

Method of Evaluation of Electronic Educational Resources Quality for Conformity Assessment (Certification)

Dmytro Fedasyuk¹, Nataliya Hots¹, Mykola Mykyychuk¹, Viktor Kuts¹, Yuliia Dzikovska²

¹ Lviv Polytechnic National University, Lviv, Ukraine
natalia.gots@lp.edu.ua

² Lviv Polytechnic National University, Lviv, Ukraine
pastsvitlo@gmail.com

Abstract. In the article the expediency of quality assessment and certification of electronic educational resources of the higher education institution is justified. The order and scheme of internal certification of electronic educational resources are formed as a result of research. Certification includes the software-technical and complex expertises. Also this article includes a system of criterias for the complex expertise of electronic educational resources (criterias of structural, scientific and methodological assessment). The quality level evaluation method of electronic educational resources is proposed on the basis of the expert assessment of compliance with the requirements. In the article the extension of this algorithm by necessity to take into account the views of consumers and the opportunity to provide a recommendation for getting ISBN are provided.

Keywords: Electronic educational resource, electronic educational edition, certification, Qualimetry, ISBN.

Key Terms. TeachingProcess, KnowledgeManagementProcess, StandardizationProcess, Development.

1 Introduction

The formation of a highly qualified specialist in the modern university is based on student's necessity of processing large amounts of information. Today we can define the following global trends in the informatization of educational process:

- extension of usage of distance education technologies in all fields of training;
- appearance of e-books and e-courses industry;
- steady entry to market new suppliers of technologies for e-learning;
- standardization of electronic content and electronic educational environments;
- development of distant education system of network electronic universities.

The transition to individual learning, the growth of the self-learning, the introduction of distance education, the quality assurance of different forms of educational process need to be supported in the educational process by modern educational literature, which includes advanced scientific developments and innovative technical solutions of world-class.

Therefore, the introduction into the educational process electronic educational resources, that involves the formation of electronic educational and scientific literature fund in the university and electronic educational editions, is important. Electronic educational editions can be viewed as an automated training information system, which includes learning, methodical, research and reference materials for academic subjects. It allows for the use of them in the learning process based on the appropriate software.

It should be noted that the quality of education largely depends on quality of educational manuals and textbooks that are used by students. To control and provide the quality of electronic educational literature of university it is appropriate to certify the electronic educational resources, that means to evaluate their compliance with certain requirements on the content, structure, included information, functionality and training capabilities, advanced scientific statements. Therefore, the development of principles of certification of electronic educational resources with the following definition of their quality level is actual task.

2 Certification of electronic educational resources

Electronic educational resource is a set of teaching, research, information, reference materials and tools developed in electronic form and presented in media of any kind or placed in computer networks, which are reproduced by electronic and technical means and are necessary for effective organization of the educational process, as part that is related to its filling with the qualitative teaching and methodical materials.

2.1 General requirements for electronic educational resources

Information about electronic educational resources is contained in these normative documents [1,2,3].

However, it should be noted that these normative documents contain only general classification information. The widest information regarding the classification of electronic educational editions is presented in the Order of the Ministry of Education and Science of Ukraine [4], which reveals the definition of electronic educational resources, their types, procedure for development and implementation. But unfortunately, these documents do not contain any requirements for the filling and forming of electronic educational resources.

Further international requirements for electronic educational resources are considered.

In the development of international standards for information and communication educational means the cooperation between the International Organization for Stand-

ardization and other international organizations and committees, including the International Electrotechnical Commission, is important. International Standard ISO/IEC 19796: 2005 Information technology – Learning, education and training – Quality management, assurance and metrics [5] is the basis for the description, comparison, analysis, quality management and quality assurance approaches in this area. It serves as a tool for comparison of existing approaches and their coordination based on the total quality model. The key element of the standard is the Reference Framework for the Description of Quality Approaches.

Standard ISO/IEC 19796: 2005 consists of three parts:

- ISO/IEC 19796-1:2005 – Part 1: General approach – the first step towards building a harmonized model for learning quality based on IT;
- ISO/IEC 19796-2 – Part 2: Harmonized quality model – defines the tools and metrics in order to implement a common approach to quality;
- ISO/IEC 19796-3:2009 – Part 3: Reference methods and metrics – expands the boundaries of the Reference Framework for the Description of Quality Approaches, mentioned in the previous part of Standard ISO/IEC 19796-1:2005. It is done by the introduction of harmonized description of the methods and metrics recommended for quality assurance's system implementation, quality management of stakeholders, who are engaged in the design, development, utilization of IT systems for learning, education and training.

But unfortunately, most of the requirements of ISO/IEC 19796: 2005 apply only to the requirements about the quality of design, development, utilization of IT systems for learning, education and training. Therefore we can say that international standards also do not reveal the concept of quality of electronic educational resources, do not include requirements to ensure it.

As noted above, the introduction of electronic educational resources in the educational process is a worldwide trend today. There are various methods in the literature for their quality control [6,7,8,9,10]. In particular, their common disadvantages can be considered:

- the formation of too many requirements which complicates the assessment and determining to what extent evaluation is satisfactory;
- the duplication of requirements content;
- presented methods for monitoring and testing do not systematize the requirements;
- methods of structural expertise allow to evaluate only the structure, not substantive, methodological and scientific filling of electronic educational resources;
- complexity of algorithms for evaluation.

But all these methods are aimed at one goal – to control the compliance of electronic educational resources to specific requirements. This process is called certification in the technical regulation. It is an action of a third party who proves that provided the necessary confidence that the duly identified product, process or service correspond to a specific standard or other normative document [11].

Therefore it is advisable:

1. To ensure and to control the quality it is necessary to form a list of requirements for electronic educational resources and to develop the methodology for internal certification of electronic educational resources in the university based on provisions of existing certification rules.
2. To implement the comparability of the various components of electronic educational resources it is necessary to develop a methodology for evaluation of their quality level on the basis of the theory of Qualimetry as evaluating the degree of conformity of electronic educational resource to established requirements.

Among the existing list of components of electronic educational resources in the normative documents we consider that it is advisable to carry out certification for the following: electronic textbook, electronic learning manual, electronic teaching-methodical complex, electronic display didactic materials (video lessons) and electronic distance learning course.

2.2 Algorithm of certification procedure of electronic educational resources

The purpose of certification of electronic educational resources is to be consistent with current scientific and technical requirements with the subsequent formation of the fund of the educational and scientific literature for the needs of the educational process of the university. At the stage of formation of electronic educational resource there is it's full filling using electronic teaching and methodical resources completely accordance with the criteria of software-technical, educational, scientific and methodical expertises.

Certification of electronic educational resources is offered to carry out in two stages: the first stage includes a preliminary examination, the results of which the expert's opinion is consisted; the second stage involves complex expertise, based on the result of which an expert certification committee decides on the certification of electronic educational resources and prepares recommendations for its entry in the register of electronic educational resources of the university. The procedure for certification of electronic educational resource, that is designed based on [3,4], generally involves the following steps according to Figure 1:

1st stage:

- document preparation and submission of an application for certification of electronic educational resources;
- previous (software-technical) expertise, documentation analysis;
- expert's opinion regarding the performance of electronic educational resources.

2nd stage:

- complex examination of electronic educational resources (structural, scientific and methodological expertises);
- evaluation of the degree of compliance with the requirements;
- analyzing of the obtained results and deciding on the possibility of issuing a certificate of conformity;

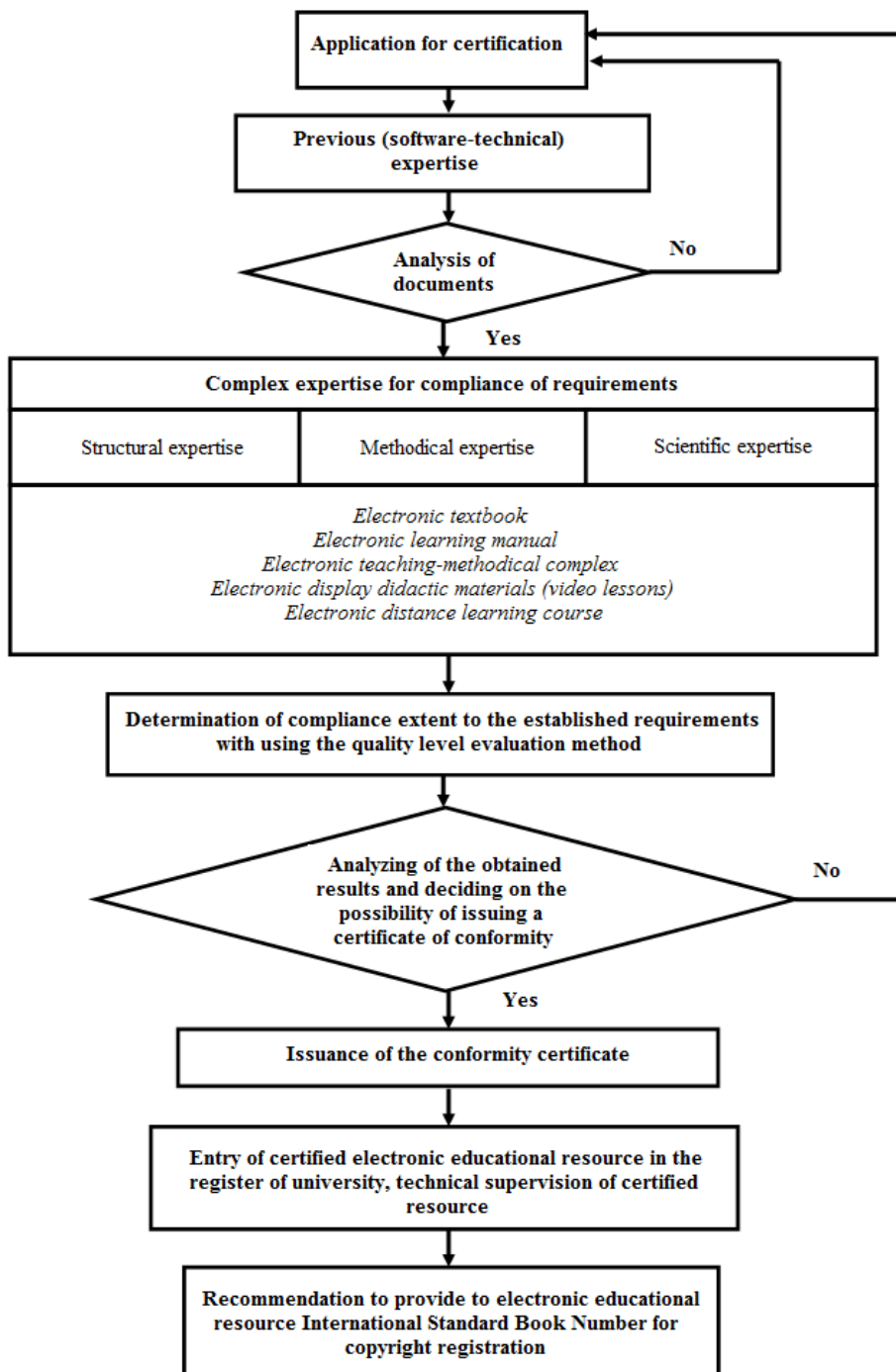


Fig. 1. Procedure of certification of electronic educational resource

- issuing the conformity certificate and entering certified electronic educational resources in the register of teaching electronic educational resources;
- technical supervision of certified electronic educational resource;
- informing about the results of certification.

The content and requirements of each expertise have been developed.

For each of these expertises are developed point scale of assessment of the implementation of the requirements (according to the theory of Qualimetry their volume is 7) and their respective weight coefficients.

To assess the degree of compliance with the requirements it is offered a method that is based on theory of Qualimetry [12], the method of differential quality indicators, taking into account the weight coefficients and using the arithmetic mean weight and weighted ratios parameters for results of certain types of expertise by the model:

$$\left\{ \begin{array}{l} K = \sum_{i=1}^N n_i \cdot k_i, \quad \sum_{i=1}^N n_i = 1, \quad N \leq 7 \\ k_i = \sum_{j=1}^J n_j \cdot k_{ij}, \quad \sum_{j=1}^J n_j = 1, \quad J \leq 7 \\ k_{ij} = \frac{P_{ij}}{P_{ij}^{bas.}} \quad or \quad k_{ij} = \frac{P_{ij}^{bas.}}{P_{ij}} \end{array} \right. \quad (1)$$

where K – generalized indicator of quality; k_{ij} – relative indicators of quality for certain types of expertise; k_i – group indicator of quality; n_i , n_j – weight coefficients; $P_{ij}^{bas.}$, P_{ij} – indicators of quality for basic and the existing levels.

Relative indicators of quality are defined for each parameter in all types of expertise and $\max(k_{ij}) = 1$.

Group indicators of quality are defined for each group of parameters of separate expertise and $\max(k_i) = 1$.

Generalized indicator of quality contains all information about the individual values of relative indicators of all parameters for each group and $\max(K) = 1$. As this is ideal option and in reality some of relative indicators can be less than 1, the decision of positive result of certification of electronic educational resource is offered to accept when the value of generalized indicator of quality is within: $0,8 \leq K \leq 1$ according to Harrington's scale. When $0,63 \leq K < 0,8$, electronic educational resources is sent for revision to correct deficiencies. Electronic educational resource is removed from the list of resources, that are certified, if $K < 0,63$.

The developed method allows the assessment of the degree of compliance of electronic educational resource to established requirements (based on expert evaluation) and identify important indicator – the level of quality.

2.3 Evaluation of the views of consumers about the quality of electronic educational resources

Assessment of quality of electronic educational resources is impossible without taking into account the views of consumers, including people, who are trained. Therefore, we developed example of questionnaire, in which customer requirements are formed. Questionnaires can be made at the end of the study course. The results can be attached to the methodology of evaluation of the conformity degree of electronic educational resources to established requirements.

3 Ownership on the electronic educational resource

As a result of a positive outcome for the certification of electronic educational resources, recommendation for getting the International Standard Book Number (ISBN) can be provided. ISBN is universal identification code that is put on the books and brochures, on different data storages regardless of their mode of production, distribution, circulation and volume. ISBN accompanies a publication from the time of its manufacture, allows the getting into the international database – the Global Register of publishers.

ISBN is also provided to the electronic publications in accordance with SSU/DSTU 7157: 2010 [1], Instruction on providing procedure of the International Standard Book Number in Ukraine [13] and the International Standard ISO 2108: 2005 Information and documentation. International Standard Book Number [14].

Also, it is necessary to add, that today practically the one way to protect the intellectual property in Ukraine is the registration the copyright by State Intellectual Property Service to obtain appropriate certificates for electronic educational resources according to [15,16]. Although registration is not a condition of the legal protection of work, but gives the right to judicial protection, that is the right to file legal action for copyright infringement.

4 Conclusion

Electronic educational resources make possible to present systematically the teaching materials, to make it more accessible for study and open to adjustment and further improvement. Using of electronic educational resources in the educational process will help to provide technologically the process of individualization of learning, the process of implementation of distance education, informatization of educational process in higher educational institutions. The proposed method allows the estimation of the quality level electronic educational resource based on the results of the examination. The result of the certification of electronic educational resources should be formation of electronic fund of modern educational and scientific literature in the university as part of the quality assurance system of educational process for various forms of learning.

In addition, this algorithm is universal and can be applied in any educational institutions, including during the training or retraining of staff, in particular during the certification of training programs for the specialists of nondestructive thermal control using thermal imaging technology.

References

1. SSU/DSTU 7157: 2010 Information and Documentation. Electronic Editions. Main Types and Output Information (Інформація та документація. Видання електронні. Основні види та вихідні відомості). – Effective as of 2010-07-01. – К.: State Committee of Ukraine for Technical Regulation and Consumer Policy (Держспоживстандарт України), 2010. – 13 p.
2. SSU/DSTU 4861:2007 Information and Documentation. Edition. Output Information (Інформація та документація. Видання. Вихідні відомості). – Effective as of 2009-01-01. – К.: State Committee of Ukraine for Technical Regulation and Consumer Policy (Держспоживстандарт України), 2009. – 45 p.
3. SSU/DSTU 3017-95 Edition. The Main Species. Terms and Definitions (Видання. Основні види. Терміни та визначення). – Effective as of 1996-01-01. – К.: State Committee of Ukraine for Technical Regulation and Consumer Policy (Держспоживстандарт України), 1995. – 47 p.
4. Order of Ministry of Education and Science, Youth and Sports of Ukraine from 01.10.2012 # 1060 On Approving Regulation of Electronic Educational Resources (Наказ Міністерства освіти та науки, молоді та спорту України від 01.10.2012 № 1060 Про затвердження положення про електронні освітні ресурси) [Electronic resource]. – Access mode: <http://zakon5.rada.gov.ua/laws/show/z1695-12>. – Title from screen.
5. ISO/IEC 19796-1:2005 Information technology – Learning, education and training – Quality management, assurance and metrics – Part 1: General approach [Electronic resource]. – Access mode: http://www.iso.org/iso/catalogue_detail?csnumber=33934. – Title from screen.
6. Quality Criteria for Digital Learning Resources [Electronic resource]. – Access mode: https://iktsenteret.no/sites/iktsenteret.no/files/attachments/quality_criteria_dlr.pdf. – Title from screen.
7. Regulations on Certification of Educational Electronic Editions for Higher Education Programs (Положение о сертификации учебных электронных изданий по программам высшего образования) [Electronic resource]. – Access mode: <http://istu.ru/component/jdownloads/viewdownload/5/1580?Itemid=0>. – Title from screen.
8. Kravtsov, G.M.: Structure of Quality Management System of Electronic Teaching Resources of University (Кравцов Г.М. структура системы управления качеством электронных ресурсов обучения университета) [Electronic resource]. – Access mode: http://lib.iitta.gov.ua/745/1/KravtsovH_issue10.pdf. – Title from screen.
9. Kravtsov H. Methods and Technologies for the Quality Monitoring of Electronic Educational Resources [Electronic resource]. – Access mode: http://ceur-ws.org/Vol-1356/paper_109.pdf. – Title from screen.
10. Regulation on electronic learning resources of HNTU (Положення про електронні навчальні ресурси ХНТУ) [Electronic resource]. – Access mode: <http://kntu.net.ua/index.php/ukr/Setevye-resursy/Elektronne-navchannya>

HNTU/Normativne-zabezpechennya/Polozhennya-pro-elektronni-navchal-ni-kursi-HNTU.
– Title from screen.

11. DSTU ISO/IEC 17000:2007 Conformity assessment. Glossary of terms i general principles (ISO / IEC 17000: 2004, IDT). – Effective as of 2008-04-01. – К.: State Committee of Ukraine for Technical Regulation and Consumer Policy (Держспоживстандарт України), 2008. – 20 p.
12. Kutz, V.R., Stolyarchuk, P.G., Druziuk, V.M.: Qualimetry: Tutorial (Кваліметрія: навчальний посібник / В.Р. Куць, П.Г. Столярчук, В.М. Друзюк). – Lviv: Publishing House of Lviv Polytechnic National University, 2012. – 256 p.
13. Instructions on the International Standard Book Number (ISBN) in Ukraine (Інструкція про порядок надання Міжнародного стандартного номера книги (ISBN) в Україні) [Electronic resource]. – Access mode: http://www.ukrbook.net/zakony/instr_isbn.pdf. - Назва з екрана.
14. ISO 2108:2005 Information and documentation – International standard book number (ISBN) [Electronic resource]. – Access mode: http://www.iso.org/iso/catalogue_detail?csnumber=36563. – Title from screen.
15. On copyright and related rights. – Law of Ukraine, Resolution of Verkhovna Rada number 3792-12 of 12/23/1993 // Verkhovna Rada of Ukraine (Про авторське право і суміжні права. – Закон України: постанова Верховної Ради № 3792-12 від 23.12.1993 р. // Верховна рада України) [Electronic resource]. – Access mode: <http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=3792-12>. – Title from screen.
16. The Order of State Registration of Copyright and Agreements Concerning Copyright to Work, Cabinet of Ministers of Ukraine of 27.12.2001 # 1756 // Verkhovna Rada of Ukraine (Порядок державної реєстрації авторського права і договорів, які стосуються права автора на твір: постанова Кабінету Міністрів України № 1756 від 27.12.2001 р. // Верховна рада України) [Electronic resource] – Access mode: <http://zakon.rada.gov.ua/cgi-bin/laws/main.cgi?nreg=1756-2001-%EF>. – Title from screen.