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Research paper

The «Wooden Structures» Discipline Educational and Methodological Complex Development on the Basis Of Informational Intelligent System

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Abstract

This article is devoted to the problem of implementation of computer systems into the educational system, which will help higher educational institutions to increase the level of training professionals.
The work analyzes the modern educational informational intelligent systems. It was figured out that they do not completely satisfy the educational process of students of construction specialties. It is proposed to develop a technical task to create an informational intelligent system which could provide teachers and students with effective provision and usage of educational material in the discipline "Wooden Structures".
The main tasks of the discipline, methods and methodologies of teaching this discipline are analyzed. On the basis of analysis the outline of the educational and methodical complex "Wooden Structures" was created.
The system offers the possibility of self-testing and self-assessment of knowledge by the student, also the ability to control the process of revising course material.
Informational intelligent system of the discipline, which is described in this work, has the principles of training openness and flexibility, individualization and interactivity. The system is implemented on the basis of SCORM standards and the concept of SMART-education.
The principles of designing GUI interfaces were used for user interface designing and the most common model for creating the interface for the teacher (editor) and teacher with extended rights (administrator) was chosen.
UML-models were used, charts of precedents were created, a database was developed during the system's designing.
Informational intelligent system of the educational and methodological complex of the discipline "Wooden structures" is based on the language of PHP-7, DBMS, Open Server, CMS Wordpress.

Keywords: *wooden structures, informational system, educational and methodological complex, intelligent system.*

1. Introduction

Nowadays, the current problem of our society is the preparation of seasoned professionals, who can achieve professional and career growth, who can think creatively, use the gained knowledge in the workplace and constantly improve themselves. One of the ways to solve this problem is the implementing of various informational technologies and systems into the educational process.
The computer informational intelligent system implementation into the education system will allow high professional training of specialists, which they will receive through the intellectualization of the interaction between the teacher and students.
While training students of bachelor's and master's degrees, there is a problem that is concerned a decrease of teaching load, and this in its turn leads to an increase of the amount of information in the lecture materials.
That is why, students are offered to increase hours for self-studying. As a result of this teachers face the task of expanding methods and information transmission facilities, in order to present material of a good quality. The usage of modern computer technologies in the educational process can solve the problem of teaching engineering discipline such as «Wooden structures».

2 Main body

2.1. The Analysis of Recent Research Sources and Publications.

Modern informational intelligent training systems were analyzed in the work [12][12-15]. Such as ATutor, which is spread on GNU GeneralPublicLicense, Dokeos – a framework based on the path Claroline, Moodle – the software module, GoogleClassroom, LAMS, Sakai, ILIAS and other [6, 8, 9, 10, 11]. The software solutions of eLearningSoft, which provides the educational sphere with finished solutions, are investigated. You do not need to have special software development skills and this is the main advantage of their development. These programs are QuizForce, WordForce and PowerPointForce [5], where material is created with the help of PowerPoint presentation and then is converted into SCORM format [3].
For effective learning by the students of engineering specialties disciplines with using of computer technologies, the newest tech-

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niques that are used in modern e-learning were considered [16 – 20].

2.2. The Selection of Previously Unsolved Parts of the General Problem.

On the basis of the latest research analysis there were found some disadvantages in the usage of existing informational intelligent systems, such as difficulties in maintenance and technical assistance, which in some cases are completely absent. The existing platforms are not focused on the specific features of building-engineers training, which involve having practical skills in testing and solving problems using software programs for drafting and structural analysis. Traditional educational patterns do not allow to make student interested in provided knowledge.

2.3. Problem Definition.

It is necessary to develop informational intelligent systems, which will provide both theoretical and practical training for students of engineering specialties. The task of this investigation is to automate the process of training students of engineering and construction specialties in discipline «Wooden structures». To accomplish this task it is necessary to design and develop the informational intelligent system, which will include the theoretical and practical course of the discipline. The target audience is teachers and students.

2.4. Scientific Novelty.

New informational intelligent system for studying the discipline «Wooden structures» for students of building specialties, which includes new approach to teaching engineer discipline is developed in this work. The system allows the student to self-assess the level of knowledge and draws attention to the gaps in the studying.

2.5. The Main Material and Results.

According to the above mentioned we have developed the requirement for development the informational intelligent system, which could offer students and teachers effective support of educational content in the discipline «Wooden structures»

The discipline «Wooden structures» is aimed to familiarize students with wooden structures made with wood and plastic, to learn physical and mechanical properties of wood, to work under loads, to form students' calculation and designing knowledge and skills.

The main task of the discipline is to teach students to use standard and reference literature, which will allow to perform calculations and design building structures using wood and plastic. As a result of studying of the discipline, the student should know the main native and foreign tendencies of development and prospects of using wood and plastic in industrial and civil building, the fundamental principles of design calculation, main physical, mechanical and building properties of wood and plastic, methods of wood protection from pests and lightning up and construction rules of load-bearing and enclosing structures using wood and plastic.

During this course students learn to use standard and reference literature, to solve specific problems concerning wood usage and synthetic materials in industrial and civil buildings and structures, to evaluate technical condition of structures which are in use, and decide on their reinforcement or reconstruction.

An effective method of teaching principal subjects of engineering specialties is using informational intelligent systems, which allow student to choose education material individually. The student can use the system whenever and wherever he is and analyse the training process individually [2].

The outline of the educational and methodical complex was created to automate the process of studying the discipline «Wooden structures» (fig. 1).

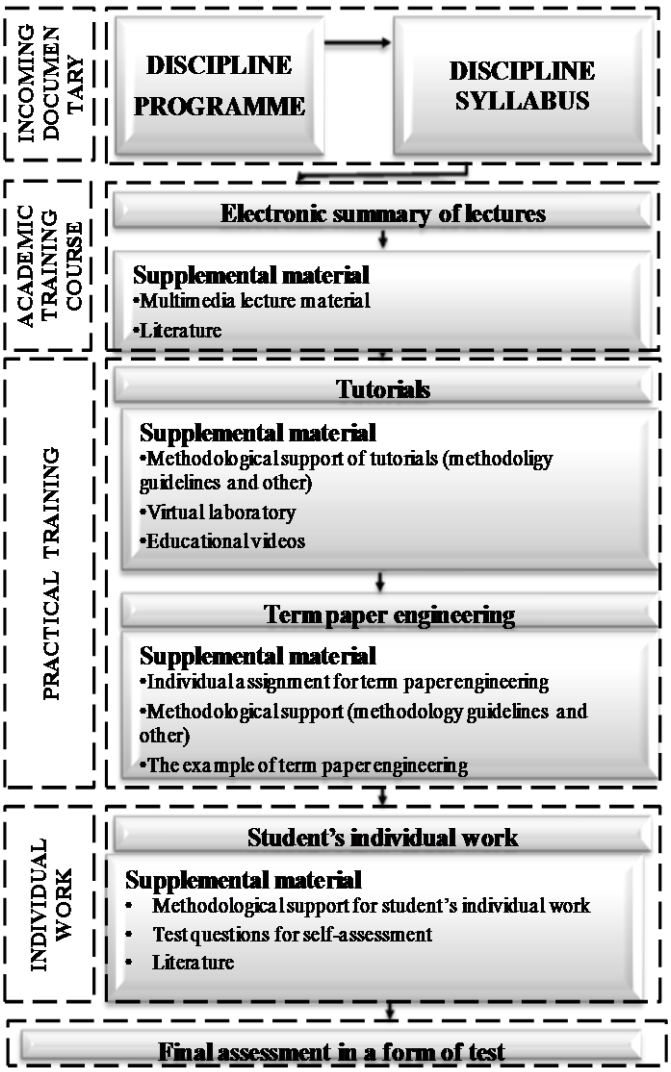


Fig. 1: The outline of educational and methodological complex «Wooden structures»

Standard documentation approved by the university, multimedia materials in the form of video, presentations, electronic books were used to provide comprehensive training for students. The interaction between the student and the teacher is provided through Internet conferences, chartrooms, forums and more.

At the stage of definition the task of development of educational and methodological complex «Wooden structures» using the informational system there were used three types of motivation: social, professional, cognitive [7].

At the stage of the technical task development, the task of integrating educational and methodical foundations into the informational intelligent system was solved.

The implementation of developed informational system is aimed to decrease financial and organization expenses for training students in the discipline «Wooden structures», to use electronic interaction between teachers and students, to increase and process information flow for the theoretical part of the discipline to a good quality, to automate the process of assessing students' knowledge.

The special task of the developed system was to allow the student to find gaps in knowledge gained in this discipline and to indicate which topics should be paid attention to in order to ensure that they receive complete knowledge of the course.

The data exchange is based on the exchange of electronic message in the XML-format while participants of the interaction are both senders and recipients of such messages.

Informational intelligent system of the discipline, which is described in this work has the principles of training openness and flexibility, individualization and interactivity.

The system is implemented on the basis of SCORM standards and the concept of SMART-education [1, 3].

Informational intelligent system of the educational and methodical complex of the discipline «Wooden structures» must comply with the requirements for the content design.
The stylistic design of the system corresponds to the style of the institution and uses its color schemes, graphic elements, fonts, logos.

2.5.1. Graphic Design is Made According to the Following Requirements:

- light blue, blue white and yellow colors are used in the interface design;
- the design is laconic and at the same time it looks stylish and modern;
- small, but stylish animation elements are used in the content of the system.

2.5.2. Requirements to the Format of Used Fonts for System's Design:

- fonts, which are used for designing graphic elements and text materials of the systems, are not contrary the general style of the institution;
- if the user does not have the necessary fonts on his computer, standard browser font group is used (Arial/Helvetica, TimesNewRoman, Courier), so that the replacement of fonts from the corresponding group will not lead to the visual distortion of the text.
- the font size (type size) provides the convenience of text perception with a minimum acceptable screen size of 14 pt.

2.5.3. Requirements to the Content Management System of the Module:

Informational intelligent system of the educational and methodical complex of the discipline "Wooden structures" was implemented as a Web-application.
The content management system allows the administrator of the website to do the following actions:

- to log in new users;
- to add, edit and delete text;
- to add and delete graphic design;
- to edit supplemental materials and appendices;
- to manage the representation of lectures, methodological materials and materials for laboratory and practical classes.

2.5.4. Requirements to the System Page Layout:

- The pages' layout of the module provides automatic page scaling depending on width of the user's browser work field. The minimal size (width) of the browser work field, which provides complete display of the pages (without a horizontal scroll bar), is 320 pixels.
- During the creation of the user's interface, user's features were designed. For prototyping, firstly, paper interface layouts were created, and secondly, screen forms that reflected interaction with users were developed.
- Human abilities are taken as a base of designing principles of GUI interfaces (fig.2).

The main requirement to the interface development is the availability and obviousness for all users. That is why, a popular model of interface design for a teacher (editor) and a teacher with extended rights (administrator), which includes 2 columns (the menu and the main unit with information), was chosen (Fig. 3).

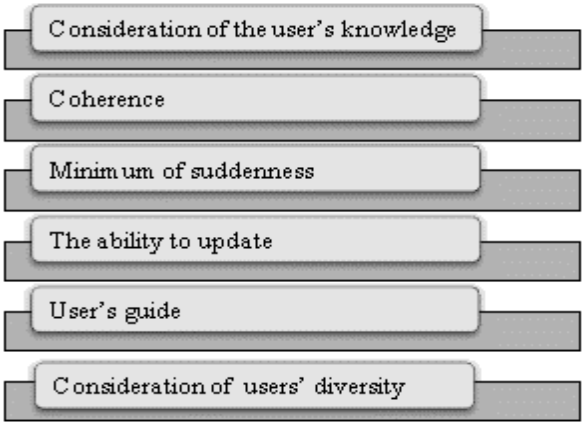


Fig. 2: Designing principles of GUI interfaces

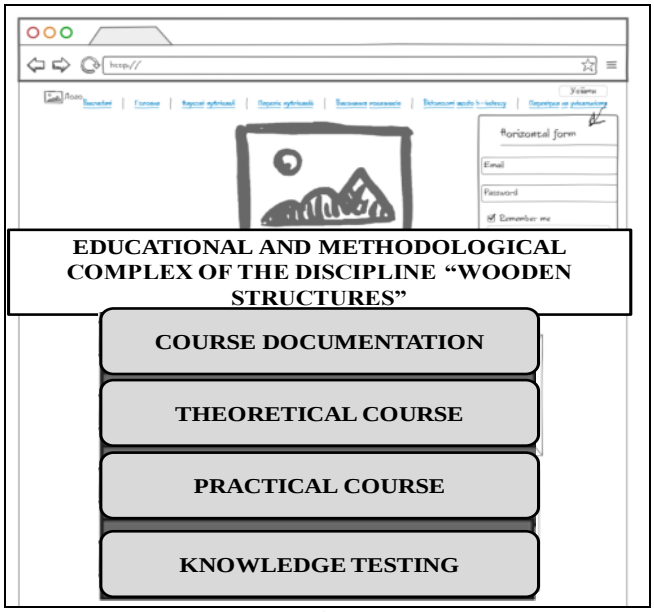


Fig. 3: The interface design model

For the proper use of color-grade the main principle of GUL developers, applied the main principle, which limits the use of colors on the screen and the rules of efficient use of color in GUI (fig.4).

2.5.5. The Developed Informational System Provides Viewing in the Most Common Browsers, Such as:

- Opera;
- Internet Explorer;
- Mozilla Firefox;
- Yandex;
- Google Chrome.

For more detailed system design UML-models were used.
To have the authentic view of the software which is being designed, it is necessary to make a general model of a use case diagram for further extension (UseCasediagram).
The use case diagram displays different interworking scenarios between the actors (users) and precedents (cases of use); it describes functional aspects of the system (business domain).
In the simplest case the use case diagram is defined during discussion with the user functions which he wants to implement. These diagrams are the basis of reaching an understanding between the software programmer, who is developing the project, and project orderer.
The Actor is a role, which the user plays in relation to the system. Actors are roles, but not the specific people or description of the activities.
In this work, there are three types of users (actors):

- Editor (the editor can add / delete / change data);

– Administrator (administrator can add / delete / modify data, and has the rights to add / delete new users and editors);
– Guest (guest, ordinary user, who can view data).

The diagram of the system usage options is shown in Figure 5.

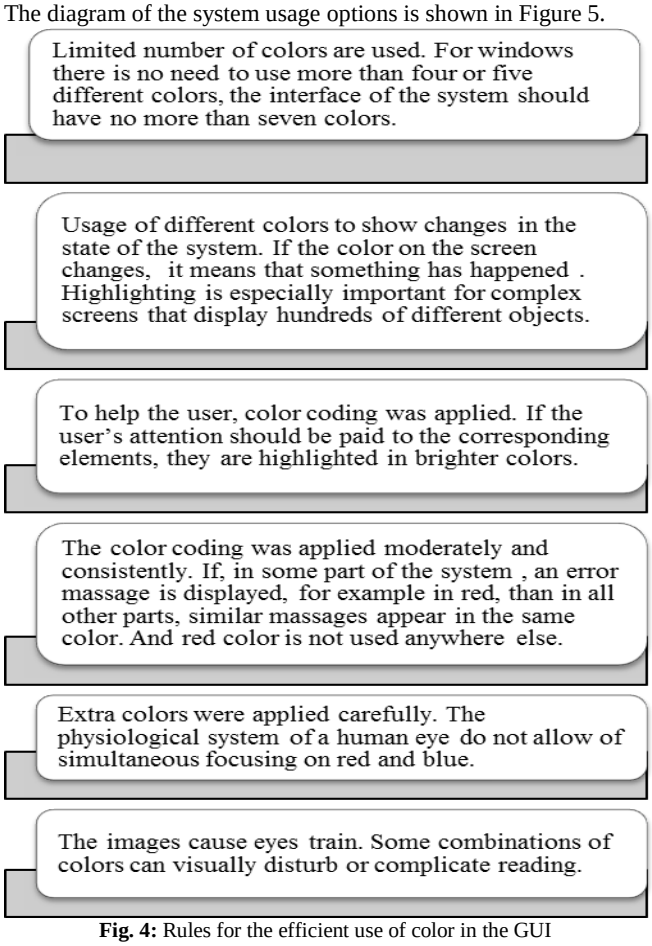


Fig. 4: Rules for the efficient use of color in the GUI

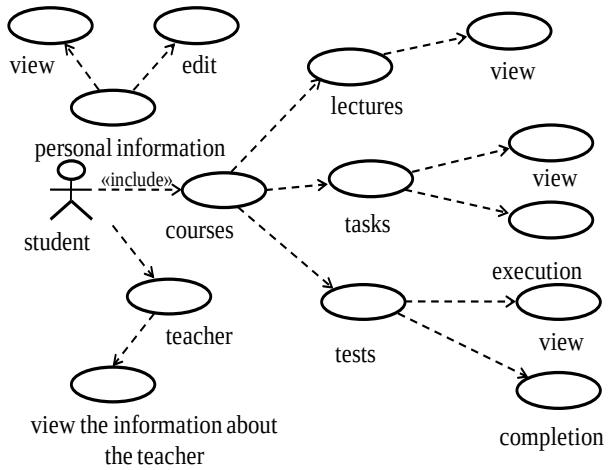


Fig. 5: Diagram of interaction for the student

2.5.6. Database Design

During database designing of the informational system, the ER-model (entity-relationship diagram) was developed, which allows to describe conceptual diagrams with the help of general block designs. Database scheme was made on this basis (fig.6)

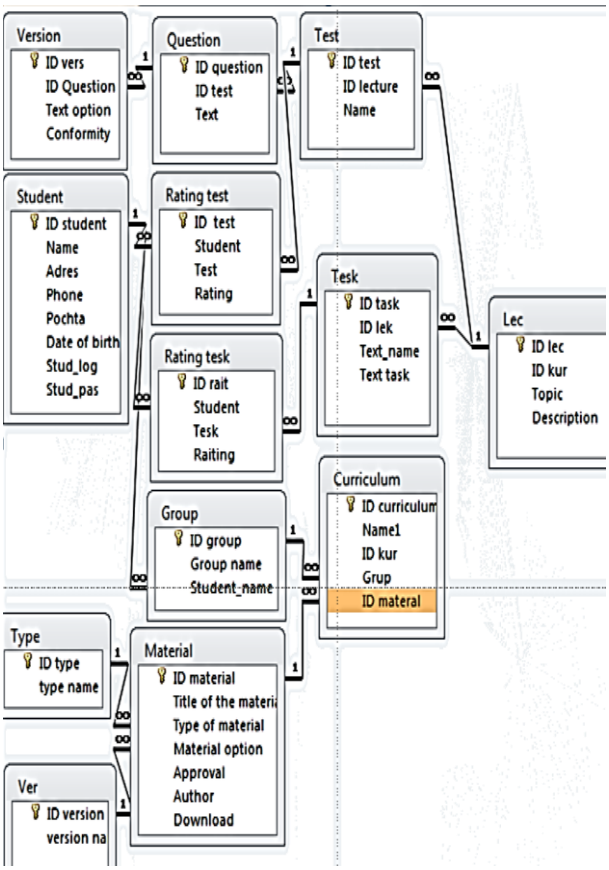


Fig. 6: Database scheme

The informational intelligent system of the educational and methodological complex of the discipline "Wooden structures" was realized on the language PHP-7, database management system, MySQL, Open Server, CMS Wordpress. The amount of users can change from 1 to 100 (it depends on the amount of teachers or research associates, who will be logged in on the website).

As it was planned at the stage of problem definition, the system contains all necessary structural and navigation elements.

You can log in into your account by tapping the button "Log in". When you enter the login and administrator password, an administrator's panel appears to edit the information (Figure 7).



Fig. 7: Log in into the account

Visualization of the testing process of structural elements plays a significant role in learning material of the discipline «Wooden structures». Therefore, a virtual laboratory which consists of six works was developed for the educational course:

– Laboratory work № 1. Testing of connection with a skew notch.
– Laboratory work № 2. Testing of laminated wood beam for bending.
– Laboratory work № 3. Testing of model of the ribbed glued plywood panel for bending.
– Laboratory work № 4. Testing of a T-beam on cross tounges.
– Laboratory work № 5. Testing of nail joining.

– Laboratory work № 6. Testing of a I-beam with a wall made of oriented structural board (OSB) for bending.

All laboratory works were made in a form of video with the help of video editing program Movavi Video Suite [4].

Lecture material was included into educational and methodological complex in a form of presentations and video, which allow student to study material more effectively.

The system provides access to the standard literature in a form of hyperlinks (fig. 8).

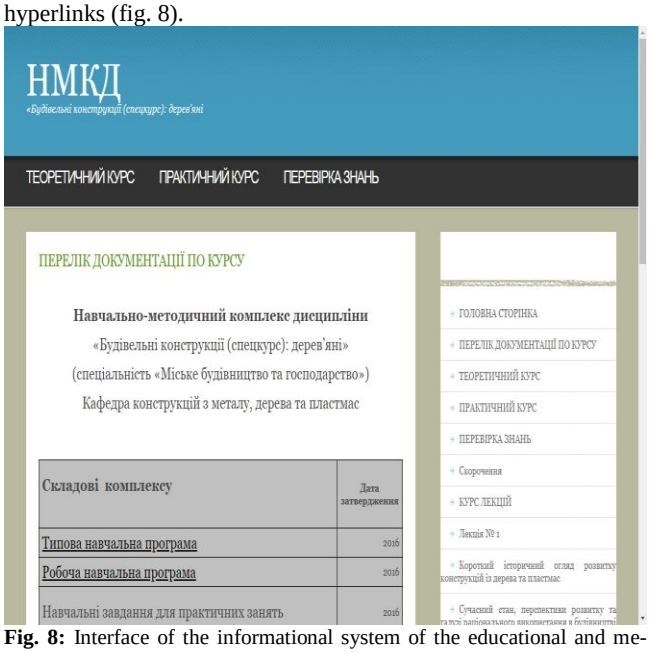


Fig. 8: Interface of the informational system of the educational and methodical complex of the discipline «Wooden structures»

3 Conclusion

The result of this research was the informational intelligent system of the educational and methodological complex of the discipline «Wooden structures» for students of engineering specialties, which is implemented on the basis of SCORM standards and the concept of SMART-education.

Informational intelligent system of the educational and methodological complex of the discipline «Wooden structures» is based on the language of PHP-7, DBMS, Open Server, CMS Wordpress.

The feature of the developed system is the ability to provide interaction between the student and the teacher, the ability to learn theoretical and practical material individually. The system is developed on the basis of the outline of educational and methodical complex, using motivation methods.

The system allows the student to identify the gaps in the knowledge of this discipline and suggests which topics worth special attention, in order to obtain complete knowledge of the course.

The usage of this system will help to reduce the financial costs of carrying out testing using hardware, materials and training staff due to the virtual laboratory.

Informational intelligent system of the educational and methodological complex of the discipline «Wooden structures» meets all requirements of content design.

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