Three-Layer Architecture of Environment for Web-Based Practical Education

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Abstract: The architecture of web-based environment for practical teaching is discussed in this paper. The processing in server layer of the information is considered. To the stile of student’s operation made special attention. The examples are given.

Keywords: web-based education, practical education, learning by doing

1. INTRODUCTION

The common model of environment web-based practical teaching is based on theories as cognitive styles of teaching [1], theory of motivation [2], psychological aspects (essence) on using the communications and common theory of the system [3]. This model uses theory of behaviorism and social constructivism.

A conceptual model of an environment for web-based education presents the basic elements that build an environment and links between them [4], [5].

The architecture of environment for web-based education divide three layers:

- The layer of the system of tasks (problems);
- The layer of the system of helping information and
- The layer of programs that give decision of problems for control of learner’s work with web-based environment.

The necessity of this division comes from logical links between elements in each level and specific in their designing.

2. LAYER ONE

The common system of tasks consists of systems intended for learning themes in designed course. The system of problems designs from point of view of the requirements for assuming of determinate knowledge [6]. The problems intended for assuming the concepts in every learning dose and links between them are considered. The relations between the problems are analogy and including one problem as a sub-problem in another problem. When a problem is including as a part of another problem’s solution, the first problem is named sub-problem. On fig. 1 is presented the non-evident relations between the problems in a system:

- Problem 1.1 and Problem 1.2 explain Property 1.1 and Property 1.2 of Concept 1;
- ...
- Problem K1, Problem K2 and Problem K3 explain Concept K.
Fig. 1: The non-evident relations between the problems that explain one and the same concept.

On fig. 2 are presented the evident relations between the problems in a system:
- Problem 1.N consists of sub-problems Problem 1.2 and Problem 1.K.
- The solution of Problem 1.K is analogy to the solution of Problem 1.3.

Fig. 2: The evident relations between the problems in a system of problems.

3. LAYER TWO

The second layer of the environment for web-based learning with problems is of the system of helping pages. It present the logical organization of the knowledge and have important role for explaining of the approaches for solving the problems in given scientific area [7]. With this system is presented how to make reasonings for achieving true decision.
The building of this system is linked with material for learning and is subordinated to the system of problems. The doubling of helping-pages is non-desirable. This means that if for some problems we can use one help, this problems must be connected with one helping-page.

In Tab. 1 explains kind of helping-information received from student.

<table>
<thead>
<tr>
<th>Theoretical help</th>
<th>Help for solution of the problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hyper-text references to respective part of lectures</td>
<td>Answer</td>
</tr>
<tr>
<td>Short theoretical information</td>
<td>One or several intermediate results</td>
</tr>
<tr>
<td>Instructions linked with specific applying of theory</td>
<td>Reference to analogical problem</td>
</tr>
<tr>
<td>Summary example</td>
<td>Reference to sub-problem</td>
</tr>
<tr>
<td></td>
<td>Sequence of several answers, when the problem has not one simple decision</td>
</tr>
<tr>
<td></td>
<td>Sequence of several answers, that include typical errors</td>
</tr>
</tbody>
</table>

4. LAYER THREE

The third layer consists from the system managing the student's work with learning-environment [8]. The programs in this layer collect and perform statistical information at the kind of:

- How many of the students beginning work with the learning-environment familiarize with all learning themes and finish it with filling a test for self-estimation;
- At learning of which theme most students refuse to work with the system;
- How many of the students are looking at the solutions of the problems but don't attempt to work independently;
- How many of the students are guessing the answers.

This is the information that is used from developers for refinement the environment for practical education. The elements, in which a lot of students refuse the learning, are revised for refinement: the problems; the help for them and announcement for motivation.

Other type of information, that the system collects, is connected with the style of student's work:

- The people with articular style of learning have high-ability for separation from surround-environment. They use received information for action. For this type of people, it is especially suitable the offered structure of practical education.
- Field-dependent people have aspirations of relations with another people, therefore they need of control from lecturer. For them in the environment for practical education are intended permanent hints, helping web-pages and encouraging announcements.

Every type of people needs correction. The field-independent people don't need unnecessary details, which slow their tempo of work. The field-dependent people are encouraged for making conclusions and solving more problems for accepting necessary knowledge.
The third type of information that is collected at the time of work is intended for building appropriate motivation scheme [9]. The system organization of web-based learning environment is premise for student motivation, but important element for supporting the non-diminish interest to the work is control the time for problem's decision or for all theme. The themes must be bound by limitation time. Important for motivation is the information for student’s progress in comparison with progress of another students. For this is used the collected statistical information.

5. GENERALIZED INFORMATION FOR THE WEB-BASED ENVIRONMENT FOR PRACTICAL EDUCATION

The first and second layers consist from web-pages that execute on browser. The third layer is realized from programs that execute on the server. These programs collect information for student’s work and make decisions for ways of stimulating them. The first and second layers present static knowledge. The third layer is adapting to the style and results of the student. It adds intelligence that is modeling the teacher’s behavior.

On fig. 3 is presented the three-layer architecture of environment for web-based practical education.

![Diagram of three-layer architecture](image)

Fig. 3: The three-layer architecture of environment for web-based practical education
PROCEEDINGS

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