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Improving the Efficiency of Educational Process by Virtual Reality Immersion

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Abstract

Methods of fundamental change in educational technologies, improving the efficiency of the educational process through the use of virtual reality are discussed. The paper presents an experience of incorporation of 3D Virtual Activity based Learning Environment (VALE) into learning and training process by means of on-line communication, 3D-visualization and virtual reality immersion. VALE is regarded as a novel educational technology that expands the scope of competencies in the field of information and communication technologies, improves motivation and learning outcomes for the participants of educational process by means of original virtual environment and diverse tools. 3D Virtual Activity based Learning Environment (VALE) is a joint project of Department of Information Technology (Novosibirsk State University) and "SoftLab-NSK" (Institute of Automation and Electrometry, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia).

The paper addresses our experience of incorporation of 3D Virtual Activity based Learning Environment (VALE) into learning and training process by means of on-line communication, 3D-visualization and virtual reality immersion.

1. Introduction

Virtual education enhances qualifying potential of leading Russian universities for dissimilation of the information-communication competences for broad audiences such as professionals, administrative staff, school and university students and instructors.

In this context, we present an example for organization of courses for IT instructors in the framework of the federal government grant for training of specialists in the field of computer science and programming (Novosibirsk State University, 2011). This example showed how the mutual efforts of the leading universities in Siberia and the Far East retraining about 2,000 people in 2 months, using the traditional face-to-face model of educational process with the elements of distance learning.

Another important example of organization of ICT courses for school students is aimed at elaboration on modern innovative technologies. The project responds to the needs of school teachers in computer science, and matches modern requirements by means of methods of knowledge control for school graduates (Project FIT NSU - SoftLab-NSK). The core of the project is a 3D Virtual Activity based Learning Environment (VALE). Its capability was demonstrated by application of this method for the preparation for the USE (Unified State Examination) on informatics and computer science. It was delivered by means of providing an effective learning process through organization the intensive team-work using networking and 3D-visualization. VALE is the first step in implementation of new educational technologies and expansion of ICT competences for school teachers. VALE provides convenient environment and tools for efficient learning. Presentation of educational material in a virtual 3D-environment demonstrates methods of an active involvement of all modes of perception as well as a number of visual stimuli in an interactive environment. Obviously the implementation of these capabilities requires further scientific and methodological experiments.

2. Pedagogical characteristics of VALE

A platform is developed for organization of interaction and collaboration in small groups for training purposes. The platform could be used in various forms of learning, i.e. face-to-face, e-learning, blended learning.

The idea is to transfer the learning process into a 3D virtual media - activity-based virtual learning environment where both teacher and student are represented by their own 3D avatars. Avatars could interact with each other and with the virtual space - move, talk, gesture, interact with virtual models of objects and processes, and interact with abstract symbolic models. Therefore, this learning environment equalizes the involvement in the learning process for participants in the classroom and remote participants.

It could be effectively used for the students in remote areas, students with disabilities

During the lesson a teacher could monitor all students on his/her own screen. The teacher's avatar could move from one group to another, and observe activities and progress of each group, ask questions and suggest help. The teacher could effectively manage the situation and thus can plan the pace and curricula for the next session. In particular, as soon as the teacher notices that all the groups have completed the task in their own way, he/she invites students into a "virtual classroom" for a broad discussion.

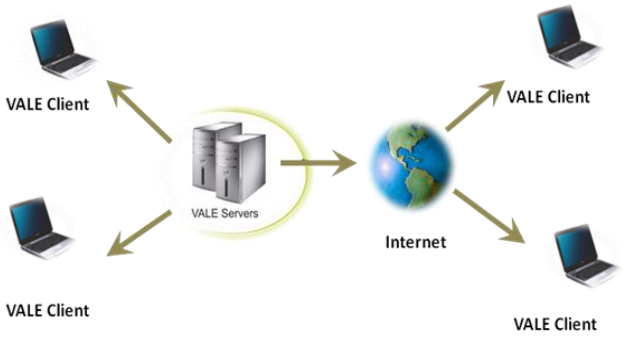

Fig.1. Architecture of 3D Virtual Activity based Learning Environment (VALE)

The map (visualization) of the virtual world is implemented by using a client program installed on users' computers. The client program is a "thin client" and at the expense of deep scaling can achieve an acceptable quality graphic even on an ordinary computer without enhanced graphical card. It is assumed that the client program will be an open and free distributed software application. The volume of communications between the client and the server data in the ordinary case is limited to the mathematical information about the changes that take place in a virtual environment, so the platform for its operation does not require a high-speed Internet connection for the end user.

The implementation of a full-scale virtual activity-based learning environment (VALE) includes a combination of:

- control tools for avatars and 3D educational environment;
- methods for processing of modern data types (including 3-D video) into the educational environment
- typical scenarios of the educational process on the base of Moodle;
- a set of electronic learning materials to prepare for the USE (unified state examination) in informatics and computer science.

This combination extends the environment for organization of the training process in exam preparation. The advantages of the new approach are demonstrated at different levels of the learning curve, depending on the specific curriculum.

In the secondary education the proposed approach allows to:

- address social and geographical aspects of the organization of training/studying;
- inherit the experience of distance learning, supported by the developers of Moodle;

- include in the educational activity tools and methods of virtual 3D-worlds constructing in the style of Second Life;
- activate various perception modes of students;
- ensure the access variability to educational materials, taking into account the capacity of the network.

In our case, Moodle is used as a learning management system. The system performs user authentication/registration, course subscription/registration, grants access to traditional and virtual educational content, evaluation and statistical analysis of tasks, provides standard internet services for communication (forums, chats, polls, etc.), tools for creating and maintaining schedules, virtual events (consultations, lectures, seminars, meetings in a virtual learning environment). The transfer into the 3D virtual environment can be carried out directly from the Moodle interface with an optional activity element - "Virtual Meeting". The introduction of this additional activity is implemented in the framework of the general Moodle ideology, so the creation and use of virtual meetings in courses is not an issue for users (administrators, educational designers, teachers, students).

Regardless of the content the supported training methods are:

- step-by-step acquisition of potential of the learning environment;
- rapid self-control in mastering the study material;
- "teacher-student" feedback, the collection of statistics, monitoring of the training process;
- USE (unified state examination) training model as well as other scenarios;
- possibility of individual learning paces.

Fig.2. 3D Virtual Activity based Learning Environment (VALE)

3. Conclusion

Varying scenarios and educational materials in the further development of the VALE could be extended to cover the broader range of scientific and educational fields, including those associated with the use of

supercomputers and multi-processor configurations. The radical increase in learning capacities and retraining can be achieved by creating the fractal spiral model of the educational process, including the promotion of the most successful students into tutors and trainers. Enhancing ICT competences of instructors, researchers, and other audiences, spreading its mechanisms into other fields of knowledge and activities is the driving force behind the development of education.

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