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TECHNOLOGICAL CHARACTERISTICS
OF THE E-LEARNING SYSTEMS DEVELOPMENT

Abstract. Modern information technology can significantly increase the personalization of learning activities and provide continuous feedback between a teacher and a student, through the widespread implementation of distance learning. At the same time, in order to provide the required level of distance learning process, an important task is to design new information systems that will allow teachers to use various forms of communication with students in learning activities.E-learning resources are investigated. The article describes and analyses the most popular web platforms for electronic education and determines Moodle system as the most functional one, but difficult for users who are unfamiliar with web technologies. Features of e-learning resources and the main requirements to their design and functionality are studied. The relevance and expediency of the use of information technologies in education are described in the paper and self-engineered information system of e-learning is suggested, its main functions and scenarios are determined and system on an abstract level is described. The main user characteristics are given and their connections with system usage cases are determined.

Keywords: informatization, educational Internet resources, e-learning, user interface, information systems, computerizing, digitalization.

Introduction

Lately, all spheres of human life are becoming more digitalized, and therefore it can be stated that modern society is an information society. The education sphere is not an exception. In order to have the necessary computer skills in further life, people need to be taught this from childhood. Therefore, educational information technology today is a necessary condition for the full informatization of society.

Articulation of issue. One of the trends of improvement of education quality is learning transition to electronic mode at different levels of the educational process. This allows students to pay more attention to important topics individually and to study interesting material more fundamentally, which is not physically possible to provide in the classroom for a limited amount of time.

The topic of e-learning is very relevant in today's reality and although more and more attention is paid to it, it still needs more detailed research.

Analysis of research and publications. An analysis of recent research and publications has shown that most of them are aimed at studying an impact of online environments on the educational process, rather than directly studying the interface and functionality of online resources.

Formation of the purpose of the article. The main purpose of the article is to analyse existing e-learning systems, identify their advantages and disadvantages and provide recommendations on the necessary functionality and more appropriate design of educational resources.

Relevance of e-learning. The rapid development of the Internet and the growth of its information and communication abilities contribute to the rapid development of e-learning. That is why one of the priorities of the modernization program of educational activities in Ukraine is distance learning [1, 2].

Distance learning is widely spread in many countries around the world. The United Kingdom was the first to apply this kind of education, where the first university of distance education was opened in 1969. Today, the United Kingdom is the first among European countries in terms of providing teachers with access to modern IT technologies.

The design of electronic resource.

While designing the electronic resource it is accepted to use motivation management approach, which means that each element of resource design was involved in energization of need in cognition and learning, this learning strategy also includes the selection and presentation of educational materials, as well as the selection and planning of educational activities [3-7].

Educational websites should not distract students from learning, their interface should be simple and concise, and what is most important user-friendly. Children should be able to choose their own schedule and get access to any learning materials at any time.

One of the main qualities of software is convenience and simplicity of use, it means the information system must be adaptable to different screen formats, so that each user, regardless of their hardware, can access it [8]. Also, students and teachers do not have to get used to and learn the rules of using the resource for a long time. It means, the developer in his pursuit of rich resource functionality cannot neglect or forget such an important indicator as the clearness of information systems for the user [9].

Functionality of the electronic resource

The main task of e-learning resources is to provide students and teachers with the most convenient functionality for better communication. It means that the learning resource should be rich in functionality, so that the teacher could give extra explanation of difficult material to students, test them, and review the test results, draw conclusions about success and determine which material was mastered worse, for further revision.

Teachers need to receive completed student's homework. Checking homework before the lesson starts

can significantly increase the lessons' productivity, because when teacher can understand in advance if students have mastered only part of previous material, the next lesson he can focus on revision of previous topic, but not moving on to the next one, which can cause problems with undigested material among students [10, 11].

Students, in their turn, should be able to contact the teacher and ask questions on difficult parts of the topic. Constant access to all learning materials is also important.

The learning resource should be flexible enough to provide the teacher with the necessary functionality to create tests and add materials.

Comparative analysis of existing information e-learning systems

There are lots of e-learning resources. The analysis of existing e-learning systems allowed identifying the most popular, among them there are:

Moodle [12],

Ilias [13],

ATutor [14].

Moodle is free open Australian platform for distance learning that allows you to use a wide range of tools for teacher-student interaction. For instance, this platform provides an opportunity to present material in various forms, to test students using a wide range of open and closed questions, and students have an opportunity to send the teacher completed task by attaching an appropriate file to the resource. Today, Moodle is the most common distance educational system.

The system provides a wide range of tools for monitoring the students' learning activities: the teacher or the administration of the educational institution can review the total time of the student's work on a particular subject, topic or e-learning material, the overall performance of each student or the whole class.

The main advantages of this resource are:

– an availability of its full code in open access, which allows you to fully customize the functionality and design of the site for specific needs and desires;

– a large number of ready-made plug-ins that allows significantly expand the standard functionality of the platform;

– a developed community that is constantly updating the system and adding new plug-ins;

– a wide choice of ways to add a new user: it is possible to add a user manually, import from a file or invite him by e-mail, and if it is necessary, users can register in the system [14].

The main disadvantage of Moodle is its complexity for the average user, it means that to administer the resource and quickly install and run the platform, the educational institution will need a special employee with IT experience. The system is quite overloaded with functionality that can slow down the work.

Among the features of this platform its easy integration with other services, which is very convenient should also be highlighted.

Moodle easily combines with other platforms, such as WordPress or Zoom.

Ilias is a German web platform, its main feature is a simple and user-friendly interface, it is similar to a social network, so it will be easy for students and teachers to learn and get used to the resource.

The platform has quite wide range of functionality and a powerful test editor with the function to create 17 types of questions.

Compared to Moodle, Ilias is very easy to use and configure, but it requires a person with special knowledge to install it and start work.

The interface and functionality of the platform can also be changed, but as the resource does not have an open source, this can only be done with plugins. The platform has tools for notification and communication between users, as well as forums, discussions and newsletters.

Ilias has a built-in content constructor that allows teachers to create surveys, exercises and tests for students. The platform allows creating and assigning learning materials.

As well as Moodle this platform has a wide range of ways to add to users to the website.

ATutor is a Canadian web-based learning management system with easy-to-use tools for teachers, which makes it easy to create and transfer educational materials, as well as create your own online courses.

The system defines three types of users: teachers, students and administrators, each type of user has its own abilities. One of the features of this system is that students can edit personal information, as well as use a convenient search system on the website.

ATutor has a built-in course editor that provides quite flexible settings and helps teachers personalize their courses and create the course page that will focus on more effective education for certain age and study groups. The system also has an interface with a high level of adaptability due to the modules.

Although interface is easy and user-friendly, system installation and administering requires special skills and a plenty of time. The functionality of the platform depends on the installed modules, which is one of the problems of the resource, as the old modules may not be supported by new versions of ATutor, and there are not many supported modules. The main functionality of the system is conducting courses and testing, collecting statistics.

Self-engineered information system

Having analysed the existing information systems, self-engineered version of web resource for e-learning was suggested.

The work of e-learning system is defined and described with the help of adequate to subject area model, for this purpose the context diagram in notation IDEF0 was constructed. (Fig. 1).

The system has three inputs (homework, students and education material), which are processed using three control streams (curriculum, the regulation of the general educational institutions and the Ukrainian laws on education) and the mechanism (teacher) and goes to the outputs of the system – student performance in subjects and the students' rating in the class.

After the general description, a functional decomposition of the system was made and a decomposition diagram was constructed (Fig. 2).

The main functions, which it will provide, were defined, namely:

– adding, editing and reviewing schedules;

– adding, editing and reviewing the educational materials;

– adding tests and display of an assessment after their passing;

– user's ability to review their mistakes after testing all students;

– adding, editing and list of homework tasks on the site;

– teacher's ability to assess the homework;

– signing on new students in the system;

– a personal account for each user with information about their grades, if it is a student, or, if it is a teacher, about completing homework sent him by students.
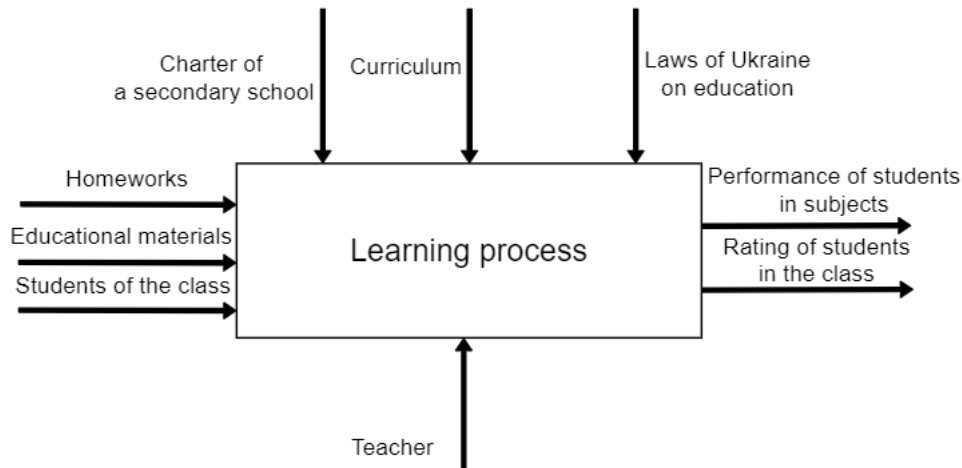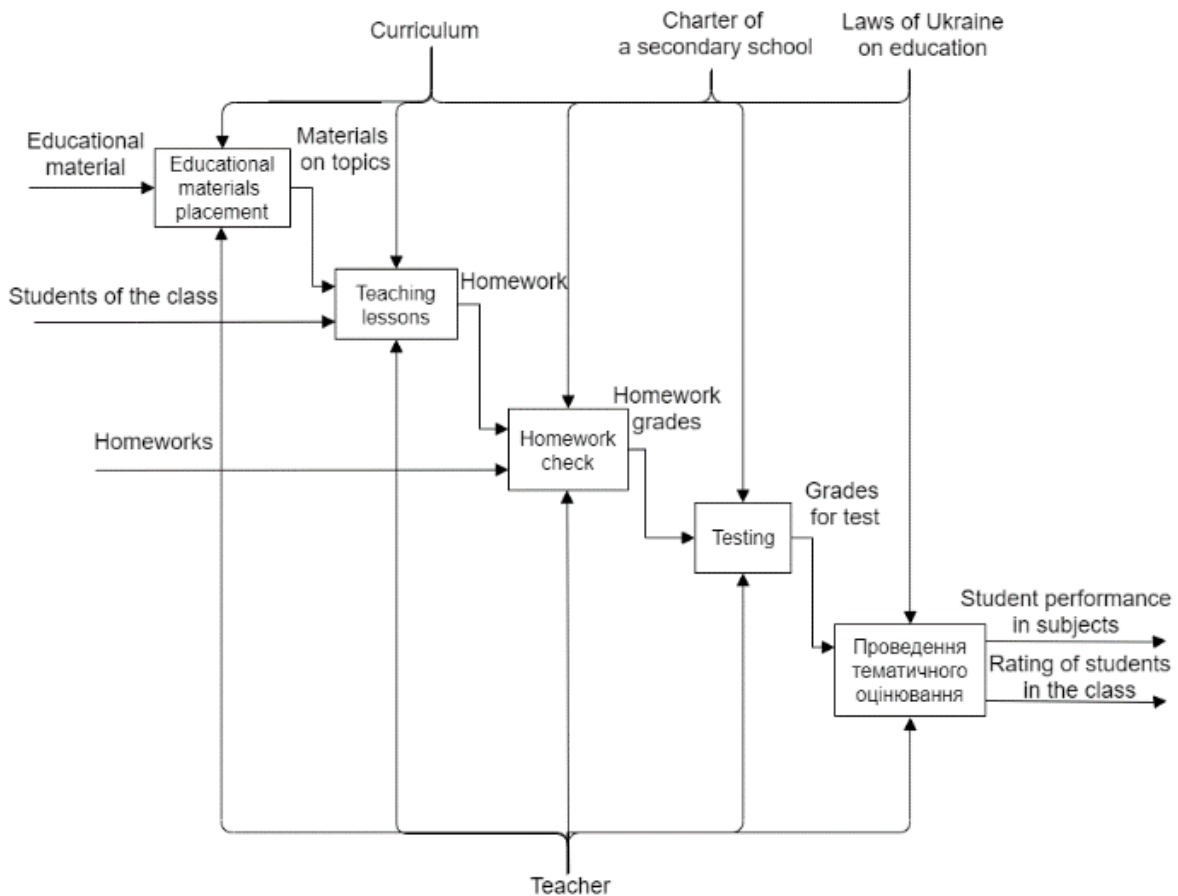

Fig. 1. Context diagram

Fig. 2. Decomposition diagram

Then, five main operating scenarios of the information system were defined:

1. Educational material assignment – teacher logs into his account in the system, chooses the subject, then

chooses or if it is necessary creates a new topic and clicks the add material button, then uploads the desired file to the website from his computer. If a user is logged into a "Student" account, he cannot add learning material to the system.

2. Adding homework – the student logs into his account, chooses the subject he needs and adds work, after that the system automatically sends a message about the added homework to the personal account of the teacher of the selected subject. If a user is logged in to a "Teacher" account, he cannot add homework to the system.

3. Adding tests – the teacher logs into his account, selects the necessary subject and topic, then the user adds each question, answer options and indicates the correct one, then saves the test and determines the time for its completion, when it is available for students and which groups of students should do it (because several groups, for example 10-A and 10-B, can learn this discipline and the schedule of their classes is different), after that each student, who learns this course will automatically get information about the necessity of completing the test and time given for this.

4. Completion of tests – a student logs into his account, sees a system message about the available test, goes to the necessary discipline and clicks on the test, then after selecting all the correct answers the user clicks "Finish test", after that the system displays the score for the test, however mistake viewing has not been yet available. After the test is closed for completion, a student can see how many correct answers he gave, and which questions he answered wrong. The teacher who uploaded the test to the website will receive a massage about completing the test by the students in the personal account, after that he can review students' grades and mistakes.

5. Viewing grades – a student logs into his account and goes to the section "Grades", which displays all the subjects the student is enrolled for and grades from homework and tests, also in the section "Final evaluation" the final grade for each subject is displayed .

Three main types of users of information electronic system are defined:

1**. Administrator** supports the system operation and helps users in case they have some problems with the system.

2. **Teacher** is a user who provides students with learning materials, conducts testing, checks homework and evaluates students' education.

3. **Student** is a user who uses learning materials, does homework and completes tests.

The diagram of usage options (Fig. 3) shows all the scenarios of working with the system and their connection with users.
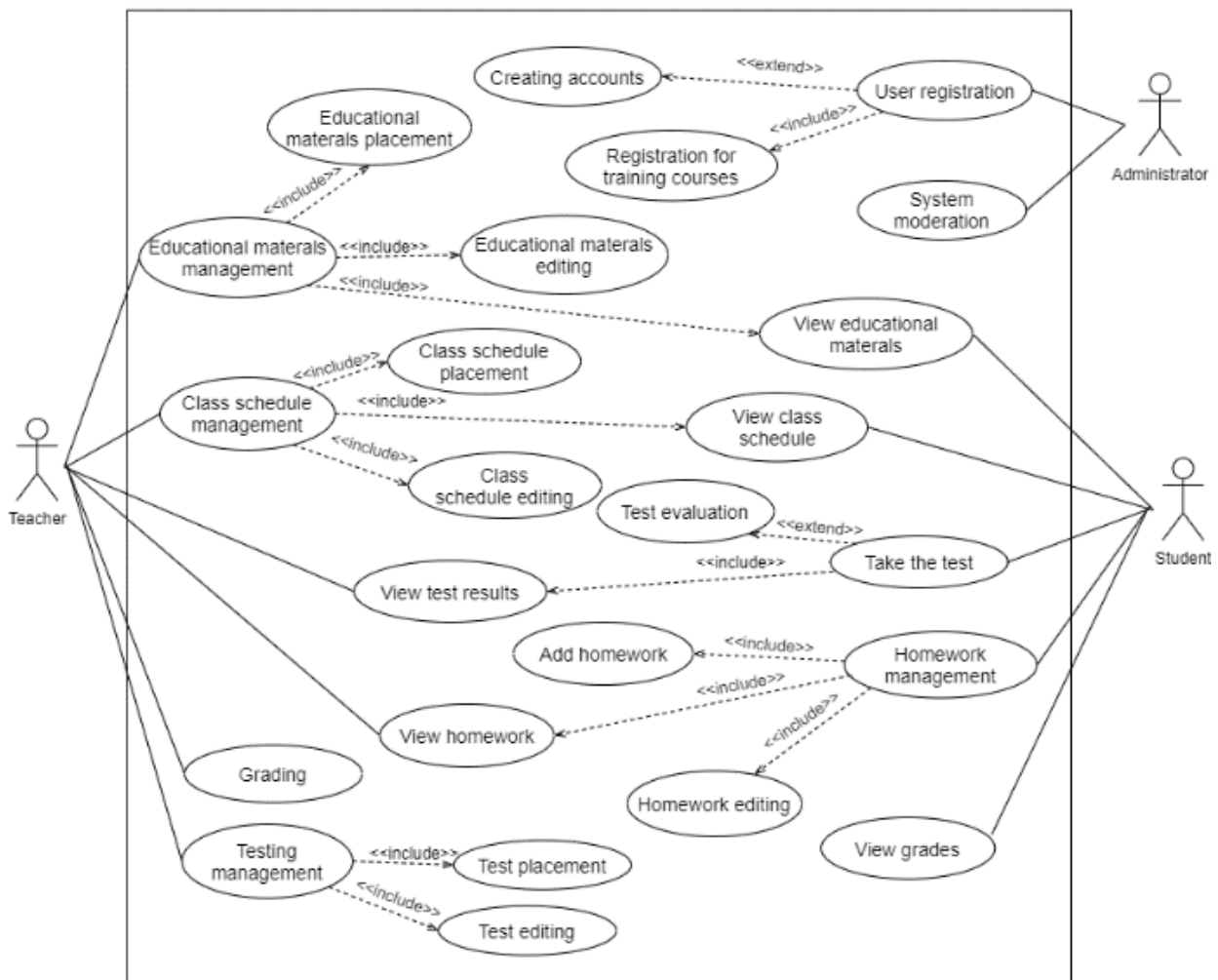

Fig. 3. The diagram of usage options

The use case diagram shows that each type of users should have access only to limited functionality; it means that a student cannot have rights for editing the learning material on the website to avoid unwanted or accidental changes in the course of the discipline.

Also, students should not see progress reports of the whole group, as information about grades is confidential, only the teacher and the administration of educational institution have the right to view it, and students in turn can only see their own grades.

From the point of view of information security, e-learning is undoubtedly the best alternative to the classical one, as the storage of grades in paper journals has a very low level of privacy.

Conclusions

Modern information technology can significantly increase the personalization of learning activities and provide continuous feedback between a teacher and a student, through the widespread implementation of distance learning.

At the same time, in order to provide the required level of distance learning process, an important task is to design new information systems that will allow teachers to use various forms of communication with students in learning activities. Among existing e-learning systems, Moodle is the most functional, but difficult to use for users who are unfamiliar with web technologies.

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Технологічні особливості розробки систем електронного навчання

А. С. Ломанченко, О. С. Хлопонін, Т. М. Деркач, Т. А. Дмитренко

Анотація. Сучасні інформаційні технології можуть значно збільшити персоналізацію навчальної діяльності та забезпечити постійний зворотний зв'язок між викладачем та студентом завдяки широкому впровадженню дистанційного навчання. У той же час, для забезпечення необхідного рівня процесу дистанційного навчання важливим завданням є розробка нових інформаційних систем, які дозволять вчителям використовувати різні форми спілкування зі студентами в навчальній діяльності. Досліджено електронні освітні ресурси. У статті описано та проаналізовано найпопулярніші веб-платформи для електронної освіти та визначено, що система Moodle є найбільш функціональною, проте складною у використанні для користувачів, які не знайомі з веб-технологіями. Розглянуто особливості електронних освітніх ресурсів та головні вимоги до їх дизайну та функціоналу. У роботі описано актуальність та доцільність використання інформаційних технологій у освіті та запропоновано інформаційну систему електронної освіти власної розробки, визначено її основні функції, сценарії роботи та описано систему на абстрактному рівні. Надана характеристика основних користувачів та визначено їх зв'язки із варіантами використання системи.

Ключові слова: інформатизація, освітні інтернет ресурси, електронне навчання, інтерфейс користувача, інформаційні системи, комп'ютеризація, диджиталізація.