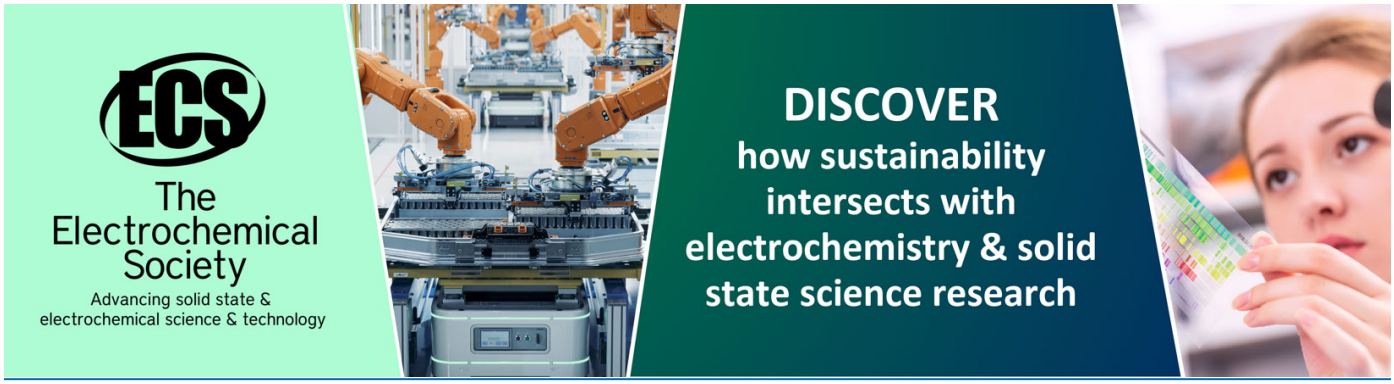
Epistemological projections of knowledge in information modeling training



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Epistemological projections of knowledge in information modeling training

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Abstract. The reforms and modernizations undertaken today in education first of all are aimed at advancing training of professional staff. The demand for experts of construction profile capable to carry out the information modeling is a relevant problem of educational training of specialists of the construction area.
The research degree of a problem demonstrates that modern researchers agree in opinion that transition from "knowledge of experience", to the creative education. This education focused on fixing professional consciousness of installations, on searching and creating innovative models, "live", personally significant knowledge, ideas, images of activity.
In the paper an attempt is made to build epistemological projections of knowledge from the point of view of the maximum accounting of interrelation of thinking processes and information modeling on the example of metal systems design.

1. Introduction

In May 2018 the Russian President Vladimir Putin signed the "May decree" which defining the national purposes of development of Russia until 2024. In this document, among seventeen points being carried out for "breakthrough scientific and technological and social and economic development of the Russian Federation" also appear target indicators relating to ensure global competitiveness of Russian education. It also includes modernization of professional education by introducing the adaptive, practice-focused and flexible educational programs. The reforms undertaken today and modernization of education are connected first of all with the decision and research of more effective ways of improving the existing professional practice [1].

Modern practice of solving design problems in construction is characterized by the high level of application of an information modeling method of the projects designed based on use of modern computer facilities, telecommunication means and digital communication lines in combination with use of high-precision measuring technologies, improvement and specialization of information technologies and methods of their providing [2].

Taking into account complexity and multidimensionality of application in various spheres of activity of a modeling method we will specify what we understand as information modeling within our research.

Information modeling is a research of phenomena, processes or systems, objects, by making and studying their models that is a simplified idea of the real phenomena, process or system of objects [3].

Models are very often used in human activity. The model represents reflection of characteristics of the object (process) studied in various interrelations. On the one hand the model imitates dynamics of possible development and emergence of contradictions in the object (process) studied. On the other hand the model designs in itself ideas of future activities for creation of an artifact and assumes obtaining a certain result planned, submitting the sequence actions conceptual scheme in achievement of the goal [4].

The characteristic feature of information modeling is formation and use of the system-counted information coordinated, internally agreed about the project designed. Skills of information modeling promote the scientific organization of the somebody's work, the development of ability to make an optimal solution in various life situations, development of ability to independently get knowledge, thereby, making a contribution to achieving one of the main goals of education - formation of person's outlook system [7].

2. Materials and methods

Creation of an object prototype in the process of its design means studying an object model. The model of an object allows revealing its properties, considering them during implementation of the design activity. It allows "losing" the various technical solutions chosen purposefully or accidentally, observing and analyzing consequences of these decisions in the situation imitated that allows assuming dynamics of succession of events in future real process [8]. Thus, the procedure of creating an object model represents an important stage of design activity of students of construction specialties. More often the object model is not given to the student in finished form. Moreover, the more original the object model is, the higher the probability of obtaining the original project as initial purpose of any model – to be a subject to observation. For this reason acquaintance to essence, contents, norms of information modeling as cognitive activity is very necessary in training of design activity of students of construction specialties [9].

To support methodologically the discipline called "Metal designs" was developed and tested undergone approbation of the program complex on design and calculation of metal designs and to gain experience of information modeling for students of the "Construction engineering" by the department at the Orenburg State University. The program complex is the software for the MS Windows operating system developed with using tool means of Microsoft Visual Studio in the C# programming language. The dialogue window screenshot "The choice of a design by the first and second option" is presented in Figure1.

The main aim of the program complex "The Automated Information Calculating System of Design of Metal Designs" is to systematize and automated process of information modeling and mathematical calculation when designing metalworks.

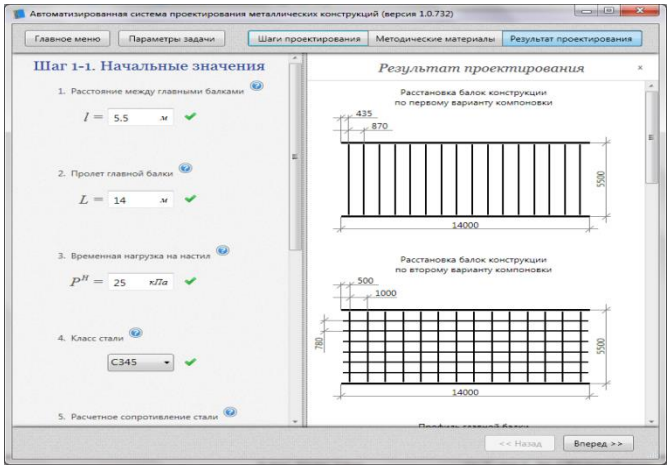

Figure1. Variant's choice

The program complex is used to solve of the following tasks:

- selecting the cross section of a flooring beam depending on option of configuration of the frame platform (mathematical checking durability, rigidity and general stability);
- selecting the cross section of an auxiliary beam with checking durability, rigidity and general stability;
- determining steel consumption on square meter of platform surface by various options of configuration and the choice of the most economic scheme;
- configuring the cross section and calculation of the main beam with determining a step of cross stiffening ribs, checking local stability of the zone compressed and girder wall;
- calculating and checking durability of the section grouped of the main beam for the normal, reduced stress and tangent tension with checking of the general stability of a beam, local stability of a girder wall;
- calculating belt welds and joints of the main beam.

All mathematical calculations of the created system were approved and tested. For this purpose for each settlement function numerical parameters were given various and the output result of calculations was compared to the corresponding calculations in Mathcad. At the result of test was recorded that all settlement procedures and functions of the application give correct results in case when entrance data are correct.

Such practice of software product use in training allowed establishing a methodical way of information modeling of processes in building constructions.

The interface of the program is presented in the form of the master dividing all designing process into six large stages, and each stage is divided into more detailed steps. At every stage (step) a user creates a project containing all results of his work. This project can be loaded at the next start of the program. The project is saved in the xml- file. Each step of designing is displayed by a dialog window, containing:

- a formulation of a task on the current step;
- fields for inputting information, necessary for calculations;
- buttons for a call of reference information, necessary for the current step (comments, theoretical bases and practical recommendations to the choice of design decisions);
- the field for calculating results which the program fills automatically after the correct filling all necessary entry fields of information;
- buttons of transition to the following step (active in case if a design step passed in the right way), the button for returning to the previous step;
- information on the current project (full name and group of the user);
- the scale of steps and design stages displaying the current progress of performance of work, also allows returning to any step passed.

Any data input is followed by the information message reflecting their correctness in case if it is required (Figure 2).

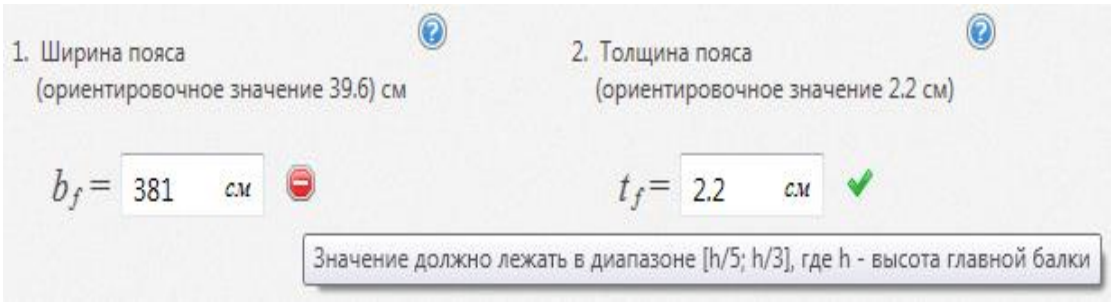

Figure 2. Incorrect parameter of the designed beam construction

When realizing the program complex we used the design pattern of ModelView-View-Model (MVVM). The MVVM template is applied in designing of the software architecture. Originally this **is** presented by John Gossman in 2005 and is used for separation of the model and its representation, that it is necessary for changing them separately from each other. The template is divided into three parts:

- Model represented by the fundamental data necessary for operation of software.
- View is a graphic interface that is a window, buttons, etc. View is a subscriber to an event of change of properties' values or commands provided by View Model. It notifies all subscribers and requires the updated value of property from View Model in case if any property of the View Model was changed . In case the user influences any element of the interface, the View causes the corresponding command provided by the View Model.
- On the one hand the View Model is a View abstraction, and on the other hand, it provides a data set from Model which are subject to binding. That means that it contains Model which is transformed to View and also comprises teams which View can use to influence on Model.

For simplifications of understanding, the designing process is divided into steps, and the graphic interface is constructed by the principle of "master" when only a current step of design is displayed on the screen, and transition to the following step is carried out only after correct performance of the current step. Saving progress of design in the file, which is indicated at the beginning, is carried out automatically upon each transition between steps of design or at an exit in the main menu.

3. Literature review

In the process of creation of model and the analysis of its behavior, modeling allows students to obtain necessary information (to process, to filter, to invert, to integrate) that allows creating ability to turn the initial (formalized) cognitive degree of structure into new, personally significant, "live" typology of knowledge [11].

In information modeling there is "a transfer of subjective reality in objective, the ideas connect to expectations, and the science opens to the person as an appeal to activity" (I. G. Shendrik) [12] and therefore "the main sense" of inclusion of students in modeling is "development of their mental abilities to learn the changing world and to solve practical problems of activity" (V. S. Lazarev) [11].

To questions of world cognition by means of modeling, to types of models, ways of construction and use of models in education are devoted works of E.G. Berdashskoy, V.I. Mikheyeva, N.I. Pak, E.S. Polat, N.A. Sycheva , to E.I. Yakovleva, etc. Analyzing the didactic importance of the modeling programs, a number of authors note that modeling allows increasing intensity of training as the essence of the phenomena allocated. The control of process and the analysis of reaction of model to change conditions serving not so much as material for storing than a basis for practical activities. Not learning rules, but the process of thinking becomes the main aspect of training. This epistemological approach can be designated as research [13]. The student himself chooses the strategy of behavior, tries to find out that he will result from his actions, based on the experience, does the conclusions about the importance of the data obtained. Thus, more active mode of training is provided. In this context the professor of the Harvard business school Luerhman told in his article "Teaching with Simulations": «A simulation stimulates active engagement of students. They are playing a role, not just reading and analyzing. They make decisions and see the results of their decisions in the response of other players and the outcome of the sim. Simulations generate much more energy among students than traditional lectures or case discussions» [16].

The methodology of information modeling application at the solution of construction tasks allows expanding a range of the directions of conscious search of new shaping, to make the analysis and a spatial configuration of an artifact, to automate design calculations.

4. Conclusions

Results of a research represent empirical evidences of advantages of training by means of the program complex "The Automated Information Calculating System of Design of Metal Designs". They consist

of high-quality and dynamic visualization of building constructions systems and knots of their interfaces, automation of routine calculations and interactivity, an opportunity to carry out information modeling in solution of tasks, changing the basic data and the strategy of design depending on the intermediate results obtained.

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