LOGO&LEGO – A Single Learning Environment for Children with Different Backgrounds

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Abstract

- Computer and information technology can help to create different learning environment for the children with different backgrounds and attitudes.
- We are using project educational approach in all levels. The students have to present their projects to different audiences and it helps to improve their presentational skills, teaching them to present their results in a comprehensible form.
- The personal computer for the every student. Viewpoints of a student and a teacher
- The teachers have to learn working in the world “without classroom walls”
- We assume that MicroWorld 2.0+ can be used as a programming environment to reach this goal.

Keywords

learning environment, Logo & Lego, project educational approach, portable computer (PC) for children, Linux, school LAN, Internet
1. Overview

We are teaching informatics in school for many years and came to a conclusion that computer and information technologies can dramatically improve the educational methodology.

The children we deal with have diverse initial background. Some of them study at a gymnasium specialized in physics and mathematics, some - in an ordinary school, some are not able to attend the classes because of health problems. The children also have different attitudes about studying. Some of them are enthusiastic and creative, some scarcely complete the obligatory homework. Sometimes, the same teacher has to work with all of them.

But computer and information technology can help to create different learning environment for the children with different backgrounds and attitudes. There exist many various software products for that, but we need a single environment that lets to work with both strong and weak students. This environment should provide means for both learning and memorizing the basic knowledge and for developing and encouraging creativity skills. In particular, these goals are furnished by Logo including control of Lego objects.

We are using Logo and Lego environments in teaching and bringing up for the students from mathematical gymnasium and ordinary school and the children suffering from chronic haemophilia. In the ordinary schools, Logo (MicroWorld 2.01) is used as an environment to study properties and actions of diverse internal objects. The children are learning methods of scientific study and result presentation using information technologies. In the mathematical gymnasium, the educational program includes the problems to describe the objects properties and actions, and to create the virtual models as well as the models using Lego bricks. Haemophilics are learning to manage the objects, systemizing their knowledge in mathematics and physics.

Currently they are also learning to manage the objects made of Lego bricks. For example, using RCX-brick, we can create a programmed and computer independent model. Programs for such a model can be written in MicroWorld 2.01.

We are using project educational approach in all levels. The students have to present their projects to different audiences and it helps to improve their presentational skills, teaching them to present their results in a comprehensible form. The best projects are converted into HTML and published on the Saint-Petersburg school server. MicroWorld includes the instruments to transform a project into HTML document with internal graphical objects. Moreover, it includes the player, which can represent a project as an HTML object.

Children, no matter which background and interests domains they have, present their projects on the student conference, communicate with each other, exchange ideas. It helps to improve the competence level of diverse groups of students - children from elite mathematical gymnasiums, ordinary schools as well as handicapped and chronically ill children.

There exists another form to activate the obtained knowledge - the annual city Logo contest. In the contest program, a team is proposed to solve several problems of different hardness levels using computer. A fifth-year schoolboy can be asked to describe and draw a solution, a seventh-year one - to write a program. A team can consist of children of different ages, children with their parents, elder brother etc. The team score is computed as a sum of points for the solved problems. The winners are decided for each team category. Logo (LogoWriter 3.2 or MicroWorld 2.01) is used as a programming environment to describe the problems and to present the solutions. The environment has proven to be a uniform language to communicate for people of different ages, with different skills and backgrounds. The teams also include children from specialized gymnasiums, ordinary schools, handicapped and chronically ill children. The competition spirit, the urge to win are shared by every participants making them concentrate, not to quit early and, finally, brings a lot positive emotions which stay in their memories for a long time. The children start to get ready to the contest
in advance and they are more serious and motivated in their studies. As a result we get increased knowledge level of different groups of students. Note that every participant, no matter which score he got, receives a certificate or diploma.

However, our experience shows that, facing the growing propagation of computers and information technologies in the modern society, the use of computers in our schools is definitely not sufficient.

2. The personal computer for every student. Viewpoints of a student and a teacher

Inspired by the ideas of Seymour Papert on the role of education in contemporary educated world, which he presented in Saint-Petersburg, we started to consider a computer as a main means to study at school and at home. This is especially attractive for the children with the health problems.

Normally, some Russian schools are equipped with computer classes (we leave aside the question of the quantity of such schools and the quality of the equipment). Some families have computer at home. But the computers at school and at home are not connected in terms of educational process, homework assignments and methodical materials. In most cases, children only use the computers at home as play stations and, for a while, their parents might think that it is useful for them. But finally, it comes out that the children just waste their time with the computers.

As a result, we aim at building a model of a portable computer (PC) for children to bridge a gap between home and school. The model includes the following important components:

- Hardware
- Software
- Internet kit

In this paper, we discuss hardware and software aspects, which are supposed to give important skills in information technologies including use of Internet services.

Use of PC in academics brings in the spotlight a number of specific requirements from both a student and a teacher. From a student's viewpoint, a computer should be:

- Available. PC should be permanently available to a student both at school and at home. The student should be able to work in the same software and hardware environment. It provides seamless educational process and turns PC in a true "means of cognition".

- Easy to use. The user interface should be intuitively comprehensible.

- Network connected. PC should be equipped with a LAN card to connect to a school LAN and a modem to use telephone line for the connectivity.

- Bilingual (at least). A student should be able use both English and Russian when working with PC.

From a teacher's viewpoint, a computer should provide:

- Multi-user support. It does not seem that every student will have its own computer soon. However, with the corresponding government support, the schools will be equipped with the sufficient amount of computers (like it is now with the textbooks, for example). School library or informatics center will be able to lend the computers to the students for a fixed amount of time. At different time, the same computer might be used by a fifth-year and a ninth-year student, who have absolutely different interests and school requirements. Thus, the user environment should be able to adopt to the different users individually. The operating system should provide separation and isolation of the users environments and system resources.
Information security. Anti-virus software and structured security policy should prevent the system from crashes and information leak as a result of incorrect users actions and intruders attacks ("Trojan horse", viruses, etc.).

Low maintenance cost. Any software is subject to individual tuning. Having in mind the educational purposes of our computer, we should design a set of typical user settings, one per each class of users. The operating system should provide certain level of stability of the system functionality in case of the incorrect user behaviour (intended or unintended). A teacher should not waste all his time administering and recovering PCs.

Low hardware and software prices. According to the current price lists, initial investment costs $600-700 per PC with the corresponding software. Note that it is especially important to install only legal software. It is impossible to teach children to respect the law and the social rules if they use illegal software copies in schools.

3. Hardware and Software

Now we formulate our vision of contemporary school PC, which complies optimally with the requirements above.

In our opinion, it is a not expensive, probably second hand, notebook with limited resources (for Windows world). Typical characteristics could be: CPU P-166, RAM 32M, HDD 1-2 GB, LED display 12", Ethernet card, modem. Operating system - Linux (Caldera eDesktop 2.4) with basic software set including:

- Text processors
- Graphical editors
- Multimedia software
- Basic databases
- Electronic tables
- Programming tools to manage both virtual and physical objects (for example, Lego Dacta models)
- Internet tools (e-mail, Internet browsers etc.)

Nowadays, the software tools mentioned above are available for Linux. It is worth noting that the cost of analogous software for Windows is much higher.

Linux administering tools allows to create user accounts with different profiles (for example, to create a separate profile for each year of graduation). High fault-tolerance and security level allows to use the PC as an entry in a school "PC-theca" (close to a school library) working with PCs instead of textbooks. When borrowing such a PC, a student gets an account together with a typical user environment. The class of the PC depends on the student's age and skills.

The concept of a school portable computer can be tested on typical representative of the class of basic notebooks - Toshiba Tecra 530 (the characteristics of the notebook are presented above). A pilot exemplar of this model will be tested in Saint-Petersburg Paypert center. Software installation and maintenance is accomplished by "SKB Informproject" company as an authorized partner of Caldera Systems.

It is important to note that the maximal benefit of using portable computers within the educational program on both informatics and other subjects depends not only on the hardware and software issues but also on the integration of it into the school infrastructure. In this sense, our experience in building school LANs using
Linux server and Internet technologies confirms the efficiency of Linux as a universal platform, not “resource-hungry”, with low maintenance cost and easy to integrate into existing heterogeneous network.

4. The learning environments

The use of a portable computer in the educational process allows to have a fresh look on the educational process as a whole. The classroom scales up to the planet size. On one hand, it can improve significantly the quality of education. On the other hand, it can turn it into a great mess. The teachers have to learn working in the world “without classroom walls”.

Let us think a little what and in which order we should teach a student having permanent access to a computer and the Internet.

Among the first necessary skills – writing and reading e-mail, web browsing. At school, a portable computer can be connected to the school local network. At home, a student can connect to the school network using modem, he can send a message to a teacher, ask him a question. If a student is not able to attend the classes because of the health problems, he can still communicate with his teachers thanks to electronic mail and download homework assignments from the school web site. It can minimize the time consumption for the educational process.

In process of learning and improving his informational skills, a student is getting used to work independently searching, collecting and analysing the information, getting in touch with the most powerful data sources of the world, attaining the knowledge necessary to solve a posed problem. A teacher has to provide friendly but directing control, encouraging students to present their knowledge in different forms (from a small local report to a conference presentation).

To prepare abstracts, reports and other documents, text processors and graphical editors are used. They can be also used as training tools for developing and memorizing the skills in most of the school subjects, such as foreign languages, geometry, social sciences, drawing, plotting etc.

Electronic tables and databases allow to classify the knowledge in a certain domain, to model different situations and to calculate the characteristics of the models.

However, we need a “first environment” in which a newcomer gets the basic knowledge in the information technologies. From our point of view, the best example of it is the programming environment. It lets us to use the computer as an object “which helps to think” (S. Papert).

Middle-age (9-12 years old) students learn to make research, modelling world as a set of objects, systemizing and classifying the objects. The created microcosms live independently following or breaking the rules created by the students. In turn, the students are able to find the errors and to improve their small worlds. The feeling of discovery and creation is incomparable and can be the strongest motivation to continue learning.

Students of advanced age (13-16 years old), getting proficient in programming, can solve different research problems. They can build models using their knowledge in mathematics, physics, chemistry etc. The models can be built out of the real objects (modelling blocks) which allow to measure the properties of the real world objects and to manage the objects in the three-dimensional world.

The results of the research is presented in a form of a report and submitted to the teacher or discussed in the teleconference, web site, real workshop.

We assume that MicroWorld 2.0+ can be used as a programming environment to reach this goal.

It is evident that all the mentioned methods of learning are achievable given a computer with the corresponding hardware and software. In this sense, a portable computer available both at home and at school can make it easy.
We are highly encouraging the teachers, scientists and engineers to participate in the project that provides to every student of every school the opportunity to “learn learning”. If, with the government support, we will manage to supply every school with a set of portable computers, the computer classes at schools will no longer have to be extended. The stationary computers could be exchanged for one powerful server, advanced local area network and the Internet access.

References