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AUTOMATION OF BUILDING AN INDIVIDUAL EDUCATIONAL TRAJECTORY FOR A HIGHER EDUCATION STUDENT

Purpose. To highlight the aspects of designing and implementing an automated system for building an individual educational trajectory for higher education students.

Methodology. To develop an automated system for building an individual educational trajectory of a higher education applicant, such general research methods were used as analysis and comparison to substantiate the requirements for the system; synthesis to form the components of the system and develop a structural diagram of a set of hardware and software in accordance with the state standard for the design of automated systems; a generalisation method for formulating recommendations for the implementation of the developed system.

Findings. The concept of an automated system for selecting elective courses by higher education students is formulated; the main stages of designing an automated system using modern information technologies are substantiated. The requirements for hardware and software are determined and a structural diagram of the basic hardware and software complex is developed to implement the main functions of the automated system. The social and economic effect of the introduction of an automated system for building an individual educational trajectory is determined and further prospects and directions of development are outlined.

Originality. A methodology is developed for building an individual educational trajectory based on modern information technologies and systems, which contributes to the intensification of cognitive activity of higher education students and ensures transparency and speed of the procedure for selecting elective courses.

Practical value. The developed system allows for the automated selection of elective courses by higher education students. The system also has the ability to record the chosen disciplines by students on the basis of electronic applications, which will reduce the complexity of the choice and the workload of the dean's office and other structural units of the university.

Keywords: *higher education, individual educational trajectory, design, system concept, selection procedure*

Introduction. Nowadays, information technology is developing very rapidly, so only through continuous improvement can a specialist remain competent and in demand. In this regard, the development of independent learning skills and the ability to build individual educational trajectories is of particular relevance and value [1, 2]. The skills and abilities acquired in this way allow students to acquire new knowledge on their own, improve their skills as needed, and after graduation, in the course of professional activities and various life situations [3, 4].

The possibility of choosing educational components while studying at a higher education institution allows students to expand the list of general and deepen professional competencies, contributing to the quality of training. At the same time, the use of automation tools in the process of building an individual educational trajectory ensures the speed and transparency of the choice.

The development and implementation of the system based on information and communication technologies will automate the entire range of procedures for the selection of disciplines by higher education applicants, including the formation of a database of applicants and their identification in the system; setting up the selection procedure; familiarising applicants with the syllabi of elective disciplines; fixing the selected disciplines and forming groups, etc.

In connection with the above, it can be noted that automation of building an individual educational trajectory for higher education students is a relevant and important area for improving the quality of education.

Literature review. Today, digital transformation is becoming a priority for the development of many industries, including education. In this regard, automation tools are gaining special importance to improve the quality of educational services, including the construction of individual educational trajectories [5, 6].

The peculiarities of individualisation of learning, as well as the formation and implementation of individual educational trajectories in the educational process have been studied by such scholars as Alekseeva S. [7], Baranovska O. [8], Godovaniuk T. [9], Horbatiuk R. [4], Kankovskyi I. [2], Korostianets T. [1], Krasnoshchek I. [10], Pinchuk O. [6], Strelets S. [5], Sharov S. [11], Shevchuk H. [12], and others.

Thus, in particular, O. Baranovska considers "individualisation of learning as a principle of implementing an individual approach to students in the learning process; as a form of organisation of student learning activities; as an educational technology based on the principle of individualisation. Individualised learning is a type of learning that is carried out on the basis of individualisation with the use of appropriate technologies, the purpose of which is to develop an individual according to his or her abilities and at a pace appropriate for him or her" [8].

Korostianets T. believes that "one of the most popular ways to individualise the educational process is to provide each individual student with the opportunity to build an individual educational trajectory.

These processes are dictated by the realities of our time, and the need for individualisation of the educational process is enshrined in the law on education and is also reflected in educational standards" [11].

Shevchuk H. notes that "the search for conditions and ways to implement individual educational trajectories of students is becoming an important area of activity for Ukrainian universities. Choosing, building and implementing an individual educational trajectory allows the student to develop exactly those universal and professional competences that are in demand in modern society" [12].

Thus, the research conducted confirms the importance and relevance of the chosen topic and the need for its further development.

Unsolved aspects of the problem. It should be noted that individualisation of learning requires active participation of both the student to form a request to study certain courses and the educational institution to ensure comfortable conditions, transparency and speed of selecting elective courses [7, 9].

In this regard, only through mutual intensification of activities based on modern interactive information and communication technologies it is possible to achieve effective construction of an individual educational trajectory of a higher education student [15].

Purpose of the article. The purpose of the research is to highlight the aspects of designing and implementing an automated system for building an individual educational trajectory for higher education students, which will allow one: to provide the possibility of remote acquaintance with the list of elective courses and their content to improve the selection process; to select elective courses and form an application for their study in an automated mode; in general, to increase motivation and interest in learning through new forms of organisation and the possibility of individualising the educational process.

In line with the goal, a number of tasks are set:

- to define the requirements and formulate a set of tasks that the system should implement;
- to describe the design of an automated system for building an individual educational trajectory of a higher education student;
- to implement the structural scheme of the system's hardware and software;
- to develop recommendations for implementing the automated system in the educational process.

Methods. In the process of preparing the materials of the article, general research methods were used [13], which include: observation, analysis and synthesis in the formation of requirements and a set of tasks to be implemented by the system; synthesis, algorithmisation and modelling in the design of an automated system; generalisation for the formation of instructional materials and recommendations for the implementation of an automated system for the selection of disciplines by higher education students.

Presentation of the main research and scientific results. Given all of the above, the need to introduce an automated system for selecting elective courses in the educational process is confirmed, which will contribute to digital transformation and transparency of education.

Let us consider the main stages of designing an automated system for choosing disciplines by higher education students based on a personal e-cabinet.

In accordance with GOST 24.601-86 and GOST 24.602-86 [14], which regulate the creation of automated systems, we present the stages of system design in the form of the Table.

Thus, in accordance with the stages shown in the table, it is first necessary to formulate the requirements that the system must meet, to study the development problems, ways to solve them, the cost and timing of development, the possibilities of modern digital technologies for the development of automated systems in education, etc.

The entire set of requirements that an automated system must meet can be divided into the following groups:

1. *Functionality requirements*:

- the ability to uniquely identify each student in the system based on authorised access;
- automated setting of parameters for the election procedure;
- the opportunity to get acquainted with the list and content of elective courses;
- the ability to choose disciplines from an available list;
- recording the elections and generating electronic applications from applicants;
- automated formation of groups for studying disciplines.

Table

The main stages of automated system development

Stages of automated system development	Content of the stages
Formation of requirements for an automated system	- justification of the need to develop the system; - formulation of user requirements and tasks to be performed by the system; - researching development problems and ways to solve them with the help of modern technologies; - development time and estimated cost, etc.
Development of the system concept	- study of system components; - conducting research and development activities; - development of possible concept options; - drawing up research results
Development of technical specifications	- development and approval of the terms of reference (TOR), which is the basis for the system development
Development of a preliminary design	- development of preliminary design solutions based on the formation of input and output documentation; array structures, basic functioning algorithms, etc. - development of documentation
Development of a technical project	- development of detailed design solutions for the organisational structure and functions of the system's personnel; - preparation of documentation for the system; - development of documentation for the supply of components for the system or tasks for their development; - designing related parts of the system – hardware and software
Development of working documentation	- creation of operational documentation for system users; - system adaptation
Commissioning and maintenance of the system	- preparing the system for commissioning; - training of personnel to operate the system; - system configuration; - commissioning and adjustment works; - system maintenance

2. *Requirements for the content of the interface*:

- accessibility and clarity of the system interface for selecting disciplines;
- an administrator panel for setting up and adjusting the parameters of the selection procedure.

3. *System requirements:*

- compatibility with modern operating and application systems and browsers;
- integration with other university programmes and databases;
- data security and distributed access to information at the user and administrator levels.

4. *Feedback*:

- the ability to exchange messages between higher education students and system administrators regarding the correctness of the election procedure and its results;
- the ability to conduct surveys on the operation of the automated system.

5. *Analysis of system performance*:

- the ability to analyse the results of students' choices and generate reports on elective subjects and their popularity;
- availability of tools to analyse the efficiency of the system as a whole, including time and energy resources, as well as user satisfaction.

6. *Scalability:*

- the ability to increase modules and functionality depending on the needs;

- the ability to work efficiently with increasing data volumes and the number of users, contributing to the system's scalability.

At the same time, in the process of implementing the above requirements, problems may arise related to the coherence of the work of various subsystems, in particular, when moving from a personal electronic account to the programme for selecting elective disciplines. Problems may also arise due to incorrect interaction between individual modules of the programme, as well as issues with up-to-date data updates during the selection process and other aspects related to the development of a heterogeneous system. In addition, the development process may be complicated by the involvement of insufficiently qualified personnel who are not able to implement all the tasks.

Therefore, to address all these issues, it is necessary to carefully plan and design the system in accordance with current standards, as well as involve highly qualified specialists and use modern development tools and software.

Accordingly, the duration and cost of development depends on the qualifications of specialists and the toolkit used.

The tasks that the system should perform include the following:

- providing remote access to the system for selecting elective courses;

- familiarisation with the list and content of elective cycle disciplines in the system environment;

- conducting the procedure for selecting the disciplines to be studied, if necessary, in several rounds, if necessary, forming groups of a certain number of applicants;

- execution of an electronic application to record the choice made;

- saving selected elective courses in electronic individual student plans;

- forming lists of group participants in selected disciplines.

After formulating the requirements and a set of tasks to be implemented by the automated system, the system concept is developed. It involves the creation of information support and the definition of system components to automate the selection of elective courses, which will allow for the rapid and transparent construction of an individual educational trajectory of a higher education student.

The main components of the automated system include: a student's personal electronic account, which is used to log in to the system of elective disciplines; a module with syllabi of disciplines to enable students to familiarise themselves with the topics, the number of hours, and evaluation criteria for each elective discipline; the automated system for selecting disciplines, which includes a module for setting up and implementing elective tours and a single database containing data on applicants, elective disciplines, timing of tours, elected discipline recorded in electronic applications; server part for storing and processing information.

Thus, the development of the concept serves as a prerequisite for the practical implementation of the automated system.

The development of the terms of reference generally involves a detailed description of the following components of the system design and implementation:

- general requirements;

- technical and software requirements for the system;

- requirements for system equipment;

- guarantees and additional conditions.

Thus, among the main requirements and tasks that the automated system should solve are: easy access to the programme for selecting elective subjects; speed of the procedure for selecting elective disciplines due to a clear and user-friendly interface; transparency of the selection procedure.

To implement the stages of automated system development and their testing, the following hardware is required: server, PC, laptops, and network equipment. In the future, it is possible to add other hardware to set up the automated system.

It is advisable to develop the software part of the automated system for selecting elective disciplines in the form of web-oriented software application based on such modern environments as Visual Studio Code, PhpStorm, NetBeans, PyCharm, Joomla, Drupal [17], which will provide a choice of a wide range of tools and support for libraries.

To develop a layout, the most popular tools at present are editors for creating raster and vector graphics such as Adobe Photoshop, Figma, Picasa, Photo-Paint, Adobe Fireworks, Microsoft Photo Editor, Adobe Illustrator, CorelDRAW, Adobe FreeHand [18], which will ensure the creation of a high-quality graphical interface of the system.

It is advisable to implement the front-end part of a web-oriented software application using modern hypertext markup languages and libraries such as HTML5, CSS, JavaScript, VBScript, jQuery, AJAX, Perl [19], which provide a wide range of functionality for creating a web-oriented application.

To facilitate the development, you can also use Django, Zend, Express.js, Backbone + Marionette, Angular, Ember.js, Vue.js, etc. frameworks [20].

To develop the server side, it is effective to use such software tools as ASP, PHP, JSP, MySQL, PostgreSQL [21], which will allow storing masses of information about elective subjects, higher education students, their chosen subjects for study, electronic applications, etc.

Thus, the reflection of a set of general, technical, and software requirements, as well as tools for implementing the future system in the terms of reference, allows for its detailed and high-quality design.

The next stage is the development of a preliminary design, which involves, among other things, determining the input and output information, the structure of data arrays, algorithms for the functioning of the system being designed, etc.

The input information for the automated system for selecting elective courses should include data on the number and content of syllabi of elective courses; arrays with information on the number and composition of groups of higher education students who will make the choice, as well as information on the number of courses they will choose in accordance with their individual curricula; information on the number of rounds of selective courses and the dates of their conduct, etc.

The output information includes information on the disciplines chosen by higher education applicants in each round; data on the groups formed in the chosen disciplines, arrays with electronic applications for studying disciplines, etc.

An important stage of design is the development of the system's functioning algorithm, which involves determining a clear and logical sequence of the automated selection process for elective subjects.

When developing complex programs, it is advisable to use a flowchart representation of the algorithm in accordance with the standards DSTU ISO 5807:2016. Information processing. Symbols and conventions for documentation of data, programs and system flowcharts, network program diagrams and system resource diagrams [22], ISO 5807:1985. "Information processing – Documentation symbols and conventions for data, programme and system flowcharts, programme network charts and system resources charts" [23].

The flowchart of the algorithm, which reflects the schematic sequence of the procedure for selecting elective disciplines, taking into account the designations in accordance with the above standards, is presented in Fig. 1.

In accordance with the above flowchart, the development of software code for the implementation of a web-based system for building an individual educational trajectory using modern development environments is carried out.

The implementation of a technical project includes the construction of a set of hardware and software tools. In general, they may include [24]:

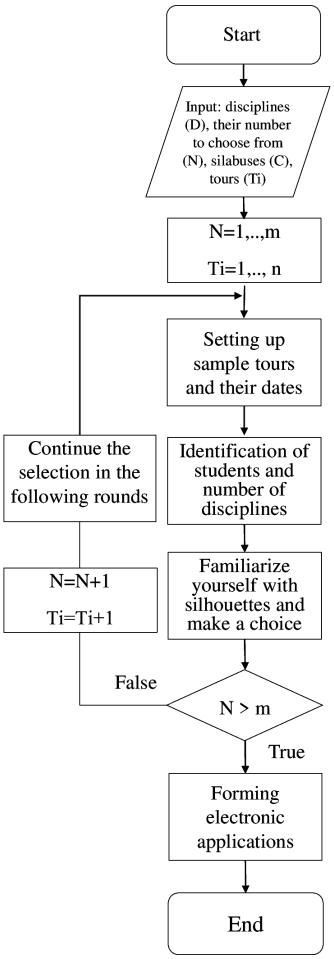

Fig. 1. Flowchart of the procedure for selecting elective subjects

1. Database servers that process and store data and execute the main application logic.

2. Client devices that provide access to the automated system functionality for end users.

3. Network devices that provide communication between different components of the system via the network.

4. Data management systems designed to store and manage large amounts of information. These can include cloud storage, file servers and databases.

A formalised diagram of the system containing the components for selecting elective subjects by higher education students is shown in Fig. 2.

According to the scheme, the process of building an individual educational trajectory requires authorisation in a personal e-cabinet containing a personal data module (authorisation, personal information, digital footprints, etc.); an individual plan module (list of compulsory and elective subjects, the amount of credits, assessment results of the subjects studied, etc.); a learning progress module (current and final grades in the subjects studied). Later, in the process of choosing disciplines, these modules interact with the system of building an individual educational trajectory.

At the beginning of the system, introductory materials are displayed on the screen, which describe in detail how to select the required number of disciplines in accordance with the individual curriculum of the higher education student. The main stages of the selection process are also explained.

It is advisable to select disciplines in several rounds in order to recruit the maximum number of students into groups, using the appropriate module for setting up rounds (Fig. 2). The selection process should begin with the first round.

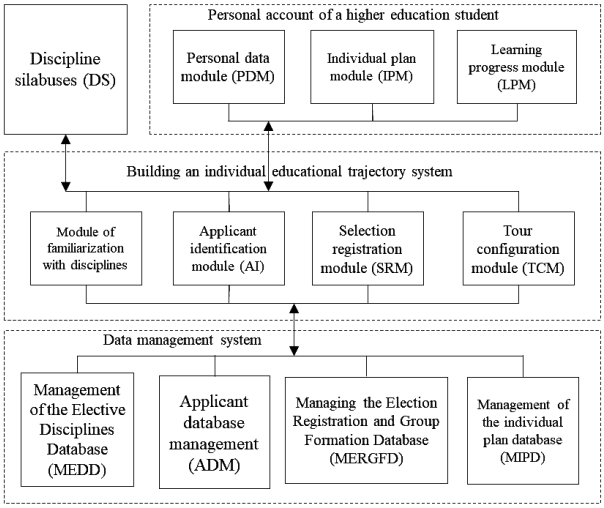

Fig. 2. Scheme of components of elective discipline systems

It is advisable to divide the interface window of the automated system into several parts, in one of which to display, for example, service information on the dates of each round and the time remaining until its completion; the number of elective courses to be selected by semester in accordance with the module of the individual plan; the number of already selected courses and formed groups, etc. In another part of the system interface, you can place a general list of elective courses; syllabi to get acquainted with their content using the appropriate module; information on the current number of students who have chosen a given elective course, etc.

For better visualisation of the status of group formation in selected disciplines by applicants, it is advisable to use colour coding (green – group will be formed (sufficient number of applicants); orange – group may be formed (not yet reached a sufficient level for group formation); red – low probability of group formation, etc.

Before making the choice, the student will have to familiarise themselves with the syllabus by clicking on the appropriate icon next to the name of the course. Once you are familiar with the syllabus, fields will become available next to the courses to select them in the first or second semester. Once you tick the box next to a particular semester, the choice of discipline will be recorded in the window with the service information next to the corresponding semester.

During the first round, it is advisable to allow the student to adjust the choice at his/her request, removing some disciplines and replacing them with others, as well as to change the choice by semester. The completion of the selection of disciplines should be recorded, for example, by pressing the Save Selection button (Fig. 3).

After the end of the first round, if each of the disciplines chosen by the applicant is chosen by a sufficient number of other applicants to form a group, the process of selecting elective disciplines must be completed and recorded in the module

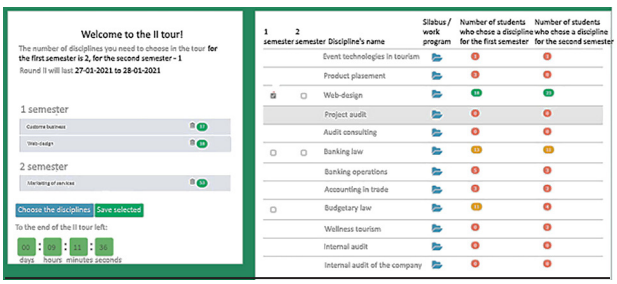

Fig. 3. Interface of the automated system

of registration of the choice and the module of the individual curriculum of the applicant. It will also be possible to create an electronic application for studying elective courses and send it to the relevant department.

Otherwise, you will need to continue choosing disciplines, joining in the next round the groups that have already been formed (green mark) or may be formed (orange mark). Or, in the last round, only to those groups that have already been formed (orange mark). Similarly, after completing and saving the selection of the required number of disciplines, an electronic application will also be generated, which will need to be printed and submitted to the dean's office.

All procedures for identification in the system determining the number of elective courses, familiarisation with their list and content, fixing the choice and transferring it to individual plans of higher education students are carried out by means of a database management system, which in combination allows recording, processing, and transmitting information on the choice of courses by higher education students.

Thus, based on the above structural diagram and the oriented interface of the automated system for building a student's individual educational trajectory, it is possible to identify a number of its advantages over the traditional paper procedure for selecting elective courses, namely:

- the possibility of automated selection of elective subjects in full-time and distance learning;
- individualisation and improvement of the quality of education, as students can choose the disciplines they want to study;
- equal accessibility through the use of an electronic student account;
- no operational and time costs for dean's office staff to conduct the election procedure.

At the next stage of developing the working documentation, instructional materials are created for its further use.

Staff from various structural units are also trained to ensure correct operation and administration of the system.

The final stage of the automated system development is its implementation and support by trained personnel, which involves preliminary testing of the system on control groups of higher education students; checking the relevance of the test results; adjusting and adapting to the wishes of all stakeholders, etc.

Support involves monitoring the correctness of the system; assistance in case of failures and errors when students choose their disciplines; checking the relevance of information on updating the data on the selected disciplines registered in the system, etc.

It is also important to be able to generate a variety of reports on the results of the choice of disciplines, which reflect information on the number of groups formed in different disciplines; the composition of group members; statistics on the choice of disciplines in different departments, faculties, etc. An example of a report on the composition of a group in a chosen discipline is shown in Fig. 4.

After the full implementation of the automated system and staff training, it will be possible for higher education students to use it to build their individual educational trajectories.

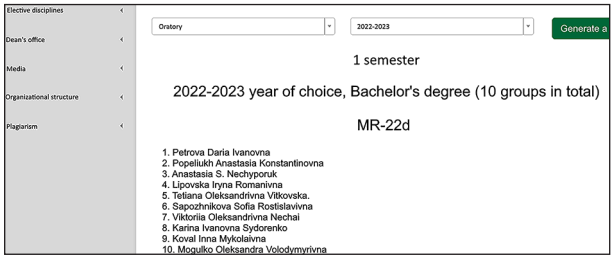

Fig. 4. Report on the composition of the formed groups in the selected discipline

Conclusions and recommendations for further research in this area. Thus, based on the requirements and description of the main stages of development, an automated system for selecting elective disciplines was designed, which is an effective means of building individual educational trajectories for higher education students and an effective tool for improving the transparency and quality of training.

At the same time, all the processes of registering, processing, and analysing data on the choice of disciplines are performed by an automated system, and administrators only configure its operation correctly.

In general, the development and implementation of a system for building an individual educational trajectory will help to achieve better motivation to study disciplines due to the personal interest of higher education students. Also, the use of modern information and communication technologies for the procedure of selecting elective courses will contribute to improving the quality of education.

In addition, automation makes it possible to reduce the time and labour costs of the dean's office and academic department staff for conducting and processing documents on the procedure for selecting elective courses for students of higher education institutions.

In general, the conducted research on the development and implementation of automated systems for selecting elective subjects in the educational environment allows us to formulate the following recommendations for the development of such systems in the future:

- automated systems for building an individual educational trajectory should be user-friendly and have the ability to adapt and integrate with other systems and platforms used in the educational process;
- automated selection systems should have tools for direct participation of students in the process of forming groups in elective disciplines and have the ability to dynamically change the selection parameters, adjusting to student preferences, which opens up prospects for the intellectualisation of automated systems in the educational sector.

References.

1. Korostiianets, T. (2019). To the problem of individual educational trajectories of students in higher school. *Innovatsiina pedahohika, 19*(2), 9-12. https://doi.org/10.32843/2663-6085-2019-19-2-1.

2. Kankovskyi, I. Ie. (2013). Individual educational trajectories as a necessity of the modern process of professional training of specialists. *Professional education: problems and prospects, 4*, 62-65. Retrieved from http://surl.li/oxysy.

3. *On core competencies for lifelong learning* (2016). Retrieved from http://education-ua.org/ua/analytics/670-pro-osnovni-kompetentsiji-dlya-navchannya-protyagom-usogo-zhittya4.

4. Horbatiuk, R., Kabak, V., & Volkova, N. (2023). Formation of the Ability For Personal Self-Development in Future Education Learners. *Osvitolohichnyi dyskurs, 3*(42), 39-53. https://doi.org/10.28925/2312-5829.2023.33.

5. Strilets, S. I. (2014). Individualization of the content of education and intensification of the learning process based on modern educational technologies. *Visnyk Chernihivskoho Natsionalnoho Pedahohichnoho Universytetu. ser.: Pedahohichni nauky. Fizychne vykhovannia ta sport, 118*(2), 217-221.

6. Pinchuk, O. P., & Sokoliuk, O. M. (2013). Individualization of the student's educational environment using the Internet. *Zbirnyk naukovykh prats Kamianets-Podilskoho natsionalnoho universytetu im. Ivana Ohiienka. Seriia: Pedahohichna, 19*, 35-37.

7. Alieksieieva, S. (2021). Indyvidualizatsiia navchannia u zakladakh zahalnoi osvity yak pedahohichna problema. *Scientific Collection "InterConf", (42): with the Proceedings of the 1st International Scientific and Practical Conference "Theory and Practice of Science: Key Aspects"*, (February 19–20, 2021), (pp. 290-296). Rome, Italy: Dana. https://doi.org/10.51582/interconf.19-20.02.2021.026.

8. Baranovska, O.V. (2021). Individualization of education: achievements, challenges, prospects. *IX-Conference "INNOVATIVE TECHNOLOGIES IN SCIENCE AND EDUCATION"*, (March 04–06, 2021), (pp. 160-164). Retrieved from https://lib.iitta.gov.ua/724265/1/IX-Con-

ferenceMarch-04-062021-book-%D1%81%D1%82%D1%80%D0%B0%D0%BD%D 0%B8%D1%86%D1%8B-160-164%20(3).pdf.
9. Hodovaniuk, T. L. (2010). *Individual education in higher education: monograph*. NPU imeni Drahomanova, 160. Retrieved from https://dspace.udpu.edu.ua/bitstream/6789/6908/1/Hodovaniuk_5.pdf.
10. Krasnoshchok, I. (2018). Individual educational trajectory of the student: theoretical aspects of the organization. *Pedahohika formuvannia tvorchoi osobystosti u vyshchii i zahalnoosvitnii shkolakh, 60*(1), 101-107. Retrieved from http://www.pedagogy-journal.kpu.zp.ua/archive/2018/60/part_1/21.pdf.
11. Sharov, S., & Sharova, T. (2017). Formuvannia indyvidualnoi osvitnoi traiektorii studenta zasobamy informatsiinoi systemy. *Naukovyi Visnyk Melitopolskoho Derzhavnoho Pedahohichnoho Universytetu, 2*(19), 149-154.
12. Shevchuk, H. I. (2021). Individual educational trajectory of the student: the essence and key aspects of the organization. *Pedahohichni nauky, 95*, 56-61. https://doi.org/10.32999/ksu2413-1865/2021-95-8.
13. Mantur-Chubata, O. S., Dubilei, Yu. A., & Mikhalets, A. V. (2018). Peculiarities of scientific research in the modern world. *Naukovyi Visnyk Uzhhorodskoho Natsionalnoho Universytetu, 21*(2), 9-11.
14. *HOST 34.601-90 Information technology. Complex of standards for automated systems. Automated systems. Stages of creation* (2024). Retrieved from https://online.budstandart.com/ua/catalog/doc-page.html?id_doc=53626.
15. Lytvyn, V. (2021). Individual educational trajectory of students of higher education: content analysis of the concept, principles of construction, forms, and methods of implementation. *Molod i rynok, 9*(195), 93-100. https://doi.org/10.24919/2308-4634.2021.243899.
16. Yaremko, S., Kuzmina, E., Savina, N., Yaremko, D., Kuzmin, V., & Adler, O. (2022). Development of a Smart Education System for Analysis and Prediction of Students Academic Performance. *Lecture Notes on Data Engineering and Communications Technologies: materials of the conference*, *77*, 762-775. Switzerland: Springer. https://doi.org/10.1007/978-3-030-82014-5_52.
17. Bilous, M. Yu. (2020). Analysis of modern software development environments. *Automation and development of electronic devices. ADED-2020, 2*, 13-16. Retrieved from https://openarchive.nure.ua/server/api/core/bitstreams/553b4358-4ce0-4cf6-908d-bf85e9460095/content.
18. Kucherov, D. P., & Zbrozhek, L. V. (2015). Modern imaging software. *Upravlinnia rozvytkom skladnykh system, 24*, 90-96.
19. Pohromska, H., & Pietukhova, N. (2017). Current trends in the development of technologies in the field of web programming: an analytical review. *Heometrychne modeliuvannia ta informatsiini tekhnolohii, 1*(3), 114-119.
20. Shynkaruk, O. M., Yashyna, O. M., & Onyshko, O. H. (2020). Managing the quality of software web systems by means of development. *Visnyk Khmelnytskoho Natsionalnoho Universytetu, 6*(291), 39-44.
21. Andreiev, A. S. (2022). Analysis of peculiarities of web application development. *Automation and development of electronic devices, 2*, 45-49.
22. DSTU ISO 5807:2016 (2016). *Information processing. Documentation Symbols and Conventions for Data, Program and System Block Diagrams, Network Application Diagrams, and System Resource Diagrams*. Retrieved from https://budstandart.ua/normativ-ocument.html?id_doc=67202.
23. DSTU ISO/IEC 2382:2017 (2017). *Information Technology. Dictionary of terms* (ISO/IEC 2382:2015, IDT). Retrieved from https://online.budstandart.com/ua/catalog/doc-page?id_doc=75076.
24. Ostapets, Y. D., & Dzuba, V. V. (2022). Construction features of hardware and software for the protection of the physical perimeter of the room. *Modern engineering and innovative technologies, 24*(1), 81-86.

Автоматизація побудови індивідуальної освітньої траєкторії здобувача вищої освіти

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Мета. Висвітлення аспектів проєктування та впровадження автоматизованої системи для побудови індивідуальної освітньої траєкторії здобувачів вищої освіти.

Методика. Для розробки автоматизованої системи побудови індивідуальної освітньої траєкторії здобувача вищої освіти використовувались такі загальні методи досліджень, як: аналіз і порівняння для обґрунтування вимог до системи; синтез для формування компонентів системи й розробки структурної схеми комплексу апаратно-програмних засобів відповідно до державного стандарту на проєктування автоматизованих систем; метод узагальнення при формуванні рекомендацій щодо впровадження розробленої системи.

Результати. Сформульована концепція автоматизованої системи для обрання вибіркових дисциплін здобувачами вищої освіти; обґрунтовані основні етапи проєктування автоматизованої системи з використанням засобів сучасних інформаційних технологій. Визначені вимоги до апаратного та програмного забезпечення, розроблена структурна схема базових апаратно-програмного комплексу для реалізації основних функцій автоматизованої системи. Визначені соціальний та економічний ефект від упровадження автоматизованої системи для побудови індивідуальної освітньої траєкторії та окреслені подальші перспективи й напрями розвитку.

Наукова новизна. Полягає в розвитку методології побудови індивідуальної освітньої траєкторії на основі сучасних інформаційних технологій і систем, що сприяє активізації пізнавальної діяльності здобувачів вищої освіти й забезпечує прозорість і швидкість проведення процедури обрання вибіркових дисциплін.

Практична значимість. Розроблена система дозволяє в автоматизованому режимі здійснити обрання вибіркових дисциплін здобувачами вищої освіти. Також у системі є можливість фіксування обраних дисциплін студентами на основі електронних заяв, що сприятиме зниженню трудомісткості вибору й навантаження на фахівців деканату та інших структурних підрозділів закладів вищої освіти.

Ключові слова: *вища освіта, індивідуальна освітня траєкторія, проєктування, концепція системи, процедура вибору*

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