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DEVELOPMENT OF A DECISION SUPPORT SYSTEM FOR ORGANIZING DISTANCE LEARNING

Abstract. *The learning process can be analyzed from the standpoint of the theory of self-organization of complex ordered systems, based on the properties of the synergetic approach. Learning systems can be attributed to the class of nonlinear systems, for example, because an increase in the controlling influence in the form of the volume of study material that is necessary for study does not lead to a clear result in the form of improvement of quality. It is known that difficultly organized systems can not use "hard" methods of management. It is necessary to understand, contributing to their own development trends, how to bring the system to the rails of self-organization, when external goals are related to the needs of these systems. The decisive postulate of the synergistic approach is that the development that takes place takes the form of self-government. The necessity of innovative solution of the tasks of distance learning, in which the teacher and the person being taught do not have the possibility of direct communication, are considered. For students of correspondence forms of teaching, it is rather problematic for direct and even correspondence with teachers. Computer telecommunications provide effective both direct and reverse action, which is envisaged in organizing the learning process and communicating with the teacher who is in charge of this course. Development of the strategy of development of distance education on the basis of the value-based approach allows us to move from one-dimensional to multidimensional formation of educational projects.*

Key words: academic mobility; educational program; decision support system; distance education

Introduction

The learning process can be analyzed from the standpoint of the theory of self-organization of complex ordered systems, based on the properties of the synergetic approach. Learning systems can be attributed to the class of nonlinear systems, for example, because an increase in the controlling influence in the form of the volume of study material that is necessary for study does not lead to a clear result in the form of improvement of quality. It is known that difficultly organized systems can not use "hard" methods of management. It is necessary to understand, contributing to their own development trends, how to bring the system to the rails of self-organization, when external goals are related to the needs of these systems. The decisive postulate of the synergistic approach is that the development that takes place takes the form of self-government.

In addition, the widespread dissemination of various types of educational information in electronic forms, on the one hand, leads to a pluralistic nature of the ways of achieving the goals of learning, on the other hand, objectively leads to the chaos of educational information. In this regard, the formation of an individual learning strategy often leads to the creation of a unique curriculum for the student, with a chaotic accumulation of educational influences [1].

Consider the need for an innovative solution to the tasks of distance learning, in which the teacher and the one who is taught have no possibility of direct communication [2; 3]. For students of correspondence forms of education, problems of direct and even correspondence with teachers are quite problematic [4; 5].

The learning system is dissipative, that is, open, because in real time time it exchanges resources, knowledge and information with the external environment. The difference in the forms and degree of integration of the content of various disciplines requires diversity in the combinations of academic disciplines in the formation of a system of competences. If as a result of self-organization there are several competing dissipative structures, then one of them survives, which produces entropy, which is a measure of disorder, at the lowest speed [6]. The development of new ordering of structures is carried out in bifurcation scenarios, that is, the choice of the further path at the points of bifurcation is determined not only by its history, but also corresponds to the new order of self-organization [7].

Distance education has long attracted the attention of both educators and students. Such training can take different forms depending on the organization and the used learning technologies.

Computer telecommunications provide effective both direct and reverse action, which is envisaged in organizing the learning process and communicating with the teacher who is in charge of this course.

There are various forms of distance learning organization based on new information technologies. In recent years, these kinds of distance learning, based on:

– Interactive TV (two-way TV);

– Computer telecommunication networks (regional and global, Internet) in text file exchange mode;

– computer telecommunication networks using multimedia information, including interactively, as well as using computer videoconferences;

– a combination of interactive television and computer telecommunication networks.

Recent literature

The problem of organizing distance learning is multifaceted and extremely complex. Of course, it is not limited to the questions above [8 – 13]. A separate problem is the student's information support infrastructure:

How, where and how should the training information be?

What should be the structure and composition of the educational material itself?

What is the optimal form of feedback when distinctively mopped up?

If some courses or their modules are hosted on certain servers, what are the conditions for access to them?

what training information is appropriate to place on Web pages?

Conclusions and directions of further research. Unique solutions, both technical and pedagogical and economic, should form the basis of the University's information environment.

The construction of the concept of distance learning defines a range of issues that should be addressed when managing educational projects. The effectiveness of such projects depends on specific indicators (indicators), which are an assessment of the achieved level of excellence and characterize its integral assessment. Therefore, taking into account the various options for organizing distance learning, one can note that in the short term, the most pressing task is the organization of an information environment based on computer telecommunications, taking into account the value-added approach.

In recent years, universities from different countries have drawn attention to the possibility of using computer telecommunication technologies for the organization of distance learning.

Computer telecommunications provide effective both direct and reverse action, which is envisaged in organizing the learning process and communicating with the teacher, leading a course.

The development of a strategy for the development of distance education on the basis of a value-based approach allows us to move from one-dimensional to multidimensional education-oriented projects.

Further development of communications will allow in the near future to create adequate models of the surrounding environment with the inclusion of virtual interlocutors in the monitored monitor on the picture. All this opens up unprecedented opportunities for the education sector to access educational information and optimize its presentation and processing.

For these projects should take into account the many factors of the external environment, the needs of society, the properties of the product being created, characteristics and level of perfection of processes, trends of the university. Then, under the product of educational projects, we will understand the new state in which the totality of graduates of higher educational institutions is translated as a result of the implementation of educational projects. That is, the product of education is graduates with new knowledge, skills and abilities that form the necessary for the specialists productive and socially important competencies.

The value created in education can be reflected as a tuple [14]:

C = {(value type ↔ drivers ↔ means ↔ indicators) i ↔ indicators}

where i = 1, 2, ..., n is the type of value index.

In this case, the indicators are an assessment of the level of perfection achieved by certain all types of values that characterize the integrated assessment of the project [15]. Yes, the effectiveness of the project depends on the values of the product, process, activity, as well as the value of development and update.

One of the most vulnerable properties of assessments is the quantitative dimensionality and physical content of the project parameters. A balanced estimation option suitable for different types of projects is the assessment system using indicators 5E and 2A [16].

Five "E" (efficiency, efficiency, earned value, ethics, ecology):

1. The effectiveness of the use of resources in projects is determined by the ratio of the benefit received from the project to the amount of resources used.

2. Cost-effectiveness refers to the level of satisfaction of stakeholders before and after the project, and also determines the benefit based on certain performance criteria.

3. Mastered volume (added value) is a universal criterion for measuring progress of projects, in which the project idea is related to its schedule (schedule) and expenses (resources).

4. Compliance with ethical standards is the response of the program community to the overall acceptability and social orientation of the program idea, to respect social and organizational rules within its

framework, and to justify the ethical expectations of participants.

5. Ecology – a criterion for maintaining a continuous growth of the organization or the continuous progress of the program, which is aimed at protecting the environment.

Two "A" (accountability, acceptance):

1. Reliability (accountability) is determined by the level of responsibility of the management for the results of the project / program, including interim results obtained by the stakeholders, as well as transparency, visibility and public (public) public information on the status of the project / program at the moment.

2. Admissibility (eligibility) is determined by a number of conditions that the interested parties have taken on the cost indicators of the program.

In order to shape the types of created value, it is necessary to first determine the projections of stakeholders [17]. The modeling of value profiling in educational projects allows us to move from one-dimensional evaluation of the effectiveness of complex learning systems to a multi-vector evaluation system from a set of characteristic parameters.

The structure of the assessment of the created value also includes drivers of innovation development and means, which in a clear or unclear form reflect the results of the university.

When designing a prototype of the decision making support system (DMSS), the concept of "fast prototype" is used, the essence of which is that the system is built consistently, from simple to complex. Such stages of the development of the DMSS as identification, conceptualization and formalization were described in the previous sections and their results are used at the development stage of the prototype [18].

DMSS performs the following functions:

– collection, storage, updating of the information necessary for academic mobility (AM) control;

– monitoring AM at the university, assessment of the situation, forecasting the development of the situation and the consequences of management decisions;

– keeping records of development of AM, history of decisions taken and consequences (accounting of precedents);

– Formation of necessary packages of documents for participation in the AM program (training agreement, individual plan and participant's schedule);

– formation of reports on AM at the university;

– conducting a comparative analysis of educational program (EP) from different universities;

– selection of program for AM participants;

– selection of participants for AM programs;

– conducting recognition of results.

To write the software, MS Visual Studio development environment, Visual C # programming language and MS SQL Server database management system were chosen for organization of the database and knowledge base.

MS Visual Studio

The Visual Studio development environment is a complete set of development tools for creating ASP.NET web applications, XML (web services), desktop applications and mobile applications. All languages (Visual Basic, Visual C #, and Visual C ++) use a single integrated development environment (IDE) that allows you to share resources and simplify multi-language solutions. Microsoft Visual Studio is a powerful development environment that delivers high-quality code throughout the software development cycle from design to development [19].

Visual C # is a C # language implementation by Microsoft. Visual Studio supports Visual C # with a full featured code editor, compiler, project templates, designers, code wizards, powerful and easy-to-use debugger and many other tools. The .NET Framework class library provides access to many of the services of the operating system and other useful, valid classes, which significantly accelerates the development cycle [19].

MS SQL Server

Microsoft® SQL Server ™ Release Year 2008 is a complete database sentence and data analysis solution for quickly creating scalable e-commerce solutions, business applications and data warehouses. SQL Server supports XML and HTTP support, tools for boosting performance and availability that allow you to distribute loads and provide uninterrupted work, features for improved management and settings that reduce the total cost of ownership. The SQL Server 2008 Business Analysis Platform is closely integrated with Microsoft. Office provides an expanded scalability infrastructure for implementing powerful business analysis capabilities into the workflow, providing access to the required business information through the MS Excel and MS Word interface [20].

MS SQL Server-2008 offers developers a well-developed, convenient and functional programming environment, including tools for working with web services, innovative data access technologies – everything that is needed to work effectively with data of any type and format [21]. ADO.NET is part of the Microsoft .NET Framework, that is, a set of tools and layers that allow the application to easily manage and interact with its file or server data warehouse.

The .NET Framework for the ADO.NET library is located in the System.Data space. These libraries provide connectivity to data sources, teamwork, and storage, processing, and data sampling.

ADO.NET allows you to interact with the database autonomously, using the <distinguish> from the database cache database. Autonomous access to data is necessary when it is impossible to maintain an open physical connection to the database of each individual user or object.

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Main material

The main interface of the DMSS prototype software is presented in Fig. 1.

The main Window of the program is divided into 4 parts:

Organization AM.

Control AM.

Input of data.

Setup, help, exit.

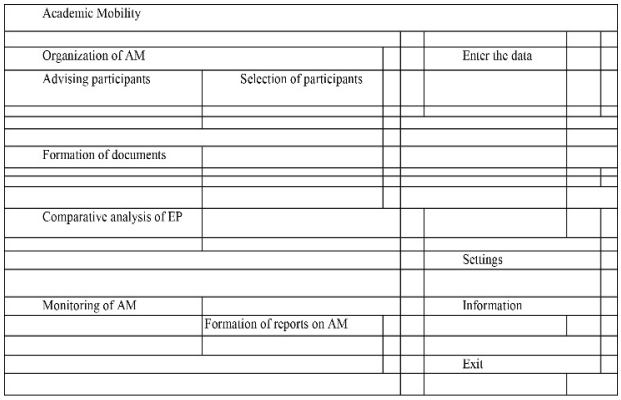

Figure 1 – The main interface of the prototype DMSS software

The AM organization includes the following modules:

- student counseling module;
- participant selection module;
- module of comparative analysis of OP;
- module for forming the documents necessary for participation in AM;
- recognition module for results.

AM control includes the following modules:

- monitoring module AM;
- report generation module.

Monitoring AM represents a definition in a situation of which type each participant is. Participants who are in critical situations are marked with red color, which are in predecritical – yellow. The step of identifying predecritical situations, that is, how many days ahead is determined by the emergence of critical situations, if nothing changes, is given in the settings. When clicks on participants in critical or predecritical situations there is more information about the participant, the type of critical situation, comment on it and manages the decision.

The Reporting Module allows you to generate a report on AM at the University for the following parameters or their combinations:

- for the specified period;
- by type of program;
- by type of participants;
- for specific participants;
- for specific programs;
- for partner countries;
- for partner universities;
- in the branches of knowledge;
- for scholarships involved and others.

A comparative analysis of the Commons University of Science and Technology (OP) of China (Common University of Science and Technology) and foreign universities is the basis for making decisions when compiling the documents required for AM management.

Comparative analysis of educational programs of Chinese and American higher education institutions. Let's consider OP in the field of computer science of several US universities:

Stanford University [22];

MIT, Massachusetts Institute of Technology [23];

University of California, Berkeley [24];

Carnegie Mellon University [25].

Selected universities are leading computer science in the academic ranking of universities in the world ARWU [26].

In the system of higher education in the United States there is no universal for all HEIs analogous to the directions of preparation of bachelors of Russian universities, which complicates the comparison of educational programs in such a large area as computer science.

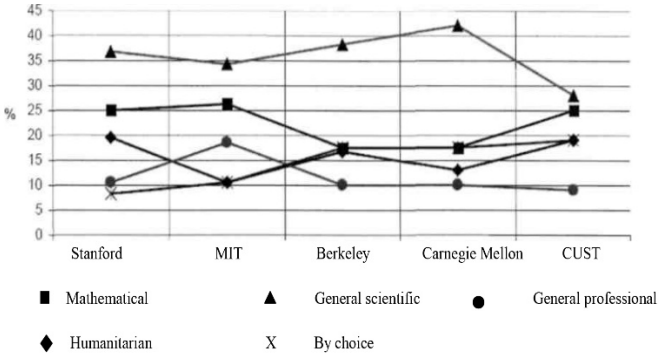

Figure 2 – Distribution of labor between blocks of curriculum disciplines of US and Chinese universities

The complexity of mathematical disciplines in standard Chinese education is 1.3-2 times higher than in US universities due to additional subjects. The complexity of the mathematical analysis lies within the complexity of the US universities: it almost coincides with the MIT and Carnegie Mellon and is less than the University of Berkeley in 2 times. The complexity of discrete mathematics is greater than in American universities. The complexity of the probability theory is less – at

35-50%. The complexity of matrix analysis and linear algebra is approximately the same.

Conclusions

1. The decision support system for managing academic mobility solves the following tasks:

– counseling and support of AM participants at all stages;

– formation of the required package of documents;

– monitoring of AM in higher educational institutions;

– formation of reports on AM in higher educational institutions.

2. The complexity of mathematical disciplines of standard Chinese education is 1.3-2 times higher than in US universities due to additional subjects. This should be taken into account when established joint international programs.

References

1. ISO / DIS 29990: 2010. (2009). Learning services for non-formal education and training – Basic requirements for service providers. ISO: ISO/TK 232, 15.

2. Kolesnikov, A.E. (2015). Project Management of the University Information Environment Creation. / A. E. Kolesnikov, S. V. Tkachuk, T. V. Otradskaya, etc. // The High Technologies in Machines, 1 (25), 72–79.

3. Kolesnikov, A.E. (2014). Formation of the information environment of the university for distance learning. Management of development of complex systems, 20, 21–26.

4. Vaisman, V.A. (2012). Methodological foundations of quality management: factors, parameters, measurement, evaluation / V. A. Vaisman, V. D. Gogunsky, V. M. Tonkonogiy // Modern technologies in machine-cutting, 7, 160–165.

5. Yakovenko, V.D., (2009). Management systems by the quality of the school foundation. Systemic data and information technologies, 2, 50–57. Gogunsky, V.D.

6. Bushuyev, S.D. & Sochnev, S.V. (1999). Entropy project management tool. International Journal of Project Management, 17, 6, 343–350.

7. Bushuev, S.D. & Kharitonov, D.A. (2010). Value approach in managing the development of complex systems. Management of development of complex systems, 1, 10–15.

8. Vaisman, V.O. 92012). Use of the latest information technologies for the formation of competencies in professional education. / V. O. Vaisman, K. V. Kolesnikova, V. M. Tonkonogy // Gents of real credit institutions, maturity systems, and their maturities. .-method. Seminar, 6, 31–33.

9. Koja, T.I., Gogunsky, V.D. (2002). Definition of necessary and sufficient conditions for the objectivity of the evaluation of test results. Proc. OPU, pp. 87–88.

10. Kolesnikova, E.V. (2013). Modeling poorly structured project management systems. Proc. OPU, 3 (42), Pp. 127–131.

11. Kolesnikova, K.V., Luk'yanov, D.V. (2013). Analysis of the structural model of the competence of managing projects of the national standard of Ukraine. Management of development of complex systems, 13, 19–27.

12. Kolesnikova, K.V. (2013). Concepts of Competent Knowledge. Places of Realization of Credit and Modular System: Materials of Science.-Method. Seminar, 7, 40–47.

13. Tertyshnaya, T.I., Kolesnikova, E.V., Gogunsky, V.D., (2001). Automated Knowledge Control System. Tr. OPU, 1 (13), 125-128.

14. Tkachuk, S.V., Gogunsky, V.D. (2011). Concepts that model of professional development at the initial foundation. Glide real estate credit-modular system: materials science.-method. Seminar, 5, 88–93.

15. Bushuev, S.D., Bushueva, N.S., Babaev, I.A., etc. (2010). Creative technologies of project and program management [Text]: monograph. K.: Summit-Kniga, 768p.

16. Kolesnikova, E.V., Olekh, T.M. (2012). Matrix diagram and "strong connectivity" of value indicators in projects. Electrotechnical and computer systems, 7 (83), 148–153.

17. Fedotov, I.E. (2008). Some methods of parallel programming [Text]: studies. Manual. Moscow: Publishing house of MGIREA (GU), 188.

18. Markelova, A.V. (2011). Managing the process of formation of the main educational program using the decision support system. Scientific. statements of the St. Petersburg GPU. SPb., 1 (115), 1, p. 187–193.

19. Microsoft. Russian MSDN [El. resource]. – URL:http://msdn.microsoft.com/ru-ru/default.

20. MS SQL server. The official website of the product [Electronic resource]. – URL: http://www.microsoft.com/rus/SQL/2008/default.mspx.

21. Shvetsov, V.I. Database: studies. manual [Electronic resource] / V. I. Shvetsov. – URL:http://window.edu.ru/window_catalog/redir?id=61460&file=shvetsov-lectures.pdf.

22. The official site of Stanford University [Electronic resource]. – URL: www.stanford.edu.

23. The official site of the Massachusetts Institute of Technology [Electronic resource]. – URL: www.mit.edu.

24. Official site of the University of California at Berkeley [Electronic resource]. – URL: www.berkeley.edu.

25. Official site of Carnegie Mellon University [Electronic resource]. – URL: www.cmu.edu.

26. Academic ranking of universities in the world, official website [Electronic resource]. – URL: www.arwu.org.

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РОЗРОБКА СИСТЕМИ ПІДТРИМКИ ПРИЙНЯТТЯ РІШЕНЬ ДЛЯ ОРГАНІЗАЦІЇ ДИСТАНЦІЙНОГО НАВЧАННЯ

Анотація. *Процес навчання можна аналізувати з позицій теорії самоорганізації складних впорядкованих систем, базуючись на властивостях синергетичного підходу. Системи навчання можна віднести до класу нелінійних систем, оскільки, наприклад, збільшення керуючого впливу у вигляді обсягу навчального матеріалу, який необхідний для вивчення, не призводить до однозначного результату у вигляді поліпшення якості. Відомо, що до складноорганізованих систем неможливо застосувати "жорсткі" методи управління. Необхідно зрозуміти, як сприяючи їх власним тенденціям розвитку, вивести системи на рейки самоорганізації, коли зовнішні цілі пов'язані з потребами цих систем. Визначальним постулатом синергетичного підходу є те, що керований розвиток приймає форму самоврядування. Розглянута необхідність інноваційного вирішення завдань дистанційного навчання, при якому викладач і той, кого навчають, не мають можливості прямого спілкування. Для студентів заочної форми навчання доволі проблематичне безпосереднє і навіть заочне спілкування з викладачами. Комп'ютерні телекомунікації забезпечують ефективну як пряму, так і зворотну дію, що передбачається в організації навчального процесу та спілкуванні з викладачем, який веде даний курс.*

Розроблення стратегії розвитку дистанційної освіти на основі ціннісного підходу дає змогу перейти від одновимірного до багатовимірного формування проектів освітньої спрямованості. Система підтримки прийняття рішень при управлінні академічною мобільністю вирішує такі завдання: консультування та підтримка учасників АМ на всіх етапах; формування необхідних пакетів документів; моніторинг АМ у ЗВО; формування звітів по АМ у ЗВО. Трудомісткість математичних дисциплін стандартної китайської освіти в 1,3–2 рази більше, ніж в університетах США за рахунок додаткових предметів. Це треба враховувати при налагодженні спільних міжнародних програм.

Ключові слова: академічна мобільність; освітня програма; система підтримки прийняття рішень; дистанційне навчання

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