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ON THE METHOD FOR ASSESSING THE QUALITY OF E-LEARNING RESOURCES

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***Nana Grigoryan**, PhD in Education, Associate Professor*
Khachatur Abovyan Armenian State Pedagogical University, Republic of Armenia
***E-mail**: grigoryannana06@aspu.am*
***Yeranuhi Harutyunyan**, Researcher at the Department of Informatics and Methods of Its Teaching*
Khachatur Abovyan Armenian State Pedagogical University, Republic of Armenia
***E-mail**: harutyunyanyeranuhi-2@aspu.am*
***Zara Grigoryan**, Master in Marketing Communications*
Armenian State University of Economics, Republic of Armenia
***E-mail**: zaragrigoriann@gmail.com*

ABSTRACT

Without the introduction of modern e-learning resources, it is hard to imagine a quality, understandable education that meets modern trends and standards. Under the current circumstances, one of the most important issues facing the world educational community is the problem of searching e-learning resources quality assessment methods. Assessment is a multi-criteria issue that is very relevant in the current trends of ICT-oriented education and requires the use of multi-criteria decision-making methods.

The purpose of this article is to introduce an interesting approach for evaluating the quality of e-learning resources, based on the method of analysis of hierarchy.

The presented method is not hard to apply; it is oriented for pedagogical purposes and can also be used in the decision-making process for any multi-criteria problem within the field of education.

***Keywords:** e-learning resources, analytic hierarchy process, multi-criteria decision-making, assessment, skills, learning process.*

INTRODUCTION

E-learning resources (ELRs) became one of the main hotly debated issues in the world's educational community in recent years (Beljaev, M.I., Vymjatnin V.M., Grigor'ev S.G. I Dr., 2002), (Grigor'ev S.G., Grinshkun V.V., Koloshein A.P., 2012), (Pervezenceva,

Je.A., 2013), (Condruz-Bacescu M., 2014). One can find different formulations of the concept of "e-learning resources". Thus, the authors of the article "Technology of using e-learning resources in the university", when referring to the wording of "e-learning resources" mean "a unified program-method complexes that integrate various computer and information-communication technology" (Grigor'ev S.G., Grinshkun V.V., Koloshein A.P., 2012).

It should be noted that numerous studies have been performed to determine students' learning effectiveness through the help of e-learning resources, which have proved both the productivity and convenience of e-learning resources during lessons.

The use of e-learning resources facilitates joint work, teacher-student interaction, and increases the level of student motivation. Due to the flexibility of the program, it is possible to adapt it to the learner's features. Students can speed up or slow down the learning process (Dey P., Tabucanon M., Ogunlana S., Gupta S., 2001).

Thus, it can be claimed that the use of e-learning resources in educational process

1. makes learning more effective, contributes to the increase students' interest to whole learning process,

2. creates an opportunity for a comprehensive study of educational material and it makes learning complete due to the fact that a systemic approach is used in the development of e-learning resources and to some extent content is coordinated,

3. Gives the opportunity to apply students' knowledge in practice and supervise achievements, allows them to work both with lecturers, as well as on their own.

The introduction of e-learning and e-textbooks within the learning process has become a priority in many countries around the world. The problems of e-learning resources development and application in the teaching process have been discussed in the works of many researchers (Beljaev, M.I., Vymjatnin V.M., Grigor'ev S.G. I Dr., 2002), (Gura V.V., 2007), (Vinnickij, Ju.A., 2006) and others).

In recent years, much attention has been paid to the regulation of e-learning resources in accordance with existing state standards in the field of education. These are the main issues when classifying e-learning resources: type of basic information, purpose, category of users is it for and so on? It is also possible to choose the distribution technology, i.e. whether e-learning resources is a local, networking or combined e-learning resource? It should be noted that e-learning resources are of particular interest, which have the opportunity for "multimedia" interaction. In order to determine the quality of these e-learning resources, it is necessary to consider the quality of the educational material, its adequacy, methodological elaboration /i.e. its content characteristics/. Type

of user interaction, degree of interaction, possibility and convenience of making necessary changes, the degree of multimedia are very important, too. Multimedia facilitates the process of memorization, makes the material more interesting and moving.

Many professionals develop a variety of e-learning resources and use them successfully in the learning process. Under the current circumstances, one of the most important issues facing the world educational community is the problem of searching for quality assessment methods of e-learning resources.

Assessment is a multi-criteria issue and requires the use of multi-criteria decision-making methods. The analysis of the normative documents of the works allowed to reveal the following methods of quality assessment: experimental, expert and complex quality assessment.

E-learning resources quality assessment requires a qualitatively new, multi-criteria approach (ie, an approach based on a modern theory of multi-criteria decision making). In our particular case, we will evaluate the e-learning resources quality not on the basis of an intuitive approach, but through precise mathematical calculations.

First of all, it should be noted that well-designed e-learning resources should meet the common evaluation criteria: the criteria should not be allowed to refer only to the technical side of the issue (level of interactivity, multimedia, its functionality). Attention should be paid to concepts such as the theory statement, examples, level of examination, exercises for processing the material and qualitative-quantitative characteristics of the tests.

Acceptance of decisions is one of the directions of applied mathematics. Developing decision-making methods requires consideration of mathematical, psychological, and computer issues.

There are various methods for making multi criteria decisions: ELECTRE (Elimination and Choice Translating Reality), TOPSIS (Technique for Order Preference by Similarity to Ideal Solution), method of analysis hierarchy, etc.

The above methods have common positive features. These methods consider the multi-criteria conditions, use criteria with an evaluation scale, help to make an individual decision. Let us now consider the issue of interaction between user and problem solving. All the presented methods, except for the method of analysis hierarchy, have certain difficulties in processing expert information. In the case of all methods, except ELECTRE, there is compliance with the intuition perception.

Let us focus on the Analytic Hierarchy Process (AHP) developed by Thomas L. By Saati. The method of analysis hierarchy easily allows to perform the algorithmization and

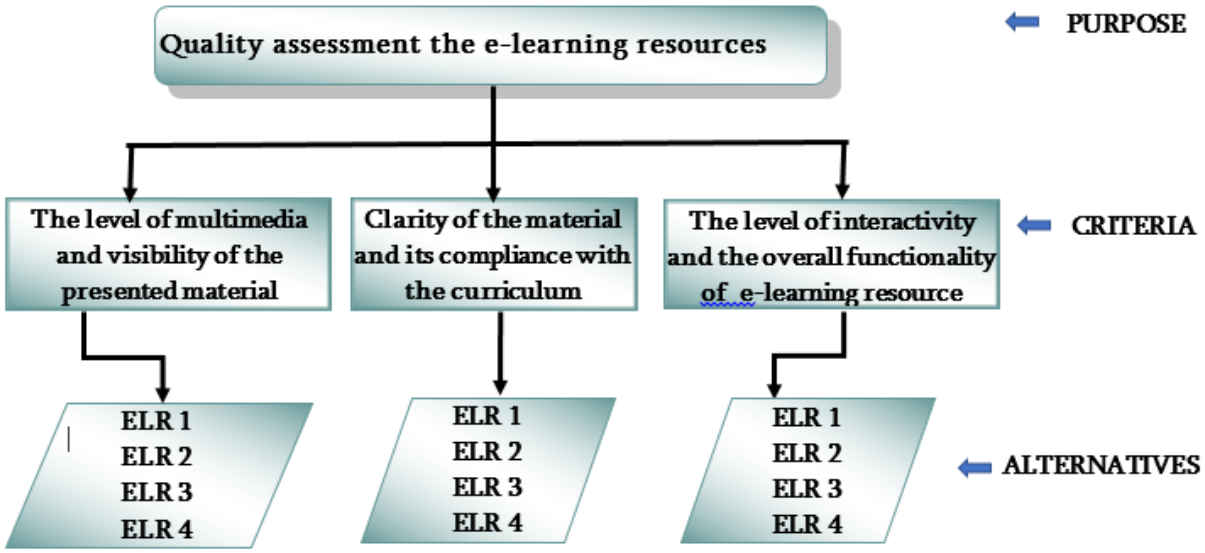
programming of the problem (Saati. T., 1993), (Saaty T.L., 1986). The method has been used successfully applied in various fields (Grigorjan N.D., 2007), (Dey P., Tabucanon M., Ogunlana S., Gupta S., 2001), (Figueira J., Greco S., Ehrgott M., 2005), (Hop N.V., Tabucanon M.T., 2001), (Saaty T., Sodenkamp M., 2008).

The hierarchy analysis method offers the following sequence of actions (Saati. T., 1993):

- solve the problem by presenting it in the form of a subordination with several levels: goals-criteria-alternatives;
- Compare the elements of each level in pairs.

Suppose ELR 1, ELR 2, ELR 3 and ELR 4 are e-learning resources that we want to evaluate. The problem of assessing the quality of an e-learning resource has presented in a hierarchy with several levels: goals-criteria-alternatives (Diagram 1).

Diagram 1. Goals-criteria-alternatives



Judgments are made by the expert (in our case, such expert will be teacher, who not only work in this field for many years, but are also specialists in the development of e-learning resources).

As criteria we will use:

- The level of multimedia and visibility of the presented material
- Clarity of the presentation of the material and its compliance with the curriculum
- The level of interactivity and the overall functionality of the e-learning resources

Undoubtedly, the main criterion is the objectivity of the methods of assessing the knowledge gained as a result of learning through the use of e-learning resources. However, we will not use this criterion at this stage because different modes of e-learning resources do exist.

- training without testing
- training, which is accompanied by a test and at the end of each chapter or paragraph the student is asked a few questions, the answers to which determine the degree of mastery of the material,
- a final test designed to summarize and evaluate.

And so, let us look at the whole evaluation process with the example of one expert. The expert answers, for example, the following question: "To what extent does ELR1 or ELR2 have a higher level of multimedia and visibility of the presented material?"

The results of the comparisons should be expressed in numbers with the help of a special table (Table 1), the upper limit of which is equal to 9 (the upper limit is justified (Scott, Dana:, 1964, pp 69-70).

Table 1. Saati comparison scale

Oral judgments	Numerical judgments
Equal value	1
Moderate predominance of one over the other	3
Significant or strong predominance	5
Significant predominance	7
Very strong dominance	9
Intermediate decisions between neighboring judgments	2, 4, 6, 8

Thus, the expert answers with one of the numbers for comparison. Conventionally, the comparison is always performed for the action or object in the left column in relation to for the action or object in the upper row.

Based on these numbers, we need to construct a matrix, the elements of which will be positive, and the matrix itself will be inversely symmetric (A matrix is called inversely symmetric if for any i and k the relation holds $a_{ki} = 1 / a_{ik}$).

If we compare the element with itself, we will see that it has equal power, so at the intersection of the ELR 1 and ELR 1 (ELR 1, ELR 1) we enter 1. Therefore, the main diagonal of the matrix must consist of 1. For inverse comparison, we enter the corresponding reciprocal values (Table 2).

Table 2. The results of the comparison of ELR according to the criterion "The level of multimedia and visibility of the presented material", given by the first expert

The level of multimedia and visibility of the presented material	**ELR 1**	**ELR *2***	**ELR 3**	**ELR 4**

ELR 1	1	**0.5**	**0.5**	**3**
ELR 2	**2**	1	**1**	**5**
ELR 3	**2**	**1**	1	**5**
ELR 4	**0.33**	**0.2**	**0.2**	1

The next step is to calculate the priority vector of the given matrix. Mathematically, this is the calculation of the main vector, which after normalization becomes the vector of priority. Let's use one of the methods of rough calculation of this vector. Divide the elements of each column by the sum of the elements of that column to get the matrix below (Table 2).

Table 3.

The level of multimedia and visibility of the presented material	**ELR 1**	**ELR 2**	**ELR 3**	**ELR 4**
ELR 1	**0.19**	**0.19**	**0.19**	**0.21**
ELR 2	**0.38**	**0.37**	**0.37**	**0.36**
ELR 3	**0.38**	**0.37**	**0.37**	**0.36**
ELR 4	**0.06**	**0.07**	**0.07**	**0.07**

Then we should sum the elements of each line and divide that sum by the number of elements in the line. As a result, we will get the vector-column of priorities (0.193, 0.368, 0.368, 0.071).

The above actions are performed by experts for each criterion. Quantitative quality index of each of the alternatives is calculated. Then the same approach should be applied and the evaluation criteria shall be compared in pairs.

The final priorities are determined by a linear function in which the relative priorities of the alternative are multiplied by the importance of the corresponding criteria and summed.

The e-learning resource that will have the highest overall priority will be recognized as the best educational resource and it can be introduced into the educational process as an e-learning resource on this discipline.

The hierarchy analysis method can be implemented both with the help of Microsoft Excel program and Expert Choice support system.

Various modifications of the hierarchy analysis method are used to make various multi-criteria decisions. For example, it is interesting using different variations of the hierarchy analysis method to assess students' knowledge (Grigorjan N.D., 2012).

A multiplicative method of hierarchy analysis and the simplified version of the hierarchy analysis method also have a great practical significance in making multi-criteria decisions.

The simplified version of the multi-criteria expert method of hierarchy analysis is much simpler both at the stage of matrix comparison and in the final calculation of the weight vector for as many objects as you want.

Using a simplified version of the hierarchy analysis method, the expert selects the main element for each criterion, after which he or she compares not all the elements in pairs, but only the main element with all the others. Fill in the line corresponding to the main element of the matrix. The remaining elements of the matrix are automatically calculated based on the fact that the matrix is coordinated, ie $a_{ij} = a_{ik}. a_{kj}$, i, j, k = 1, 2, ..., n.

When making decisions on e-learning resources quality assessment, a simplified version of the hierarchy analysis method can be used, when we need to evaluate the quality of a large number (more than 10) of e-learning resources.

CONCLUSIONS

Thus, the use of the various methods of hierarchy analysis for e-learning resources evaluation has a number of merits.

- allows you to really describe the problem, that is, to build the necessary hierarchy: setting a goal, setting the necessary criteria, separating the suitable alternatives
- allows combining quantitative and qualitative characteristics,
- assists in making decisions based on the opinions of a group of e-learning experts.

We would like to note that the hierarchy analysis method and its variations can be used both in the education system to solve many problems (for example, to determine the best graphic work, the best school, the best faculty, career choice, students' knowledge assessment (Grigorjan N.D., 2012), etc.), and in making multi-criteria decisions within other areas (economics, marketing, social media, etc.). The application of the method will allow you to make decisions based not on intuition, but on specific mathematical calculations. And this will allow you to identify the components of this problem and help you make the right decision.

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