

Andrii Kostiuchenko,

T. H. Shevchenko Chernihiv National Pedagogical University,

Liudmyla Matviichuk,

T. H. Shevchenko Chernihiv National Pedagogical University,

Sergii Gorchynskyi,

T. H. Shevchenko Chernihiv National Pedagogical University,

Nataliya Min'ko,

T. H. Shevchenko Chernihiv National Pedagogical University,

Liudmyla Kukhar,

National Pedagogical Dragomanov University

The choice of criteria of pedagogical software quality, for expert evaluation

Abstract: The problem of quality evaluation of pedagogical software, as one of constituents of computer-oriented learning tools, is considered in the article. General software quality indicators are analyzed. A list of quality indicators of pedagogical software based on them is formulated and their content is disclosed. The methods that can be used for quality evaluation of pedagogical software are described and the use of the peer review as the most complete and reliable method is grounded.

Keywords: pedagogical software, indicators of pedagogical software quality, expert evaluation.

1. INTRODUCTION

Target Setting

The advent of computers in schools gave birth to the software programs designed to train students in programming. Then, there were supporting programs to train students in other subjects. Such programs and tools became known as “pedagogical software”.

Pedagogical software (PS) is software designed to support computer training and to achieve specific learning goals [9, p. 5]. The concept of PS in the research [3]

is rather similar, namely: PS – the software products used in computer-assisted instruction systems as means teaching or educating students.

Under studies [1, 3, 4, 10], PS can refer to the computer-based learning tools or e-tools of educational character, that is, in general, learning tools based on information and communication technologies and stored on digital or analog data media as well as reproduced by means of the electronic equipment (computer programs of the general educational didactic direction, spreadsheets, electronic libraries, slide-shows, test tasks, virtual laboratories, etc.) [4]. However, PS is one of the main components of a computer-oriented complex including, in addition to PS, methodological and didactic materials and facilities designed to use these programs for the computer support of educational and cognitive activities.

Actual Scientific Researches and Issues Analysis

General issues concerning the design and use of electronic and computer-oriented teaching aids are treated in works of scholarly interest written by Bykov V. Y., Lapinskyi V. V., Zhaldak M. I., Shut M. I., et al. In particular, their research [1] considers possible approaches related to the classification of e-learning resources. A significant contribution to the study of issues concerning the PS use was made by Zhaldak M. I., Horoshko Y. V., Morz N. V., et al. Some works of foreign scientists: Philip Bayard Crosby, Joseph M. Juran, Frank M. Gryna, Chertkov E. A., Gurov V. V. and Ukrainian scientists: Morhun I. A., Botsula M. P. are devoted to software quality. Chertkov E. A. in his article [2] considers the specification of functional requirements for the computer training programs and approaches used for the development of the document-concept structure as the common part of the specification integrated for software.

PS Requirements, In addition to the quality criteria, have a big impact on quality characteristics that can be used in the expert assessment of the developed PS. Most of them listed in the paper [8] can be presented to the teaching staff. They include pedagogical (didactic, methodological, substantiation of the subject selection), technical, ergonomic, physiological, hygienic, aesthetic requirements, and requirements for execution of documents.

The purpose of the article is to review the existing quality characteristics of software tools and to make a list of the PS quality characteristics on their basis.

2. METHODS OF RESEARCH

The study was carried out within the framework of the training course under the title: "Programming Technologies and Creation of Pedagogical Software" developed for the Physics and Mathematics Department of T. H. Shevchenko Chernihiv National Pedagogical University. Theoretical analysis, systematization and generalization methods were used as part of the research study. The critical analyses of theoretical sources concerning the software quality evaluation issues was conducted, as well as the experience of domestic and foreign scientists was examined to determine the pedagogical software quality criteria. To obtain quantitative values of the created PS quality index, the method of expert evaluation was chosen, and on the basis of which, an experimental check of the PS quality criteria list proposed during 2013-2016 was carried out.

3. RESEARCH FINDINGS

Presentation of Basic Material of the Research

The process of any software quality assurance is a process of appropriate guarantees that software measures up the imposed requirements. The very concept of software quality is defined as a set of software properties determining its suitability to meet specified requirements in accordance with its purpose. Demianenko V. M. and Shishkin M. P. note in their article [5] that pedagogical software quality can be understood as the degree characterizing how a set of properties of the software product can meet the learning process needs and contribute to the achievement of learning objectives." Any software quality is evaluated by a large number of various characteristics, which, in their turn, include a whole series of subcharacteristics.

The quality specification development means the building of the unique quality model for software to be created. Such a model should contain a list of all the properties that need to be involved in the creating software. In this case, each of such properties should be sufficiently specified for the possibility of its evaluation in any developed software.

The choice of software quality characteristics is a complex process. There are their various classifications. But, a set of six software quality characteristics outlined in the International standard ISO 9126: 2001 [6] is universal for any class of software and consists of:

- functionality providing users with the opportunity to resolve issues necessary for them within the relevant field under given conditions;
- reliability giving users an operability of some quality under the conditions for a specified period of time;
- usability providing users with some easy use;
- efficiency, which is able, under given conditions, to provide the operational capacity demanding in relation to the resources allocated to it;
- maintainability - the convenience of carrying out all the activities associated with the program maintenance;
- portability – some saving functionality when moving PS from one place to another with taking into account the organizational, hardware and software aspects of the environment. This characteristic is sometimes called mobility in the domestic literature.

According to another International standard ISO 9126: 2004 [7], a narrower set of characteristics is proposed below:

- effectiveness providing users with the opportunity to complete tasks in a specific domain with the required accuracy;
- productivity providing users with necessary results in the framework of the expected resource consumption;
- safety ensuring a low risk causing loss of life and health of people, business, property or some environment;
- satisfaction as the ability to bring pleasure (comfort, acceptability, utility) to users when software is used in a given domain.

Based upon the software quality standard ISO 9126: 2001, we made a list of PS quality specifications and reveal their identity. Quality characteristics reviewed above can be divided into two groups: characteristics that are more relevant to users that is some reliability, functionality, usability or practicality, efficiency or productivity; and quality characteristics - portability, learnability and modifying that are more centered on the programmers.

Reliability is a capability providing users with some opportunity, thanks to PS, to perform some functions without any fail in the given conditions for a specified period of time. Simultaneously, the failure of any execution is understood as the occurrence of errors in it. Thus, a reliable PS does not exclude the presence of some errors in it and it is important that such errors will meet very rare when this PS is used

in practice under specified conditions. To verify that the PS meets this or that requirement is possible, when we use it through testing or in practice.

Functionality provides any user with some opportunities to perform a set of functions meeting tasks or possible needs of users in the relevant domain thanks to PS.

Usability is a characteristic of PS, according to which, the user's efforts to prepare the initial data for own use and analysis of the obtained results are minimized, as well as some positive emotions will arise when using it.

Efficiency (productivity) is the ratio of the level of services received, when using PS, to the amount of the computer resource consumption.

Portability is a characteristics ensuring operability of PS when it moves without much efforts from one hardware and software environment to another.

Learnability is a characteristic, due to which, you can minimize efforts to study and understand the program and its documentation.

Modifying is the characteristics reflecting the possibility of making changes in any PS without much time spending for its next configuration.

There is a problem how to evaluate any PS quality and to check whether it meets the characteristics mentioned above. It should be noted that in modern theoretical and practice-oriented studies, there are several approaches to the problem of the PS quality evaluation. We can distinguish:

- criteria-based assessment of their methodological validity based on the use of quality assessment criteria;
- experimental verification of their pedagogical expediency use which is based on the practical approbation in the learning process during a certain period of time;
- expert quality assessment based on the competent opinion of experts who know this branch of knowledge and have the scientific and practical potentials for decision-making;
- integrated quality assessment integrates all or some of the approaches outlined above.

The initial assessment of any methodological validity is carried out by analyzing the compliance of PS with the above criteria. The method of criterion estimation can be combined with the use of testing programs to analyze accuracy, stability, security, etc.

Some domestic and foreign experience in assessing PS quality convinces us of the expediency of conducting an expert assessment of PS quality which is used for training purposes.

During the expert evaluation, two groups of experts can be formed: the first one consisting of scientific leaders in the field of education will also include the teaching staff and programmers. In particular, one person can act both as an expert in the field of education and as a professional programmer. The second group will involve users who can be the professionals belonging to the first group, subject teachers, and the best students of senior courses who have already been practicing at school.

4. CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

Summing up, it is determined that PS quality assessment issues are closely related to some software quality evaluation and PS requirements. It is shown herein that in order to assess the PS quality, it is convenient to take the expert evaluation methods recommended by a group of experts as a basis due to their use and reliability.

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