Інформаційні технології

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THE DEVELOPMENT OF EDUCATIONAL COMPUTER GAMES

Abstract. The implementation of information and telecommunication technologies in information processes is aimed at achieving a number of goals: accelerating information processing processes and reducing the cost of their implementation, saving a person from the need to perform routine actions and eliminating the negative impact of the human factor on the result of work. The use of electronic teaching aids, that is, using computer technologies in education, not only allows us to achieve these goals, but also allows us to realize a number of unique features that are not available when using traditional teaching aids.

Keywords: the role of educational computer games, development stages, cascading and spiral life cycle.

Introduction

One of the effective ways of e-learning is the use of training systems in which the components of the game process are implemented - educational computer games. One of the problems with the use of e-learning tools is the loss of trainees' interest in learning. The use of computer games can increase the motivation of students, while retaining all the advantages of e-learning.

The development of computer games requires the use of a large number of specialized software tools. In the process of developing modern games, dozens, and sometimes hundreds of specialists in various fields are involved. When developing educational computer games, the same tools and technological developments are used today for standard logical and strategic computer games. As a result, the efficiency of the game development process is reduced. This is due to several factors:

- The complexity of setting the parameters of the learning management process in the game;
- The lack of the necessary tools for managing educational content;
- The lack of quality management mechanisms for evaluating the developmental game.

Another common option for creating educational games is to incorporate game elements into traditional electronic learning tools. The development of such games takes place using tools designed to build learning systems. As a result of the inappropriateness of these tools to the specifics of game development, in particular the use of inappropriate data formats for storing training content and the inability to organize an interactive game process, the motivational effect of the training computer game is reduced [1].

Using information technology allows you to implement an interactive training mode. The interactivity of the learning mode allows the learner to actively interact with the learning system, which is important for stimulating the learner. Interactivity is especially relevant for self-learning, as well as teaching a large group of people when the teacher is not able to pay enough attention to everyone. A good example of interactive teaching materials can be computer models of physical processes and phenomena for students - instead of asking the question "what if we do this ..." to the teacher, the student can try to do this and see an adequate model response [2]. The use of virtual computer models (virtual simulators) can significantly reduce the risks that inevitably arise when training a person on real systems. Another important advantage of such models is the significantly lower cost compared to real systems or full-scale simulators. At present, virtual models have been developed that are used to train almost any technical personnel, which not only simulate the behavior of real systems, but also allow you to work out actions in emergency and emergency situations. The most significant contribution was made by virtual models for training.

Medical personnel, pilots, drivers and the military - that is, specialists in those areas where human life can be at the cost of error.

The purpose and tasks of the publication

The aim of the work is to analyze the development of models, algorithms, and tools for creating computer games with learning elements that allow you to manage the learning process taking into account the features of the interactive game process. Furthermore, The purpose of this publication is to analyze the impact on implementation and on the quality of the developed educational computer games based on cognitive knowledge systems.

Formulation of the problem

One of the key problems of using electronic learning tools is the loss of motivation achieved in traditional learning through direct communication of the student with the teacher. One of the effective ways to solve the problem of motivation is the use of computer educational games, that is, electronic learning tools that actively interact with the user in a game form. At the same time, the benefits of e-learning remain. The phenomenon of the game has been studied many times, but only in the nineteenth and twentieth centuries did scientific interpretations of this phenomenon appear. One of the most famous works that gives the most complete

picture of the role of game activity in human life is the Johan Huizings treatise "The Man Playing", published in 1938. The treatise formulated, and later repeatedly rethought by other researchers, the main characteristics of the game, the most significant of which for the learning process is emotionality and voluntariness of participation. Emotional reward is the main incentive to continue the game as opposed to business activities, in which material incentive is such an incentive. An equally important quality of the gameplay is voluntariness of participation, lack of coercion.

Brain model

A computer game, as a type of software, has certain specifics that are important in building a model of its life cycle. In software development, two main life cycle models are currently distinguished: cascading and spiral.

The cascade model (Fig. 1) assumes that the transition to the next stage occurs only after the work on the previous one is completed. At each stage, a set of documentation is formed, which is the source data for the tasks of the next stage. The main advantage of this approach is the fixing of requirements and the reduction of possible risks. However, in software development it is very rarely possible to adhere to a rigid framework. Changing requirements in the later stages forces one to return to the early stages and re-do the work done.
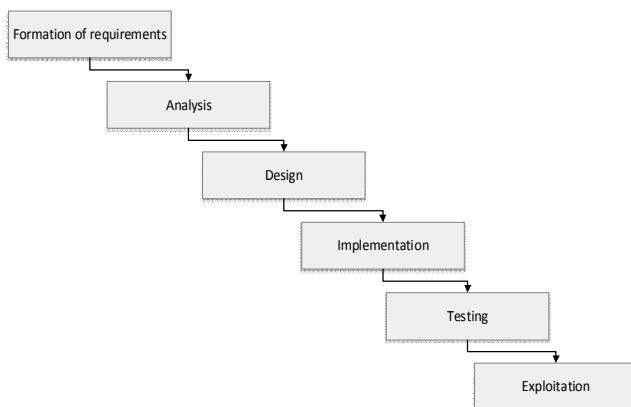

Fig. 1. The Cascading Life Cycle Model

In accordance with the spiral model of the life cycle, it is planned to create a large number of prototypes (versions) of the program. The build-up of the functionality of the program being created is gradual. Making decisions regarding future versions of the program is based on the results of testing intermediate versions. Making changes with the spiral model of the life cycle is much cheaper, since it does not always require a return to the previous stages and the rejection of the work done [5].

The implementation of gaming and training opportunities requires a performance test on test groups. To perform this test, a lot of prototypes are created at the earliest, which implement individual elements of the gameplay or the learning process. Often, the creation of technological prototypes is required to evaluate the fundamental possibility of implementing any elements

of the game. The presence of prototypes that clearly affect the design of the game makes the process of its development similar to a waterfall model [3].

On the other hand, developing software for a game can be a very small part of the labor, and the most time-consuming task of the game development process is to create content. It is often possible to do without programming at all if the software requirements are satisfied by existing solutions.

Making changes that affect the content is expensive even for a waterfall life cycle model [11]. The solution to this problem is a combined life cycle model that has elements of a waterfall model in the development of software and the concept of the game, and a cascade model in the creation of content.

The prototypes use temporary content, the creation of which is significantly less time consuming, or content available from public sources. After performing the necessary checks and clarifying the design of the game, the requirements for most of the content are fixed. In accordance with such a model, the creation of content is postponed to the latest stages of development, and the changes made at these stages are made in such a way as to minimize the loss of content.

Development of the computer educational games

The development of computer games requires the use of a large number of different tools. Among the main tasks in the development of the game, for the solution of which special tools are used, the following can be attributed:

- creation and editing of multimedia content (two-and three-dimensional graphics, video and sound processing);
- creation and customization of game cards;
- content preparation
- programming and debugging programs [6].

Such tasks could advancly improve the educational techniques in various educational institutes [9]. Accordingly, by analogy the quality of the educational computer game can be defined as the totality of the characteristics of the system that determine its ability to provide the required level of knowledge of the student. This ability is determined by many factors: the structure of the training course, the quality of the training content (theoretical materials and practical tasks), the mechanisms used to adapt the learning process to the individual characteristics of the student and the current learning outcomes. The set of quality characteristics related directly to the learning process and the training components of the game makes up the training qualities of the game.

The goal of incorporating game elements into learning systems is to increase the motivation of students. The motivation effect (engagement) of the application of the educational game is determined by the totality of the characteristics that make up its playing qualities: interactivity, competitiveness, plot effects, and multimedia qualities.

The quality of the learning game is not determined by the sum of the playing and learning qualities. On the one hand, the predominance of the learning process, that

is, the suppression of game elements by it for a sufficiently long time, can push the player away, thereby reducing the motivational effect. On the other hand, the predominance of the game process will lead to the fact that the learning process will take a long time, which will reduce the effectiveness of training using the game. The characteristics of the mutual influence, balance, as well as the integrity of the perception of the game and learning processes make up the systemic qualities of the learning game [4].

Role of computer educational games in training personnel

Educational games are introduced widespread in enterprises and firms. Industrial enterprises depend on the educational games to train its employees on practical skills in flexible and advanced way. Educational games are introduced widespread in enterprises and firms. Industrial enterprises depend on the educational games to train its employees on practical skills in flexible and advanced way. Computer educational games helps employees to operate the automative devices in the most efficient way. However, it important for the top management in an enterprise to stay aware and share their recommendations and comments during the designing process of computer educational games. computer educational games should be structured logically to ensure implementation for effective training program [13]. Thus, the implementation process and the designing program of computer educational games must determine the service regulations and personnel job description, and it must be approved by the enterprise management team. L. Kapustina and I. Martynova [14] have made study on the effect on digital transformation for employees in several companies to realize the effect of educational games on employees. they concluded that the educational computer games developed and spread the digital economy in a fast way. Moreover, they concluded that educational computer games motivate trainees to get new knowledge in the operational processes and develop their autonomous decision. Top managers in Deloitte Leadership Academy (one of the international financing and accounting companies in the world) have noted marked improvements in the engagement levels of their employees after they used the computer educational games (GameLearn). GameLearn is a game-based learning platform for corporate training, more than 2000 companies worldwide are already using this platform of serious games training courses specified in internal communication, negotiations, leadership, customer service, time management, cybersecurity, coaching, anti-money laundry, stress management and for creative thinking techniques.

According to the Entertainment Software Association (ESA), 70% of their major employers utilize educational programs to train employees. Employers invest time and resources and reduce risks by depending on educational computer programs [15]. Besides, employers or managers could quickly review the attitude of the employees in the line of operation, since computer educational programs help to identify specific operational characteristics for emplyees. for example, if one employee

has high social skills, so he could be more productive in the sales department. If another employee has a high concentration in calculations and statistics, so he could be more productive in the financial department. So, from a cognitive aspect, computer educational programs will enhance mental rotation abilities and improve learners' problem-solving skills. from social aspects, computer educational games will find the right job for the right person and will encourage employees to collaborate with each other and respect competition rules.

Challenges to overcome for computer educational games

Computer educational games face several barriers that slow or stop its development and adoption. one of the barriers is that it has to interact with the sustainability factors, such as responding to economic, social and environmental needs and expectations. Recognizing these barriers is crucial to determine the fastest and easiest way to overcome it. Overcoming these barriers could be done efficiently just by systemic coordination and collaboration between funder and developers of computer educational games and between the other stakeholders as industry managers in the enterprise, educational institute or social organization.

Barriers and challenges could be divided into three main categories: the first category is barriers to design and development, the second category is the barriers to innovation, and the third category is barriers to sustainability. [10]

Firstly, barriers to design and development could be the high development cost, where computer educational games are expensive to design and maintain. Another barrier could be the lack of funding for developing computer educational games, where it is difficult to make financial forecast for banks and funders about the expected income and profit that will be gained from such virtual platforms.

Secondly, the barrier for responding to social expectations, in other words, to understand what the market needs. such a barrier could be overcome by making a statistical study for the educational computer games used by consumers in the market, then to analyze it for targeting its limitations and deficiencies. for that designers and programmers could innovate a new program or edit the current one to become more adopted by users and consumers. It is highly recommended to make more researches for the demographic and commercial industry data that depend on computer educational gaming [16].

Thirdly, barriers for designers and producers of educational programs to meet the international quality standards required by international laws and conditions. For example, producers have to meet some environmental standards as depending on renuable energy sources in the line of production.

The new vision to overcome these barriers is to make an environmental and social study for the need of customers in the market, in order to satisfy their expectations in the computer educational games. In addition, targeting the sector is crucial to maintain sustainability and specialty in computer educational games. Moreover, thre must be systemic and direct communication

and interaction between the designer, funders, decision makers and managers in the targeted sector (whether it is educational institution or commercial enterprise).

Conclusions

Finally, educational computer games represent a new technological concept that supports the training systems in various fields. Designing and implementing educational computer games in a rational, systemic and organized way have positive feedbacks on producers and consumers. For producers, it helps in realizing new aspects and innovating new techniques. for consumers, it helps in improving the practical skills in training programs and reduce future risks.

Depending on cognitive system knowledge, combining the life cycle model with the concept of the game could be the idle method for integrating development criteria in the software of computer educational games.

Collaboration between the designers of computer educational games and consumers (employers or managers) is a must to enrich the computer educational game with the right concepts and specifications. The designs must fit with the training programs and must fit with the work description of trainers.

Innovation in computer educational games is the key factor for its development, and to make it successful it must meet with the sustainable goals of the educational institutions or enterprise.

The development of computer educational games is a modern learning tool based on the adventure that could provide educators with a superior mechanism and virtual environmental knowledge acquired through intrinsic motivations.

Further research could be done in the future to design a united framework for designing and implementing computer educational games for targeted sectors.

Acknowledgment

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Розвиток навчальних комп'ютерних ігр

Ю. Бреславець, М. Неме

Анотація. Впровадження інформаційно-телекомунікаційних технологій в інформаційних процесах спрямоване на досягнення низки цілей: прискорення процесів обробки інформації та зниження витрат на їх реалізацію, рятування людини від необхідності виконувати рутинні дії та усунення негативного впливу людський фактор за результатом праці. Використання електронних навчальних посібників, тобто використання комп'ютерних технологій в освіті, не тільки дозволяє нам досягти цих цілей, але і дозволяє реалізувати низку унікальних особливостей, недоступних при використанні традиційних навчальних посібників.

Ключові слова: роль освітніх комп'ютерних ігр, етапи розвитку, каскадний та спіральний життєвий цикл.