concept regarding the information-analytical system of university management is based on the idea of efficient and scientifically grounded usage of modern pedagogical and information-communication technologies.. Structurally, the concept consists of three components: organizational, pedagogical and technological. Model of information-analytical system of entrepreneurship education & university management is built with the usage of modular architecture, which provides standardized realization of its particular parts (modules). This makes it possible to develop several independent modules simultaneously by different developers. It is revealed that the implementation of information system modules, which is based on the complex usage of different modeling technologies and takes into account the complex relationships between all educational process subjects, in particular, characterized by the integrated use of object-oriented modeling of complex systems and imitation systems modeling technologies is an effective tool for research and development of new technologies for managing the university's educational process.

Keywords: university management, information-analytical system, entrepreneurship education, higher education institution, visual modeling.

Introduction

The urgent problems of socio-economic, scientific and technological development of modern society include the following: development, improvement and implementation of information and communication technologies (ICT) in everyday practice, the use of which significantly increases the efficiency of information processes - collection, search, systematization, analysis, storage, generalization, processing, submission and transmission of various data.

This is especially true in the field of social and economic process management, which remains a source of social problems. Due to the introduction of information and communication technologies, all components of human activity management have acquired new powerful tools. However, the problems regarding effective usage of these tools added to the typical problems of business process management.

However, there are also problems in managing business processes in the educational sector, including in higher education institutions (HEI). Moreover, the synchronization complexity of actions between different systems, the differences in the data presentation and, as a consequence, the complexity of data exchange between them, create new problems related to redundancy of data, delays in obtaining the needed data, fragmentation of business processes occurring in HEI. All this complicates the efforts of educational subjects to transfer routine processes to ICT tools.

Another problem for most HEIs is the redundancy of service personnel, whose functions can be performed more efficiently by automated information systems and complexes. The solution of this problem will not only have an economic effect, but it will also provide an opportunity to get rid of the undesirable, "human" factor: mistakes, incompetence, bias, etc, when making management decisions. However, the approaches to solving this problem must be thoroughly researched and balanced.

Specialists in the field of automation, creation and implementation of information and communication technologies into education, pedagogy, psychology, theory and methodology of teaching computer science, pay considerable attention to finding ways of solving these problems.

The major aim of the research is to substantiate theoretically and to create a methodical system for designing and implementing web-oriented university information-analytical management system.

Literature Review

However, the issues of designing web-oriented information systems for managing the university's educational process and their systematic implementation and usage of higher education institutions in the information environment are still not explored enough.

Theoretical analysis of the current state of scientific research and practical aspects of the ICT usage for the purposes of organizing and managing the HEIs educational process, indicates the existence of contradictions between:

society's objective need to renew the educational process management system in order to improve the quality of preparing the future higher education professionals (Cao, Y., Kirilova, G. I., & Grunis, M. L.; 2017), and the lack of development of its conceptual, scientific and applied provisions;

the rapid increase in the impact of information technology on all processes occurring in the HEI, and the lack of theoretical and methodological research regarding the systematic usage of ICT in the educational process;

the need to overcome fragmentation in the usage of ICT tools during the management process regarding educational operations, and the need for their justified usage in order to support the educational activities of the university`s scientific and teaching staff;

available technological opportunities to use modern information and communication technologies in order to support the educational sphere, in particular, web-oriented and cloud-oriented technologies (Whitlatch, C. J., & Orsulic-Jeras, S.; 2018), and insufficient readiness of the educational process HEIs members for their scientifically grounded, pedagogically balanced and effective usage (Król, K., & Gawroński, K.; 2018);

significant didactic potential of the information systems usage in managing the educational process of HEI, and the shortage of theoretically justified models and effective techniques for their development and implementation (Cioruţa, B., Coman, M., Lauran, A., & Cioruta, A. A.; 2018).

Methods

A complex of scientific research methods was used in order to achieve set goals and to solve certain tasks. The following theoretical methods apply to them: analysis of current standards of higher education, programs, monographs, dissertation research on educational issues, articles and materials from scientific and methodological conferences, application problems regarding modern information and communication technologies in the HEI, existing experience of such work in higher education institutions; generalization of the existing experience of applying ICT into the HEIs management and personal organizational and pedagogical experience of developing, implementing and using information systems for managing the HEIs educational process.

Results

The university`s decision to choose the creation ways of its information-analytical management system requires consideration and analysis of a large amount of different, sometimes contradictory factors, taking into account the state of the university's IT-infrastructure and its capabilities, and this decision is often in favor of independent development of its information system.

Further consideration will be aimed at discovering the key features of developing a Information-analytical system of university management (IASUM) (Fig. 1), which reffers to the component "Management of the educational process" as the most complex and resource-intensive component of the university's management system.
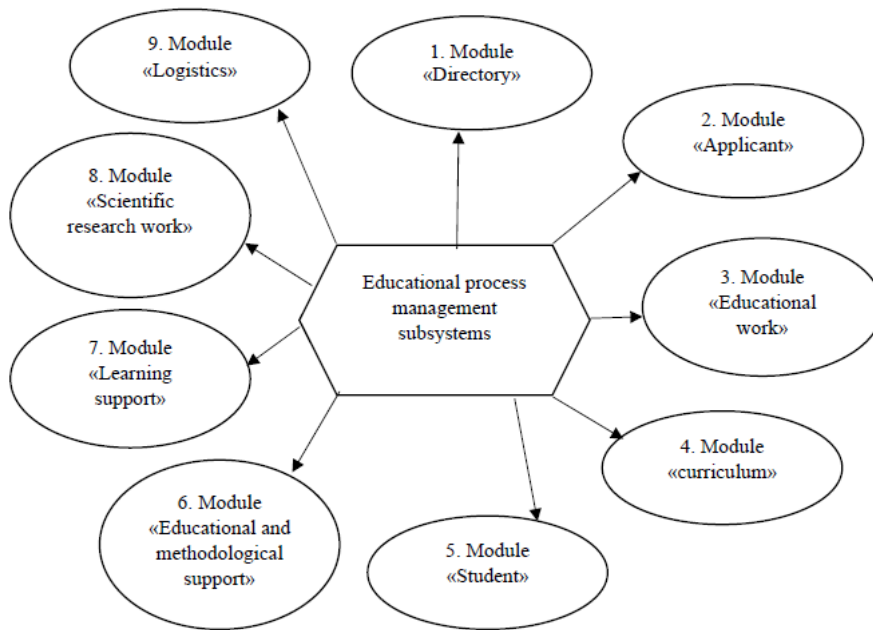
Figure 1. Structure of the management subsystem regarding the educational process of the university`s management information-analytical system (author's development)

As shown in Figure 1, the IASU Educational Process Management subsystem has a modular architecture. The modularity of information system (IS) implementation is that it involves relatively independent modules.

The implementation of individual modules of the system is standardized and realizes under a single scheme. Due to this, the creation of several independent modules of different developers can be organized at the same time. Next, we propose to briefly consider the modules of subsystem for managing the educational process of IASU "University".

The "Directory" module contains the most requested, by various modules of the system, data about the following aspects: specialties, institutes, faculties, departments, teaching staff, positions, roles, permissions, system users, etc. This subsystem module is linked to all of the following modules using a unified data format and controlling their relevance individually for each subsystem.

The module "Applicant". This module of the subsystem provides informational and analytical support for the processes of managing interaction with applicants, as well as automates the routine processes (Fig. 2) at all stages of the introductory campaign of the higher education institution. The applicant module includes a range of search tools (electronic questionnaires, competitions, training courses, etc.).

During the introductory campaign, online data exchange is ensured, in particular, obtaining an up-to-date version of the rating list of entrants, automated verification of data in electronic applications submitted through the official service, their automated registration in the module "Applicant", receiving up-to-date lists of applications, operative receiving of statistics regarding applications submitted by entrants, automated decision making of the Admission Committee (changing the applications status in accordance with the made decision).

Based on the data from this module, rating lists of entrants are formed for their further publication on the University website. Data on enrolled students are automatically transferred to the module "Student".

Module "Educational work". This module provides informational and analytical support for the planning and organization activities regarding the educational process, as well as, automates the activities of all structural units involved into the educational process.

The curriculum of the respective specialty is automatically formed, based on the specialty`s educational standard in the Curriculum block.

Annually, on the basis of the curriculum, in the block "Working curriculum" a working curriculum and schedule of the educational process of the relevant specialty is formed automatically.
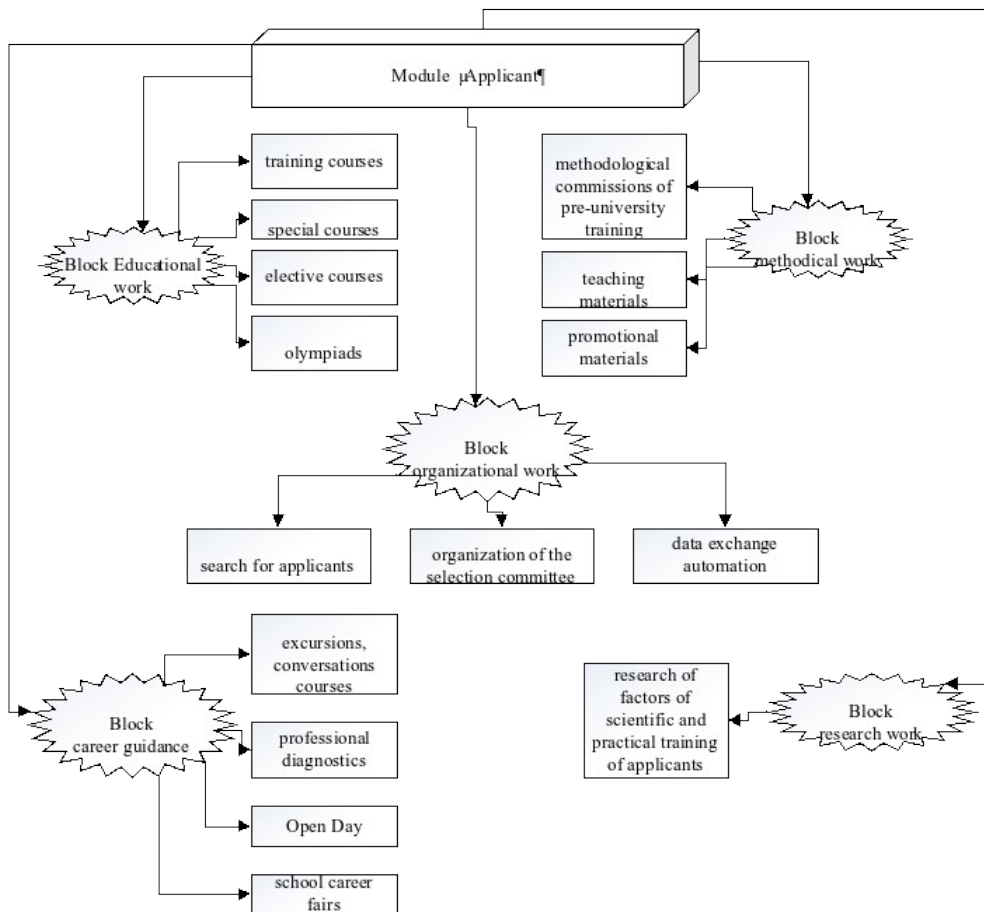
Figure 2. Structure of the model «Applicant» (author's development)

After the approval process, data from the work curriculum and schedule of the learning process are used in the module «Student» to form individual student curricula.

The block "Calculation of educational load" automatically calculates the amount of educational load for the corresponding contingent (stream, group, subgroup), based on data from the working curriculum and data on the contingent, obtained from the module "Student", taking into account the time standards for the implementation of different types of educational work. This block provides the opportunity to unite students, depending on the chosen discipline, into streams, groups or subgroups.

Based on the data from the block "Calculation of educational load" in the block "Educational load of academic departments", automatic distribution of educational load between the departments, as well as the calculation of scientific and teaching staff are carried out, using the approved algorithm for calculating rates.

Using data from the block "Educational load of academic departments" in the block "Teachers` educational load", the educational load between teachers is automatically distributed in the departments.

Module «Schedule». This module of the subsystem provides informational and analytical support for the processes of forming and using the schedule of classes, sessions, and other events.

Based on the data, received from the block "Teachers` educational load" of the module "Educational work" and taking into account the appropriate schedule of the educational process and the available classroom resources, the schedule of the educational process, schedules of consultations and examinations are automatically formed in the module "Schedule".

This module contains the automatic search tools for automatically finding the free audiences, required for certain types of classes, and checks the ability of a particular teacher to hold classes at specific times for specific groups of students.

The module provides different formats for printing schedules (DOC, XLS, PDF), as well as for displaying them on University sites using a range of filters (by faculty, specialty, group, teacher, etc.).

Module «Student». This module provides informational and analytical support for student learning management processes and automates the activities of directorates (deans). After the enrollment command, the data from the "Entrant" module is transferred to the "Student" module regarding the enrolled students in a certain specialty. Using this data, student ID cards are generated automatically, and, using quantitative characteristics of the contingent, groups and subgroups of students could be created automatically. After forming a contingent of student groups, information about them is transmitted on request to the module "Educational work" for the calculation of academic load.

The individual curriculm of each student for the current academic year are formed on the basis of data from the block "Work curriculm" of the module "Educational work" and personal students` application formed in the module "Student" on the list of selected subjects in the category "at the student's choice". Individual plan data is analyzed, summarized and transmitted to the module «Schedule» on request.

The module contains the means of automatic formation of examination-credit information for the students, taking into account their individual directions of study for each academic discipline.

Also, the module «Student» has a mechanism for automatically gathering data from the module "Learning support" to a students' success log, included in this module.

Based on the data from the success log, commands are formed automatically: transfer to the next course, appointment of scholarships, deductions from the university, admission to attestation, etc, as well as, diploma supplements and other supporting documents are formed. Information about the current and final academic progress of students are transmitted to the subsystem «Logistics» on request.

Module «Educational and methodological disciplines support» (EMDS). This module provides information and analytical support for the formation and systematization processes of educational and methodological provision of disciplines, as well as automation of data exchange with the module «Learning support» .

On the basis of data from the educational program and data from the block «Working curriculmn» of the module «Educational work», teachers of departments automatically carry out the formation of educational programs and work programs of educational disciplines. Teachers of the departments also create a list of relevant educational and methodological literature that is included into the electronic repository of the university, as well as form lists of questions for the intended types of control.

Based on the data collected, the EMDS module automatically generates all required documents and provides public access to them from various modules, where it is necessary, in particular from the module «Learning support» and the University portal.

The module contains analytical means for controlling the availability, completeness and quality of the educational and methodological disciplines support.

Module «Learning support». The module provides information and analytical support for the educational process, provides effective tools for organizing the interaction between its participants, using a formed model of learning support, which is created on the basis of the systems Moodle and Google APPS for Education.

Such module, together with the modules «Educational work», «EMDS» та «Student», gives the opportunity to provide:

- management of the development of educational materials for different disciplines;
- formation of disciplines` educatisional programs of, using a single base of educational materials;
- managing the development and support of disciplines` e-courses;
- organization and support of students' educational activities using distance learning technologies;

- control of student studying organization.

The module «Scientific research work» (RTD). This module provides information and analytical support for teachers, doctoral students, postgraduates and students in conducting scientific research work.

The block «RTD Planning» provides an opportunity to formulate general RTD plans, RTD thematic plans, plans for scientific events (competitions, exhibitions, etc.).

The block «RTD results accounting» provides an opportunity to register and account applications for RTD activities, automatic inclusion of approved applications into the R&D plan, as well as accounting of staff involved into research activities, reports and other documents.

The block «Analysis and prediction of the RTD results» provides an opportunity to analyze scientific publications, the effectiveness of RTD achievements of scientific and pedagogical staff, current success of postgraduates and doctoral students.

The block "Organization and accounting of scientific personnel training" provides the opportunity to manage a contingent of postgraduates, doctoral students, scheduling lessons, examinations and other events, as well as controlling documentation (orders, licenses, certificates, etc.).

Block «Report Generation» provides an opportunity to automate the process of forming the annual report on the university`s scientific activity, the annual reports of departments about employees` research activity, the annual report on the work of postgraduate and doctoral studies, the preparation of reports on the students` scientific achievements, etc.

Module «Logistics». Together with the considered modules, it provides informational and analytical support for the monitoring and analysis processes of educational activities, as well as predicting the outcome of the recruitment process, analyzing the university's ranking among other educational institutions, automated job search on demand provides automated graduation resume creation.

Discussion

The subsystem`s model «Managing educational load» is recommended to be developed based on the usage of modern network technologies and a single data backup, which provides a simple mechanism for integrating data into a unified information resource of the university and enables to share it, taking into account the access differentiation mechanism (for data protection purposes) for many users: university administration, teachers, students of various education forms, entrants, which in turn, provides an opportunity to achieve a high level of data integrity and create conditions for the implementation of complex automated control system of educational process with the following functions: development (modernization) of curriculum according to directions and specialties, as well as educational curriculum for the next academic year; calculation of the university`s teaching staff; distribution of teachers` educational load; forming the schedule of study groups at the university; accounting of the intermediate (rating) and final academic performance of students; formation of diploma supplement.

The designed model of the subsystem "Control and assessment of students achievements" has become the basis for the development of computer testing system, which should take into account and support the fulfillment of the basic didactic principles of the studying control, to ensure the implementation of the various types of computer testing for students of any discipline, as well as provide tools for analyzing and interpreting test results.

Conclusion

In our opinion, one of the main directions of the university`s development regarding informational educational and scientific environment is the formation and implementation of informational and analytical management system, in particular, managing it`s educational process, which will enable to:

- intensify the usage of existing and create new effective and high-quality educational and scientific resources;
- open the access to these resources for students, teachers, employees of education and science governing bodies, public organizations, a wide range of users;

- create an organizational and technological base for the introduction of teaching information technologies into the traditional educational process, as well as to support distance learning at universities;
- reduce the cost of educational processes;
- increase the level of students` professional training of all education forms;
- ensure that the general public has access to educational and scientific resources;
- improve the process of interaction between the departments of the university, as well as with other educational and scientific institutions;
- improve the efficiency of student learning and the productivity of the teaching staff;
- create a unified platform for the provision of educational services;
- ensure transparency and investment attractiveness of the university;
- increase the level of graduates` competitiveness in the labor market;
- integrate the university into regional, national, European and global educational and scientific spaces.

Due to the complexity of these processes, their dynamism and even, sometimes, unpredictability, the issue of careful selecting the means of designing the information system appears. The main tools for the creation of university`s management information-analytical system are the following: project management system, visual modeling tools, web frameworks.

Conflicts of Interest: The authors declare no conflict of interest.

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