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A MODULAR EDUCATIONAL MODEL BASED ON A VIRTUAL REALITY PLATFORM

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Abstract

Immersive environments of virtual worlds are very important tools in modern educational practice, providing excellent opportunities for implementing effective distance and online education. However, the process of gamification of learning based on the use of virtual reality platforms has faced a number of limitations. When creating educational games, teachers participate only in creating educational content, while the game architecture is developed exclusively by game designers, traditional training formats poorly use the advantages of virtual modeling, the level of interaction between game participants is very weak, and the participant's activity is limited, both in terms of locations and options for actions. An educational model based on the online platform of virtual reality Second Life was developed and tested in the educational process of a number of universities. The model provides students with the opportunity to participate in role-playing games, interactive learning and social interaction in the learning process. A survey of students showed a generally positive reaction to the introduction of v-Learning elements in the educational process.

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1. Introduction

The development of the traditional learning system is moving in the direction of increasingly dynamic educational environments. Constructivist teaching models come to the forefront, the main idea of which is the postulate that it is impossible to transfer knowledge to a student in a finished form, it is necessary to create pedagogical conditions for effective self-construction and self-growth of students' knowledge (Saragih et al., 2018). Information and cognitive aspects are becoming increasingly important in society, while ICT technologies are changing approaches to learning and teaching.

One of the main results of the evolution of 3D web technology is the development of multi-user virtual environments (MUVEs) such as Second Life and Active World. MUVE provides multiple members with the ability to simultaneously access virtual contexts through their own avatars. Participants can interact with digital artifacts, communicate with other users and recreate the experience, they are given the opportunity to solve problems similar to those encountered in real life. MUVE attracted the attention of representatives of the business world and scientific researchers.

The number of MUVE users is growing every day, according to rough estimates, their number has already significantly exceeded the one billion people. Taking into account these data, we can conclude that the development of methodologies and models of online education associated with the use of MUVE has broad prospects (Qian, 2018).

There are many different types of virtual worlds that serve different purposes and are designed for different types of users.

According to their main purpose, they can be classified into the following main types:

- Social VWs focus on providing the ability to communicate between users, they are often compared with 3D chat rooms;
- Casual game virtual worlds, aimed at users playing simpler casual games, are characterized by simplification of role-playing systems;
- Role-playing worlds or MMORPG (massively multiplayer online role-playing games) encourage players to play a role in the thematic world and progress in the game by competing with other players in various quests in a fictional environment.
- Worlds to create content allow users to create their own content, and in some cases also sell it to other users.
- Educational virtual worlds seek to educate their users on a specific topic. More often than not, these worlds offer the same features as virtual game worlds.
- Worlds focused on the interests of users in the real world, such as sports, music, etc.
- Brand virtual worlds are created around a specific real brand and may include elements of other types of worlds. All this prompts users to buy real products of this brand, and some require a real purchase to register an account.
- Mirror worlds are created to reflect the real world. They can be used as 3D cards.
- VW platforms are software environments that allow users to create their own virtual worlds, and some of these platforms (mostly open source) allow users to host their worlds on their own servers.

- Using virtual reality is very useful when the actions that users must take are actually too expensive, complex, or dangerous.

The systems that can support these virtual worlds are platforms, in particular v-Learning platforms. These are formal virtual learning environments in which students can complete, organize, and manage training courses. The V-learning environment is a space within the Network where users can work together using various tools and information resources to achieve common learning goals in the course of solving problems. Knowledge is considered as a set of meanings characterized by metacognitive processes through interaction with the environment, including tools and resources (Annetta et al., 2010).

V-learning is a term that describes online learning in a virtual world that gives participants a sense of reality. V-learning provides the application of various teaching methods and increases the level of motivation of students to study subjects (Anzorova & Platov, 2019; Klement, 2017). Virtual worlds are effective learning tools that provide users with an exciting graphical environment and experience-based learning. V-learning improves features:

- for students: personalize and customize their educational process;
- for teachers: adapt and customize educational learning models for virtual interaction.

There are various types of educational virtual worlds, but two of them are the most important. The first type is characterized by user access and interaction with the virtual environment using special tools such as a helmet, glasses and gloves.

The second type allows users to create an alter ego with a new body and go with it to the virtual world. This "alter ego" is identified in an avatar that lives in a new virtual world.

When implementing classes in v-learning format, a combination of various tools is used: voice, chat, text, audio, video and presentations. Content management and updating occur through a user-friendly web interface, training videos or tests can also be planned, some monitoring and evaluation tools are provided.

3D virtual worlds stimulate the creative development of students more than in 2D (Tramonti et al., 2015). Students form their educational path in accordance with various styles of individual learning organizational learning through knowledge sharing.

Based on information technology, new virtual educational environments are being formed in which innovative tools for solving modern education problems are created. One such medium is Second Life (SL), Linden Lab's virtual three-dimensional world.

Second Life is a three-dimensional technology, a three-dimensional version of the Internet, created in 1999 by Linden Lab, with which you can access the virtual world with your economy, education and social networks. Second Life provides users with a three-dimensional space that can be organized at the request of users. In three-dimensional space you can have fun, develop business contacts and do business. How and why to use it, depends on each individual person (Grimes & Bartolacci, 2012).

Second Life users can communicate with each other, participate and move freely in various games around the game world, interact with the environment. Second Life provides users with original opportunities for organizing activities in the virtual world (even those that are difficult to implement in the real world).

Many international companies have opened their representative offices in the virtual world. The Second Life project was initially created as a virtual game, but right now it began to play an important role in the world of advertising training and promotion of education. A new trend in online education is engaging students in activities using animated characters called avatars, learning in simulated schools, and even surfing the Internet for knowledge. The Second Life project is today regarded as an advanced distance learning tool. The main advantage of Second Life for distance education: creating an audience of any style and size, using voice or chat, PowerPoint presentations, virtual whiteboards, video and audio podcasts, developing technologically equipped laboratories, etc. The atmosphere in which the training takes place plays a huge role in learning, and it is this atmosphere of Second Life that makes it possible to create it perfectly (Ahern & Wink, 2010).

The first university to open a virtual office on SecondLife.com in 2007 was Vrije Universiteit Amsterdam (Free University of Amsterdam). Today, students, teachers and researchers of many educational institutions of the world (Harvard and Oxford universities, the Massachusetts Institute of Technology, the University of Berkeley, etc.) successfully interacting and organizing the learning process in a virtual environment (Ridvan & Sevil, 2013). For example, the London School of Journalism conducts free lectures on journalism, linguistics and literature for everyone in Second Life.

Hobb et al., (2006) note that SL is an interactive and immersive environment that provides unhindered information exchange, communication support, and obligates group discussions and collaboration between participants. The use of Multi-user Virtual World Environments (MUVEs) increases student engagement compared to traditional learning methods (Claman, 2015). The experience of applying Second Life in problem-based learning has provided more immersion and participation than traditional technological support methods designed to increase the depth of learning (Parson & Bignell, 2017). Jarmon et al. (2009) emphasize that SL provides practical experience during training. In the training of engineers, the use of SL in the educational process provided a higher degree of mastering of educational content in comparison with traditional educational approaches (Okutsu et al., 2013). SL adapted innovations that appeared on social networks: simple creation of a profile, circle of friends, opportunities for public and private distribution of messages, new media elements. All this creates an optimal environment for the development of experimental pedagogical technologies (Dadakoğlu & Aksoy, 2020).

2. Problem Statement

The process of gamification of learning based on the use of virtual reality platforms has faced a number of restrictions.

When creating educational games, teachers are involved only at the stage of creating educational content, while the game architecture remains completely in the hands of game designers.

Traditional training formats do not take advantage of virtual modeling, even though all integration possibilities exist.

The degree of interaction between the participants of the game is very weak, at best, the player interacts only with the teacher.

The participant's activities are limited, both in terms of locations and options.

3. Research Questions

1. A literary analysis of the use of virtual reality platforms in learning.

2. The content of the educational model based on the Second Life virtual reality platform.

3. Implementation of the educational model based on the Second Life virtual reality platform.

4. Purpose of the Study

The main goal of this work was to develop an educational model based on the Second Life virtual reality platform, taking advantage of role-playing games, collaborative and interactive learning, as well as realistic cases in a virtual environment.

5. Research Methods

The main goal of developing an educational model based on Second Life is to improve the educational process, taking advantage of role-playing games, collaborative and interactive learning, as well as realistic cases in a virtual environment. This can be achieved with the help of three modules: the information preparation module, the joint modeling module for studying the situation, and the reflective module. The general scheme of the model is shown in Figure 01.

MODULE	INFORMATION PREPARATION MODULE	COLLOBORATIVE MODELING MODULE	REFLECTIVE MODULE
SL LOCATION	DEMO SPACE	OPERATING SPACE	REFLECTIVE SPACE
PRIMARY TOOLS	SEMANTIC WIKI TEMPLATE	SL PRIM CREATION SKETCHUP	LECTURE GAME
MAIN ACTIONS	INFORMATION CONTRIBUTION KNOWLEDGE ANALYSIS	3D SIMULATION OF THE CASE FROM THE PREVIOUS STAGE	LEARNING INSPECTION

Figure 01. Education model based on Second Life

Unlike some virtual educational systems, this model is specially designed to help students understand the causes of problems and methods for solving them through data visualization and simple modeling, convenient communication and flexible interaction, collaboration and immersion in an SL environment. By integrating the three modules in the SL environment, the model provides more opportunities for effective joint training in various fields of knowledge.

6. Findings

6.1. Information Preparation Module

In this section, teachers and students use moving avatars to complete all the activities presented in the virtual demo in SL with the support of the Semantic Wiki Template. This template provides the platform with sections of information on the studied academic discipline. Using it, teachers can easily transfer practical tasks to a student, while students can answer and present results without having any in-

depth training in the field of information technology. The information preparation module includes four main steps.

1) Scenario selection: teachers who are experts in their subject area download exercises for students who need to conduct a case study and find solutions using SWT in the showroom;

2) Material preparation and information communication: online class students are divided into groups. Each group solves one problem posed by the teacher. At this stage, all members of each group collaborate, discussing the relevant theories, and then generalize them. The tasks of each participant will be determined through social interactive discussion and audio communication between group members in the virtual SL environment;

3) Case study: on the basis of data collection, each student identifies the causes of the problem and also suggests ways to solve it. All ideas are captured on SWT boards, which are available in the showroom. After all ideas have been published, all group members through their avatars discuss them and vote to select the best answer, using the capabilities of voice chat and virtual reality SL. Ideas with the most votes are stored in the SWT;

4) Evaluation and confirmation of the results: the result of the analysis of each group is evaluated by their teacher.

6.2. Collaborative modeling to study the situation

Possessing the knowledge gained from the previous section, each group takes part in creating a 3D model of the case for a better understanding of its essence. The module consists of three stages: task setting, joint modeling and 3D model verification.

In the beginning, the group leader defines and sets the task of simulation for each student in the group. Next, each student will create a separate three-dimensional part of the entire model and integrate it with the rest using simulation software. SL provides collaborative and interactive virtual spaces, making the collaborative modeling process faster than ever. In the end, the teacher checks and, if necessary, corrects the errors of the 3D model.

In this module, students can play an active role in obtaining information during the three-dimensional modeling procedure. In addition, it will help students not only fully understand the case scenario, but also improve their analysis skills.

6.3. Reflective module

After completing the simulation tasks, all students study in a hotel safety course and in a knowledge test game. The module as a whole includes three stages.

The first step is a lecture on security in a hotel company, prepared by a teacher. The teacher, using the communication audio channel and the virtual SL environment, explains the material to the students using examples of previously reviewed cases. The digital environment and virtual reality provide a more effective and efficient way of communicating to students the concepts of the subjects studied. After the lectures are over, the teacher modifies the 3D model to create scripts to test students' knowledge. Students should indicate their reaction to the causes of the problem and the solutions to it discussed in the previous module.

In the end, students go through the final certification procedure in the format of a 3D test game in which they should identify and solve the problem.

To obtain information on the learning outcomes, the teacher looks at the electronic checklist. In conclusion, the data of the checklist and video recording is sent to the student for analysis.

7. Conclusion

We consider this model as universal in relation to academic disciplines. The model has been tested in several Russian universities while teaching such disciplines as life safety, Russian as a foreign language, and jurisprudence.

Using avatars can increase the participation of even the most inactive students, and the possibility of text dialogue through chat allows you to prevent the seizure of the initiative by more communicative students.

The results of our study showed that students become more motivated and are very enthusiastic about the lessons, fully revealing their potential.

The ability to use role-playing games in the virtual space has made training more effective and attractive.

In order to improve understanding of the potential and limitations of the proposed model, we conducted a survey of teachers and students.

The vast majority of students expressed satisfaction with the classes in the proposed format. Students especially noted the final test 3D game, emphasizing its realism and usefulness in acquiring practical experience. However, students also noted some difficulties in collaborative modeling when integrating complex elements and complex scenarios into SL.

Teachers were generally satisfied with the proposed teaching method. They emphasized that the elements of role-playing and social interaction SL will contribute to improving the effectiveness and efficiency of training in the field of life safety. However, most teachers noted that preparing a game scenario takes a lot of time (at least two days for one scenario).

It can be concluded that the proposed model creates a potentially powerful and attractive environment for joint and experimental training in life safety, using the advantages of virtual reality and social networks. With its help, students will be able to better understand safety and labor protection issues, while the teacher can connect theories with practical experience and transfer this knowledge to the student. Despite the many advantages in the process of training in safety and labor protection, it is important to mention some limitations:

1) joint modeling still faces some difficulties due to the complex of the primary connection in SL;
2) some realistic types of work are not yet sufficient;
3) the time taken to create the script.

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