

Defining a system of indicators for evaluation the effectiveness of e-learning

Donika Valcheva, Margarita Todorova

Abstract: *In this paper some approaches for evaluation the effectiveness of e-learning are discussed. A new method for evaluating the effectiveness of virtual environment is presented and the basic groups of quality indicators are classified.*

Key words: *E-learning, effectiveness, quality indicators, classification.*

1. Introduction

In its different forms the e-Learning offers a set of considerable priorities over the traditional teaching:

- Individual instruction;
- Reduced costs;
- Opportunity for team work;
- Flexibility of the learning material, etc.

The implementation and usage of the virtual learning require large investments of time and money. That is why the evaluation of its effectiveness is necessary to be done. In the last few years the research work that has been made in that direction is very limited. [1,2,3,5] Here are some general approaches for evaluation the effectiveness of e-learning [4]:

- Comparison with traditional learning – this approach is a study that compares e-learning effectiveness with traditional learning by preliminary determined quality indicators.
- Tools and instruments for evaluation of e-learning – they are divided into two types. Firstly there are many on-line data gathering instruments for assessing, typically, the user interface characteristics of software (e.g. students perception questionnaires) or secondly, there devices to record and analyze usage by duration and frequency of log-in, pages accessed, etc.
- Return on investment (ROI) reports – if learning is defined as knowledge or skills acquired by instruction or study; learning efficiency (E) can be defined as the sum of knowledge and skills gained that improves performance divided by the sum of all the information delivered during the learning process.

$$E = \frac{\text{gained knowledge and skills}}{\text{all information delivered}}$$

Perfect learning efficiency - where all of the information delivered leads to learning that improves performance - is achieved at a rate of 1.0.

- Product evaluation – reports describing particular education software. The vast majority of these reports are published or commissioned by the software developers.
- Performance evaluation – another term for this approach is ‘student assessment’. The examination of student performance is a powerful indicator of the effectiveness of e-learning.
- Comparison with hypothetical system, that contains complete set of requirements and functions ensuring relevant set of outcomes. This approach is difficult to be applied, because there are not exact characteristics for the hypothetical system and each user will have his own ideal system as etalon [1] etc.

All the approaches, discussed above, have one common disadvantage – lack of universality.

That is why another generalized approach that will be more universal and will evaluate the different aspects of the e-learning environment is suggested in this paper. The main idea of this approach is that the quality of the virtual learning is directly connected with the concept – measurement of the characteristics of the e-learning components.

For defining the efficiency of the different forms of e-learning some groups of indicators will be defined. These indicators will be used not only for evaluation the effectiveness of existed e-learning platforms but also for developing new ones.

The suggested evaluation method consists of the following main steps:

1) Defining the system of indicators – the following basic groups of indicators are presented:

- a) Software indicators;
- b) Hardware indicators ;
- c) Didactical indicators;
- d) Communication indicators;
- e) Information indicators.

The offered system of indicators is open and its content can be changed and modified depending on the concrete applications and goals of the education. Each of this group contents of a large set of concrete indicators, which can have quantity or quality measure.

2) Quantifying the quality indicators - some of the indicators will be transformed into quantity form. It may be done by grading or specifying numerical evaluation scale or by breaking the generalized indicators into sufficiently great number of components, which can be measured with logical values (true and false). This gives an opportunity for presenting in numerical evaluation scale, the rate of accomplishment of the general indicators.

3) Defining the weights of the coefficients - one of the most widely used approaches of defining weights of the indicators is the expert evaluation method. This methodology is based on getting an interview from specialists in concrete sphere and processing the results of the questionnaires;

4) Defining the general evaluation of efficiency of virtual environment by appropriate goal function.

2. Defining the system of indicators

In this paper the first step of the suggested evaluation approach will be discussed and the main quality indicators will be classified and defined.

2.1 Software indicators for evaluating the effectiveness of the virtual learning.

The basic software component of the e-learning is the software platform for e-learning. The great variety of software indicators measures the features and the characteristics that are visible not only for the users (the students, the teachers; the content builders, the administrators, etc.), but also for the developers of the e-learning environment:

- Interoperability – to support content from different sources and multiple vendors' hardware/software solutions, the system should be based on open industry standards for Web deployments (XML, SOAP or AQQ) and support the major learning standards (AICC, SCORM, IMS and IEEE) [6];
- Accessibility – the access, delivery and presentation of the material is easy-to-use and highly intuitive; the software platform is robust enough to serve the diverse needs of thousands of users;
- Navigability - Every screen/page has a standard primary navigation area, allowing users to go directly to the desired screen/page;

- Flexibility – to exist an opportunity for changes in the content;
- Reliability – to give acceptable results even if there are invalid inputs. The assessment gives an opportunity refusals and situations that involve refusals to be predicate;
- Portability – to be independent from the users' operating system and to be used by widespread browsers such as Internet Explorer, Netscape Communicator etc;
- Functionality – to be useful enough for its users;
- Stability – to manage a large implementation running 24x7 (24 hours per day and 7 days per week);
- Accountability - the classifying, testing and the assessment are automated in such a way that the participants are distributed according to their responsibilities in the process of learning;
- Security – the system selectively limits and controls access to the online content and resources for its diverse user community;
- Costs indicator – measured the costs for purchasing the system, its exploitation and support, etc.

2.2. Hardware indicators for evaluating the effectiveness of the virtual learning -

The effectiveness of the modern e-learning environments depends on the presence of different multimedia hardware components that gives an opportunity for usage of multimedia application and makes the process of learning more interesting and attractive. There is no better manner to support e-learning without including multimedia in the courses material. In addition, there are many tools to create media elements, like images, sound and video, and thousands of media elements are already available over the Internet. But, just putting all these media items together in the same document will not necessarily enhance the course quality. Those media should be synchronized to make a good presentation of a document and reflect over time the content used by the teachers like gesture, demonstrations and examples. The suggested from us hardware indicators for evaluating the effectiveness of the virtual learning are:

- Parameters of the micro-processor;
- The memory capacity;
- The speed of the Internet access (for the web-based learning);
- Presence of input/output devices for multimedia data processing.

2.3. Didactical indicators for evaluating the effectiveness of the virtual learning

It is very important for the effectiveness of every e-learning environment, the course material to be structured and projected in a proper way, according to the following didactical quality indicators:

- Personalized teaching - the tools for self-teaching helps the students to study according to their capabilities and free time, to choose the form and the way of providing the material on the basis of their own predilections;
- The material is presented in a logical sequence. Broken into small, incremental learning steps;
- The material is linked to other sources, with reading assignments clearly specified;
- The material is Illustrated by examples and/or case studies when new information is presented;
- Encouragement for critical thinking, creativity, and problem-solving.
- Relation to other material the learners have studied;
- Usage of illustrations, photographs, animations, and other forms of multimedia in order to present facts and reinforce concepts.

- Abbreviations and symbols are defined.
- Clear and direct writing style
- Appropriate language level for the intended audience.
- Clear expectations and criteria for credit assignments. Examples of assignments that meet the criteria are included for students to review.

2.4. Communication indicators for evaluating the effectiveness of the virtual learning

Nowadays one of the most important aspects of every e-learning environment is the communication strategy. We defined the following communication quality indicators:

- Collaboration between learners - opportunity for team work;
- Opportunity for communication by e-mail;
- Opportunity for mobile communications;
- Opportunity for communication by on-line conferences, discussions, chat, etc;
- Multilanguage support.

2.5. Information indicators for evaluating the effectiveness of the virtual learning.

Another aspect of the e-learning environment that is of great significance is the information. Every effective e-learning environment must suit the following information indicators:

- Usefulness – depends on the concrete goals, interests, motivation and knowledge of the student;
- User satisfaction – the information is evaluated according to the user gratification;
- Information value - it depends on the extent of its authenticity, actuality and clearness.

3. Conclusion and future work

The evaluation of the effectiveness of e-learning is very important for both - the whole analysis and the improvement of a given system.

The effectiveness can be defined by a definite target function, where regardless of its analytical aspect; a given number of indicators are included. Their importance can be defined by appropriate, objectively estimated coefficients' weights.

The right assessment for the rate of importance of the different indicators ensures an adequate rate of objectivity of the whole process of e-learning evaluation.

The next task and future goals of the authors are:

1. Defining weights of the indicators' coefficients for evaluation the effectiveness of e-learning by the expert evaluation method;
2. Some of the indicators will be transformed into quantity form. It may be done by grading or specifying numerical evaluation scale;
3. Normalizing the indicators. On this stage all indicators will be presented in general unified grading scale;
4. Developing a Web-based application for data gathering, in order the different generalized indicators to be evaluated;
5. Defining the general evaluation of efficiency of virtual environment.

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ABOUT THE AUTHORS

Associate Prof.Dr. Margarita Todorova, St.Ciryl and St.Methodius University of Veliko Turnovo, e-mail: marga_get@abv.bg
Donika Valcheva, St.Ciryl and St.Methodius University of Veliko Turnovo
PhD e-mail: doni_ka@mail.bg