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ADAPTATION OF LIFELONG LEARNING IN THE FIELD OF ELECTRICAL ENGINEERING

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Lifelong learning (LLL) is crucial to engage citizens in acquiring up-to-date knowledge of electrical engineering. Riga Technical University has developed a new continuing education program with key competencies to be integrated into the curriculum along with specific competencies in disciplines such as engineering. To empower students to formulate their lifelong learning skills, we have developed a new "Industrial design" continuing education program for electronic and optical equipment for engineering students. Continuous training covers disciplinary boundaries, this program can be adopted by trade professionals, production company managers, technical staff.

***Key words**: long life learning, program, industrial design, electrical engineering, adaptation*

I. INTRODUCTION

The formation responsibility for professional growth was purposefully organized and carried out systematically. The process including skills and ways of communication under the employers, educational institutions, mentors, etc. The more qualified the staff, the better the organization works.

II. THE DATA OF EXECUTION

The main group of people of the program is merchants, managers of manufacturing companies, technical staff.

Inspired to improve the field of knowledge about industrial design in the production of electronic and optical equipment: the use of new materials, design, improvement, thoughtful use in production and everyday life. The targets of the programs are designed to use reliable and updated data about educational achievement for the management and ensuring the quality of education [1].

This will lead to higher quality professional study, as well as a set of conceptual provisions that determine the development of quality assessment. Specialists will apply:

• mechanisms, principles and focus of development for assessing the quality of education of specialists developed with subject to changes in the requirements for learning outcomes, the possibilities of modern learning and information technology and student needs;

• the theoretical foundations of the formation and assessment of competencies that make up the main component - configurators of training quality assessment systems designed to integrate the requirements of the individual, production, state and society to the quality of training in the system of vocational education, productive domestic and foreign experience;

• technological foundations for the development of systems for assessing the quality of training of specialists, which contain necessary technological solutions and limitations of control and evaluation activities, without which it is impossible to obtain reliable information about individual educational achievements [2-8].

III. EXISTING METHOD IN EDUCATION

In developing the program were used adaptive teaching methods introduced into the educational process. Adaptive learning is a technological pedagogical system of the form and methods that promote effective individual studying [8].

Adaptive learning systems (ALS) classified according to the approach of choosing the next portion of educational information (OI): stochastic, navigation and hybrid.

In the stochastic model, the state of the student in the n-th training is described by a probability vector not
knowing each of the elements of the amount of information (AI) and the next part of the training material
determined by the probability of ignorance of AI.

This type of model was introduced by ALC based on iterative learning. Iterative learning (IL) is the repetition of actions, attempts, etc. by a learning system to achieve a goal in constant external conditions [9].

Learning in general is “the process and outcome of an acquisition individual experience ”[10]. The constancy of external conditions allows us to make a quantitative description of ID in the form of learning curves representing the dependence of the learning level criterion on time or on the number of iterations.

The criterion of the level of training - accuracy, speed, time and informational characteristics - were adopted as an effective characteristic of AI [11].

Stochastic Learning Model Algorithm:

1. Realization of the test of knowledge of the intern;
2. Based on this test, the trainee’s knowledge score, parameters adapted;
3. The learning system corrects the vector of ignorance of the elements;
4. Calculation of the quality of train [12].

Trainee navigation model. This model shows the student where the content is in each node and consists of a sequence of classes of nodes. There you can navigate through the links between nodes. On each node, it is possible to select backlinks to the previous node. Each node has navigation rules, nodes were identified by the number and class of nodes.

The speed of training may depend on the parameters of the model: the number of elements, relationships and the laws of their interaction. Knowing this dependence, we can propose measures leading to a corresponding change in the model parameters and a necessary increase in the learning rate [13]. The learning algorithm is as follows.

Verification of the student is carried out on the basis of the test. The sector of ignorance of the elements of educational information has been fixed. Calculates the quality of learning criteria [12].

Depending on the quality of learning criteria, ALC decides to complete the training or retire the next part of the AI.

The hybrid model contains two previous approaches. The main goal of this method is when the choice of a certain part of the training information depends on the probability of ignorance of the material, as well as the relationship between the blocks of the training system. If decisions were made about the need to continue training, the Model determines the tasks that will be adequate knowledge for the next stage of training, i.e. minimization of training time [13, 14].

An example of using iterative learning models for ALC creation is the study of foreign vocabulary. Many cells for discrete information are generated in the memory by replenishing the information reserve, for example, when learning new material or when learning a language [16].

In addition, associations Ai, i = 1, S, H, F arise in the memory when updating the i-th cell with discrete information. The associative parameter (the degree of communication of the i-th discrete value and its association) is represented as follows:

$$F_i(A) = 1 - e^{-n_0 kx} \quad (1)$$

Where -n_0 — rate of perception of information by trainee; k – number of lessons x - coefficient of compactness of the volume of discrete information in the lesson:

$$n_0 = \frac{V_n \lambda}{t_n}$$

(2)

where *Vn* — volume of the next part AI; t_n — duration of the n-th training lessons (according plan of lectures); 0<λ<1— information loss rate during memory entry.

The condition of the trainee in the n-th lesson is been described by the probability vector of not knowing each of the elements of the training information:

$$Y_n=P_n=(p^n_1, p^n_2,\ldots, p^n_i),$$

(3)

where p^n_i — probability of ignorance of the i-th element at the n-th instant of time tn. The probabilities of ignorance of AI elements vary according to the rule:

$$p_i^n = p_i(t_i^n) = 1 - e^{\partial_i^n t_i^n},$$

(4)

where ∂_i^n— speed of forgetting the i-th element of the AI at the n-th training session; t_i^n - the time since the last memorization of the i-th element of the AI.

The speed of forgetting each element decreases, if this element is given to the student for memorization, and does not change if it is not learned:

$$\partial_{i+1}^n = \begin{cases} \partial_i^n, & if\ i \nexists I_n \\ \acute{\gamma}\partial_i^n F_n, & if\ i \in I_n\ and\ y_i^n = 1 \\ \gamma''\partial_i^n F_n, & if\ i \in I_n\ and\ y_i^n = 0 \end{cases}$$

(5)

where ∂_i^n is the initial value of the speed of forgetting, estimated by the maximum likelihood method by the
expression (6), ∂_i^n>0 (i = 1,2, .., N), x is the number of uncommitted terms from discrete information of the volume
Vn first learned

$$\partial_i^n = -ln\frac{V_n - x}{V_n},$$

(6)

γ', γ'' — parameters of the correction of forgetting rates, characterizing the individual characteristics of the trainee's
memory, estimated by the maximum likelihood method $0 < \gamma' < \gamma''$, $Y_n = (y_1^n, \ldots y_{Vn}^n)$.

$$y_i^n = \begin{cases} 1, the\ trainee\ did\ not\ recall\ the\ discrete\ information \\ 0, the\ trainee\ recall\ the\ discrete\ information \end{cases}$$

(7)

The criterion of the quality of learning *Q*n for a given task has been determined by the probability of not knowing the element of AI, at random selected from the text:

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$$Q_n = \sum_{i=1}^{N} p_i(t_i^n) q_i \rightarrow min, \quad (8)$$

To minimize the value of *Q*n, by the end of the learning course, it is natural to include elements with the greatest value
of the product *p*i (t_i^n) *q*i in the portion of AI, since as a result of their memorization, the product becomes equal to zero and thereby reduces the value of Qn most. Thus, to ensure the optimal value of *Q*n, by the end of the n-th training session, it is necessary to find the *M*n of the maximum terms of the sum in the criteria, the indices of which will determine the next portion of AI issued to the student for memorization [14,16, 17].

When Qn reaches the required level of training δ - training ends, and the number of training sessions n determines the duration of training. Therefore, we can distinguish the following stages of the learning algorithm:

In accordance with the expression (7) testing the student's knowledge on discrete information leads to the formation of a set of student responses to tests.

The parameters of the student model are adapted in accordance with rule (5), taking into account expressions (1) and (2). In accordance with this program, a combination of the following was proposed: materials science, automation, and adaptive communications.

Native knowledges and skills + Ability + New knowledges →New skills (-New competences in the disciplines 1,…j)

IV. INTERNATIONAL MEASUREMENT

Student knowledge is tested to assess the quality of the developed curriculum. Based on the student's knowledge test, parameters are adapted.

The vector of ignorance of the elements of educational information is fixed and the criterion for the quality of education is calculated.

Depending on the quality criteria for training, the ALC decides to complete the training or, in accordance with certain rules, choose the next part of the AI. In the next training cycle, steps 1-5 are repeated again.

V. CONCLUSIONS

When developing a new program, the following requirements were taken into account:
- the quality of training and the amount of digestible information has been improved;
- training requirements.

And also, to implement this program, the following training approaches were used: lectures, discussions, practical and research work, explanatory illustrative method, situation analysis, use of information technology.

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АДАПТАЦИЯ НЕПРЕРЫВНОГО ОБРАЗОВАНИЯ В ОБЛАСТИ ЭЛЕКТРОТЕХНИКИ

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Непрерывное обучение (LLL) имеет решающее значение для вовлечения граждан в приобретении современных знаний по электротехнике. В Рижском техническом университете была разработана новая программа непрерывного обучения с такими ключевыми компетенциями, которые должны быть интегрированы в учебные планы наряду с конкретными компетенциями в таких дисциплинах, как инженерное дело. Чтобы расширить возможности студентов формулировать свои навыки непрерывного обучения, мы разработали новую программу непрерывного обучения «Промышленный дизайн» для электронного и оптического оборудования для студентов инженерных специальностей. Непрерывное обучение охватывает дисциплинарные границы, эта программа может быть принята специалистами торговли, менеджерами производственных компаний, техническим персоналом.

Ключевые слова: *непрерывное образование, программа, промышленный дизайн, электротехника, адаптация*

ЭЛЕКТР ТЕХНИКАСЫ САЛАСЫНДА ҮЗДІКСІЗ БІЛІМ БЕРУДІ БЕЙІМДЕУ

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Үздіксіз оқыту (LLL) азаматтарды Электротехниканың қазіргі заманғы білімдеріне тарту үшін шешуші мәнге ие. Рига техникалық университетінде инженерия ісі сияқты пәндерге нақты құзыреттермен қатар оқу жоспарларына интеграциялануы тиіс негізгі құзыреттіліктерді ұзақ мерзімді оқытудың жаңа бағдарламасы әзірленді. Студенттердің үздіксіз оқытуға деген өздерінің дағдыларын қалыптастыру мүмкіндігін кеңейту үшін біз инженер мамандығының студенттеріне арналған «Электронды және оптикалық құралдар үшін өнеркәсіптік дизайн» жаңа бағдарламасын әзірледік. Үздіксіз оқыту пәндік шектеуді қамтиды, бұл бағдарламаны сауда, өндірістік компаниялар менеджерлері, техникалық қызметкерлер қабылдай алады.

Түйін сөздер: *ұзақ мерзімді оқыту, бағдарлама, өнеркәсіптік дизайн, электротехника, бейімдеу*

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