



UDK 378.018.43

THE NEW MODEL OF FEEDBACKS BETWEEN STUDENTS AND E-LEARNING PLATFORM MOODLE

Valentyna SHVETS

Ph. D. in Physical Chemistry, Associate Professor of Physics, Work place at the time of article creation: Institute of Vocational Education of National Academy of Educational Sciences of Ukraine, laboratory of electronic educational resources, senior scientific researcher

© Shvets V., 2017

Ключові слова: зворотний зв'язок, освітні технології, платформа електронного навчання MOODLE.

Поява нових методик навчання в сучасному інформаційному суспільстві пов'язана з розвитком електронних навчальних систем, що вимагають постійного пошуку нових шляхів спілкування між студентом і викладачем. Головна проблема дистанційного навчання, заснованого на зворотному зв'язку, полягає в тому, що автоматизована система повинна забезпечити студенту можливість досягнення більш високого рівня ефективності навчального процесу. В даній статті запропоновано розв'язок цієї проблеми, який полягає у розробці нового типу зворотного зв'язку між студентом і платформою електронного навчання MOODLE. У статті описана технологія створення додаткових модулів до платформи MOODLE для досягнення цього нового типу зворотного зв'язку, написаних мовою програмування JavaScript.

Introduction

The important component of the educational process in a higher school is a feedback between the student and the teacher, which provide a control of student's activity and give the opportunity of their correction. The feedbacks, proposed by B. F. Skinner [11] (as a part of the operant behavior), have the opened form, unlike the programmed instructions, proposed by N. Crowder, with closed form [8].

The feedbacks, proposed by B. F. Skinner and N. Crowder, were used in a pedagogical system consisting of two components – the teacher and the student [3], but the development of information technologies changed the structure of this pedagogical system, namely: supplemented the pedagogical system by third component – a computer. The appearance of new component in the pedagogical system significantly affected forms of feedbacks.

The appearance of e-learning platforms, of which one of the most widespread is MOODLE [12], created the conditions for the development of new control and correction methods in the educational activity management of students.

The aim of the article consists of the presentation of the new model of feedbacks

construction and its practical examples, which have been developed for control and correction of student's knowledge in e-learning platform MOODLE.

The methodology of the feedback construction

The development of the information society changed the scientific knowledge in a way in which linear thinking was replaced by non linear thinking [9]. These changes affected pedagogics and management of students' educational activity process where nonlinear thinking approach found its reflection respectively. The linear algorithm consisted of algorithmic steps carried out one after another; the nonlinear algorithm contains, apart of a linear steps' set, a set of additional educational information. This additional educational information can be used by student in a case if he (or she) demands the help while performing on the algorithmic step. The nonlinear algorithm may be realized in two ways: with use of a hypertext [1; 6] or with use of e-learning platform [2; 5].

E-learning platform MOODLE gives the opportunities allowing the addition of nonlinear algorithms with one essential element – the feedback between an educational environment and the student. This new type of feedbacks differs from feedbacks described by B.F. Skinner and N. Crowder. The feedbacks in e-learning platform MOODLE, which we will describe, are more flexible, they are capable to satisfy students with various cognitive requirements and capabilities.

Let's consider the principle of nonlinear algorithm flowchart creation.

The flowchart of an algorithm is a graph which has the tops [10] presented in fig.1.

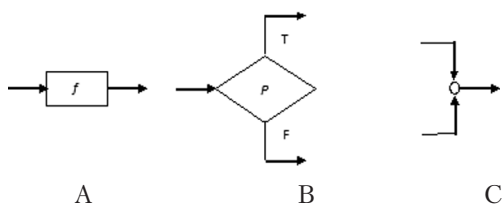


Fig. 1. The types of tops in flowcharts

The *functional top* is represented on fig. 1 A and it's used for function representation $f: X \rightarrow Y$. The *predicate top* is represented on fig. 1 B and it's used for predicate representation: $X \rightarrow \{T, F\}$. The predicate top transfers the algorithm to the one of its branches. The *connecting top* is represented on fig. 1 C – it bounds two branches to the common top.

Special forms of flowcharts are the *structural flowcharts*. The structural flowchart consists of four elementary schemes [7] which are represented on fig. 2.

The Boolean expression, which can accept value of 0 or 1, is designated as B on fig. 2. Program operators (procedures) are designated as S1 and S2 (fig.2).

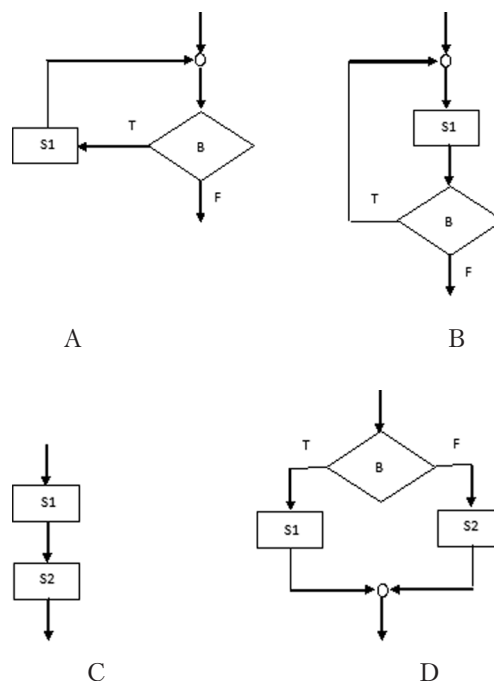


Fig. 2. The structural flowcharts

The flowcharts represented on fig.2, are called *structures of program control*. The scheme represented on fig. 2A, is called *composition*. The scheme represented on fig. 2B, is called *choice* or *alternative*. The schemes represented on fig. 2C, 2D, are called *iterations*.

The *first feature* of four program control structures consists of the one entrance and one exit, therefore each flowchart formed by these

structures has one entrance and one exit. The *second feature* of structural algorithms is that flowchart has a tree structure.

Let's construct the flowchart of educational activity algorithm with use of e-learning platform MOODLE and compare it with types of structural flowcharts.

The creation of the task solution algorithm consists of algorithmic steps s_1, s_2, \dots, s_n ; these steps form the set $S = \{s_i\}$ of linear algorithm.

The nonlinear algorithm has an additional set $T = \{t_i\}$ of theoretical modules, which can be activated in the process of task solution. The set of hypertext comments $AC = \{ac_i\}$ and the set of text comments $IC = \{ic_i\}$ are created as well.

The association of sets S, T, AC, IC forms the main didactic field GF of the nonlinear algorithm of the task solution:

$$GF = S \cup T \cup AC \cup IC \quad (1)$$

Each element of the set $GF = \{gf_i\}$ is a didactic unit which contains i^{th} element of the set $S : s_i$, j^{th} element of the set $T : t_j$, i^{th} element of the set $AC : ac_i$, i^{th} element of the set $IC : ic_i$:

$$gf_i = \{s_i, t_j, ac_i, ic_i\} \quad (2)$$

The elements gf_i of the set GF can be created by standard tools of MOODLE platform.

Two types of administrative buttons are created for management of logical transitions from one algorithmic step to another and for organization of feedbacks between e-learning platform and student. These buttons are united in two sets: $K1 = \{k1_i\}$ and $K2 = \{k2_i\}$. The button united in the set $K1$ informs the student that the task of the algorithmic step was performed correctly. The button united in the set $K2$ informs the student that the task of the algorithmic step was performed incorrectly. The association of sets $K1, K2$ is an additional didactic field of nonlinear task solution.

$$AF = K1 \cup K2 \quad (3)$$

Each element of the set $AF = \{afi\}$ is the didactic unit that contains the i^{th} element of the set $K1 : k1_i$, i^{th} element of the set $K2 : k2_i$:

$$afi = \{k1_i, k2_i\} \quad (4)$$

E-learning platform MOODLE has no standard tools for creation of additional didactic field for nonlinear algorithm of

task solution. However, the open key allows creating the additional program modules we used for creation of the additional didactic field (AF) in JavaScript programming language.

The fragment of nonlinear algorithm flowchart with the sets stated above is shown on fig. 3.

The comparison of the flowchart represented on fig. 3 with flowcharts of structural algorithms testifies that the algorithm of nonlinear programming is structural. The feature of nonlinear programming algorithm is that the appeal to j^{th} of the theoretical module takes place on i^{th} step of the algorithm.

It should be noted that the set of theoretical modules is not a subprogram, because the subprogram works according to the same algorithm, but with different values of variables.

Thus, the additional information row turns algorithm of educational activity programming into nonlinear algorithm in both didactic and programming theories.

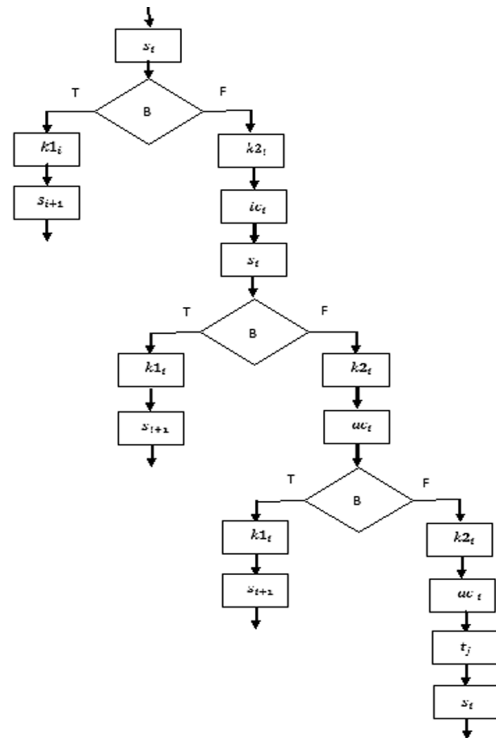


Fig. 3. The fragment of the algorithm for the new model of feedbacks between student and e-learning platform MOODLE

We can understand the difference between linear algorithm and nonlinear algorithm of new model of feedbacks with use the figures 4 and 5.

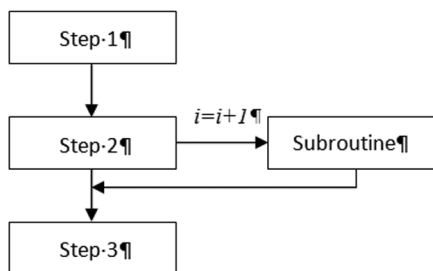


Fig. 4. The flowchart of linear algorithm with subroutine

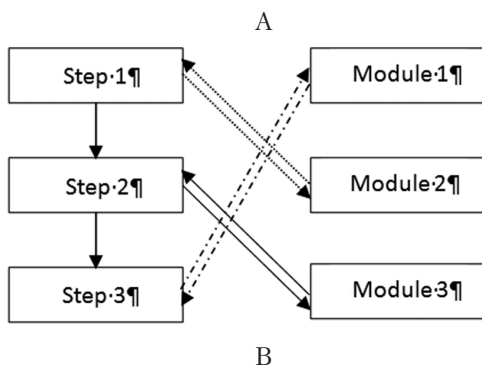
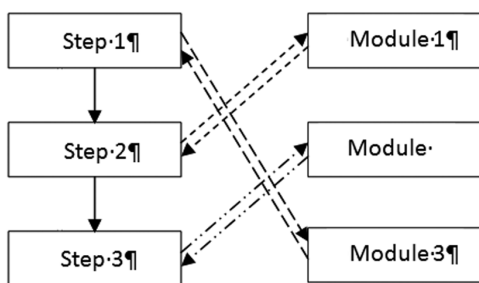


Fig. 5. The scheme of work of new model feedbacks algorithm in e-learning platform MOODLE: on left in cases A, B are steps of algorithm, on right are modules of theoretical information for the solving of the task

We see from fig. 4 the subroutine works at new parameters of a variable, for example, at $i = i + 1$. The fig. 5 shows the different modes of operation in the new model feedbacks: we

see these modes are not linear character. The move of work depends from the knowledge of the student: for example, in case A the student needs for solving of the step 1 in the knowledge from the module 3, in the case 3 other student needs for solving of the step 1 in the knowledge from the module 2. In this sense, the nature of the operation of the algorithm is nonlinear.

The examples of Java scripts, which were written for the algorithm of the new feedbacks model by O. Vetchynkin, are presented on fig. 6, 7.

```

<h2 class="div_container" id="my_div" style="display: block;"><strong><span style="font-size: small;"></span><strong><strong><span style="font-size: small;"><a ref="#inline1" id="various1">The answer is wrong. Read Section 1.5</a></span></strong></h2>
  
```

Fig. 6. Java script for the programming of the comment to wrong solution of the step of the task

```

<p style="text-align: justify; text-indent: 20px; margin: 0px;"><strong><span style="font-size: small; font-family: arial, helvetica, sans-serif;"></span></strong>
<p style="text-align: right;"><strong><span style="font-size: small;"><input onclick="LocFunc()" type="button" value="Go to task"></span></strong></p>
  
```

Fig. 7. Java script for the programming of the button "Go to task"

Results and Discussion

Let's show the example of feedbacks in e-learning platform MOODLE which were built according to the proposed methodology.

The condition of the problem. Find the capacity of the electrical circuit, if $C_1=15$ pF, $C_2=45$ pF, $C_3=20$ pF (fig. 8).

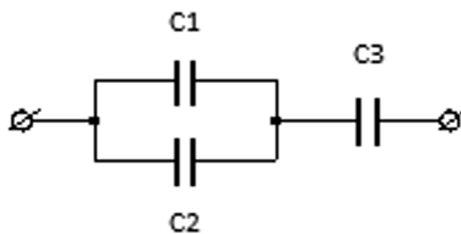


Fig. 8. The electrical circuit with capacitors.

Let's consider the solution of this problem according to the algorithmic approach proposed by L. Landa [4]. The problem's algorithm consists of three steps. *Each step is*

formed as a test question in e-learning platform MOODLE.

Step 1. Find the total capacity C_{12} (in pF) of parallel-connected capacitors C_1 , C_2 .

Step 2. Select the electrical circuit which is equivalent to the electrical circuit within the problem's condition (fig. 9).

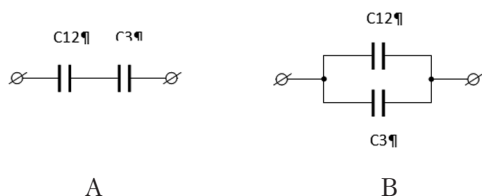


Fig. 9. Electrical circuits, one of which is equivalent to the electrical circuit within the problem's condition

Step 3. What is the total capacity C (in pF) of the circuit?

The e-learning platform offers 2 types of help at each step of the algorithm if the student is unable to correctly answer the test question. Let's consider, for example, the help to step 1. The next comment appears on the screen, if student gave the wrong answer to the test question 1: «*The answer is wrong. Read Section 1.5, drawing attention to the parallel connection of capacitors*».

This comment consists of two parts. The first part in italics is hyperactive, unlike the second part which is not neither in italics nor hyperactive. The student which has sufficient information in the second part of the comment returns to the previous step. The student who didn't form the concept of the "parallel connected capacitors" discloses hyperactive part of the comments, forms

appropriate concepts and then answer the question. The level of the help provided by e-learning platform to student is determined by student's profile of knowledge and his level of cognitive ability.

It should be noted that e-learning platform MOODLE, as opposed to B. F. Skinner's and N. Crowder's tests, provides more opportunities for answers forms choice. In the example for step 1 and step 3 the answer form "calculated" is the most advisable. Thus, the use of multiple choice answer form, which was the pretext for Crowder's tests critics, is reduced to a minimum.

Conclusion

Such feedbacks simultaneously perform two functions: they control the student's knowledge and automatically adjust it.

The feature of these feedbacks is the lack of direct contact between student and lecturer. This contact is still present, but in indirect form. The indirect contact between student and lecturer takes place in two stages – during formulation of the problem and while development of learning activities algorithms. The second stage is characterized by lecturer-student relation, when lecturer is analyzing knowledge profile of each student, which the e-learning platform builds automatically based on the student's answers.

The work was performed as part of scientific research „Methodical basics for creating of new generation textbooks”, which was financed by Ministry of Education and Science of Ukraine (registration number 0111U002506).

ЛІТЕРАТУРА

1. А. с. 45787 Україна. Нелінійне програмування навчально-пізнавальної діяльності студентів з використанням гіпертекстового електронного посібника як засіб педагогічної технології управління навчальним процесом / В. Д. Швець (Україна). – № 46052; заявл. 26.07.2012; опубл. 29.09.2012.
2. А. с. 46187 Україна. Нелінійне програмування навчальної діяльності студентів в платформі MOODLE як засіб управління процесом засвоєння знань / В. Д. Швець (Україна). – № 46426; заявл. 30.08.2012; опубл. 30.10.2012.
3. Берг А. И. Состояние и перспективы программированного обучения / А. И. Берг – М. : Знание, 1966. – 25 с.

REFERENCES

1. Copyright certificate 45787 Ukraine. Nonlinear programming of students' educational and cognitive activity with hypertext electronic guide as a means of pedagogical technology learning management / V. D. Shvets (Ukraine). – № 46052; 26.07.2012 stated; published 29.09.2012 (in Ukrainian).
2. Copyright certificate 46187 Ukraine. Nonlinear programming of students' educational activities in MOODLE platform as a means of the learning process management / V. D. Shvets (Ukraine). – № 46426; 30.08.2012 stated; published 30.10.2012 (in Ukrainian).
3. Berg A. I. State and prospects of programmed learning / A. I. Berg – M. : Znanie, 1966. – 25 p. (in Russian).

4. Ланда Л. Алгоритмизация в обучении / Л. Ланда. – М. : Просвещение, 1966. – 523 с.

5. Швець В. Д. Методичні особливості програмування навчальної діяльності студентів з використанням електронних навчальних середовищ / В. Д. Швець // Проблеми освіти : наук.-метод. зб. – К. : Ін-т інновац. технологій і змісту освіти МОН України, 2012. – № 71. – С. 40–47.

6. Швець В. Д. Основи класичної фізики [Електронний ресурс]: навч. посіб. для студ. вищ. навч. закл. / В. Д. Швець. – 80 Min / 700 MB. – К. : 1С – МУЛЬТИМЕДІА, 2007. – 500 електр. опт. дисків (CD-ROM): 12 см. – Систем. вимоги: Pentium; 32 Mb RAM; Windows 95, 98, 2000, XP, Vista; MS Word-2007.

4. Landa L. Algorithmization in training / L. Landa. – M. : Prosveshchenie, 1966. – 523 p. (in Russian).

5. Shvets V. D. Methodical features in educational programming of students using information technology / V. D. Shvets // Problems of education: scientific-method. Coll. – K. Institute of Innovative Technology and Education, 2012. – № 71. – P. 40–47.

6. Shvets V. D. Fundamentals of the classical physics [Electron resource]: textbook for university students/V. D Shvets. – 80 Min / 700 MB. – K. : 1С – МУЛЬТИМЕДІА, 2007. – 500 electr. Opt. Disks (CD-ROM): 12 cm. – System. Wimogi: Pentium; 32 Mb RAM; Windows 95, 98, 2000, XP, Vista; MS Word-2007.

7. Aho A. V., Hopcroft J. E., Ullman J. E. Data Structures and Algorithms/ A. V. Aho, J. E. Hopcroft, J. E. Ilman – Massachusetts : Addison-Wesley, 1983. – 427 p.

8. Crowder N. Automatic Tutoring by Intrinsic Programming, in A. A. Lumsdaine and Robert Glaser, eds., Teaching Machines and Programmed Learning, National Education Assn., Washington, 1960.

9. Deleuze G. Empirisme et subjectivité / G. Deleuze. – Paris : Presses Universitaires de France, 1973. – 152 p.

10. Knuth D. E. The Art of Computer Programming. Vol. 1 / D. E. Knuth. – Massachusetts : Addison-Wesley, 1997. – 650 p.

11. Skinner B. F. Science and Human Behavior / B. F. Skinner. – New York : Simon and Schuster, 1965. – 461 p.

12. URL : <https://moodle.org>.