From *Learning by Playing* to *Learning by Programming*

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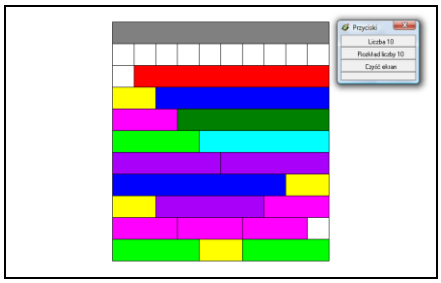
Abstract

Inspired by Papert's idea of learning and microworlds we try to put it into practice in our centre (Computer Assisted Education and Information Technology Centre - OEIiZK, Warsaw). We have prepared different workshops for teachers and children to spread this idea.

Firstly, it is worthy to examine computer games. Watching children playing games, one can observe that something important is affecting them. They learn skills such as data manipulation, strategic planning, making snap decisions or negotiating. Their emotions strongly affect motivation. So we can ask, what will children learn by making a game?

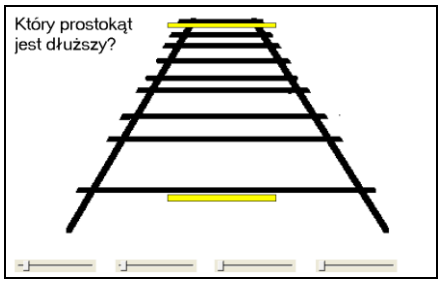
Secondly, a very popular activity which teachers do with children is storytelling. Creating animate presentation students gain new knowledge about the world, they improve their understanding of human nature and feelings. Moreover, they become fluent in using ICT.

Thirdly, storytelling and creating animations with descriptions and sounds are perfect ways to present some scientific ideas. Working in microworlds usually leads to a deep and broad learning experience. Students are ready to put much effort and spend a lot of time to prepare such projects.



Number division

Holiday adventures



Which rectangle is longer?

Figure 1. Some examples of projects

Keywords

playing, learning, programming, children, Imagine Logo

Introduction

Seymour Papert wrote in *The Connected Family:*

"I have seen many dozens of advertisements for software that make promises like: *Such Fun Your Child Won't Know She Is Learning*. I am horrified by the message. The suggestion is that learning is a nasty pill that must be sugarcoated with fun and games. It is true that learning has sometimes been given a bad name by poor practices in school and even by some parents whose constant refrain is *Do your learning. You can have fun afterwards.* But one of the great things the computer can do is turn this around and store the kind of enjoyment of learning you see if you watch an infant or a scientist. Both are learning all the time and they both know it and they love it."[1]

Inspired by Papert's idea of learning and microworlds we try to introduce some of these ideas in our centre (Computer Assisted Education and Information Technology Centre - OEIiZK, Warsaw). Together with Wanda Jochemczyk and Agnieszka Samulska we have prepared different workshops for teachers and children. The aim of this article is to present some ideas and experiences together with examples of students' and teachers' work.

Games in Imagine Environment

Computer games are a unique form of media. In strategic games players win by successfully navigating and meeting challenging tasks. They learn skills such as data manipulation, strategic planning, making snap decisions or negotiating. Their emotions strongly affect motivation. The first time children play, they usually fail, and then they have to do it over and over again, until they master the skill, they gain the knowledge or just win.

"When the reviewers like a software, they are full of gush such as: *easy to use*, *marvellous graphics*, *children love it*, *lots of learning*. When you talk, you raise more controversial questions. Half the time I can't agree with you but you get me thinking. Something important is affecting our children. What we need is not being told it's good, it's bad or it gets four stars like a restaurant. We need to talk more, argue more, think more about what lies behind it all."[2]

Although some of the educational games represent innovative approaches to learning, the majority aren't successful. Why? Because they are not attractive, children do not find them funny to play.

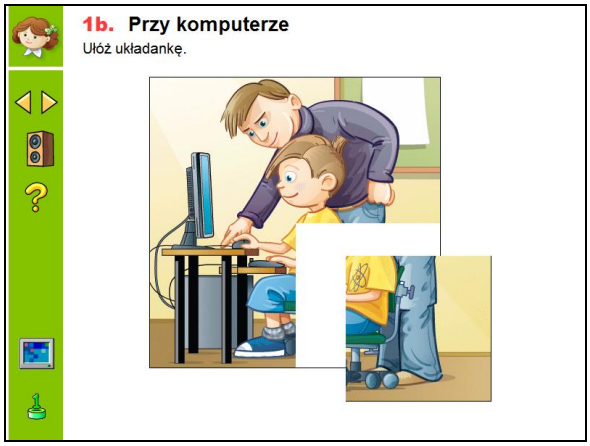


Figure 1. Jigsaw

[1] Papert (1996), p. 50
[2] Ibid., p. 7

There is a common believe that when children dislike schoolwork because it is too hard. “Nothing could be more wrong. Most dislike of school work comes from finding it boring, the exact opposite of finding it too difficult. Children, like everyone else, don’t want **easy** – they want **challenging** and **interesting** – and this implies **hard**.”[3]

An example of an interesting application is jigsaw where a child has to put many small elements together to make a large picture. To do this, analysing and synthesising is required. The difficulty level is carefully designed to gradually introduce more difficult problems. Both children and adults enjoy the puzzles and learn some sophisticated skills solving it. There are many other examples of puzzles which simulate thinking.

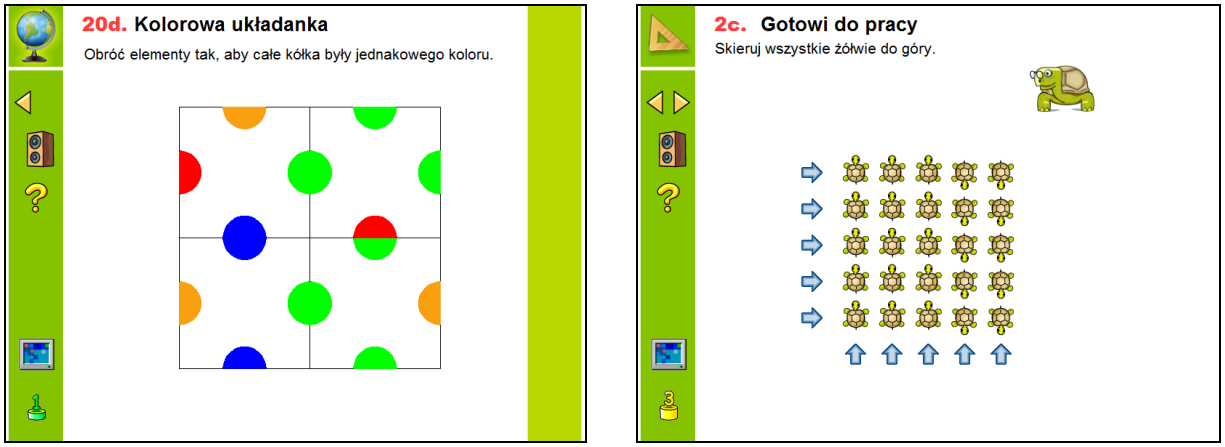


Figure 2. The examples of puzzles - Colourful Puzzle and In the Same Direction

Colourful Puzzle - You can turn right and left square pieces. The aim of this game is to join square peaces with the same colour of dots.

In the Same Direction - By clicking on an arrow near the row, you turn right all turtles in this row, by clicking on the arrow below the column, you turn right all the turtles in this column. The aim of this game is to direct all turtles vertically upward.

In Imagine Logo, object-oriented programming is applied. In a natural way, one can implement classes, objects and inheritance, and make event control objects. One can give new shapes to the turtles described in a drawing list. It is also easy to create animation. Fore example, in the *Colourful Puzzle* there is a class for squares with dots and each square is described in a drawing list. Students and teachers like to make such games. There are two more examples of games *Pentomino* (teacher’s project made by Anna) and *The Maze* (student’s project made by David). The first project was created during a workshop for primary school teachers, and the second one - during a distant learning course entitled “Programming in Logo”. David is very proud of creating this project and has his own secret connected with the way the board for the maze is remembered by a computer.

[3] Ibid., p. 52

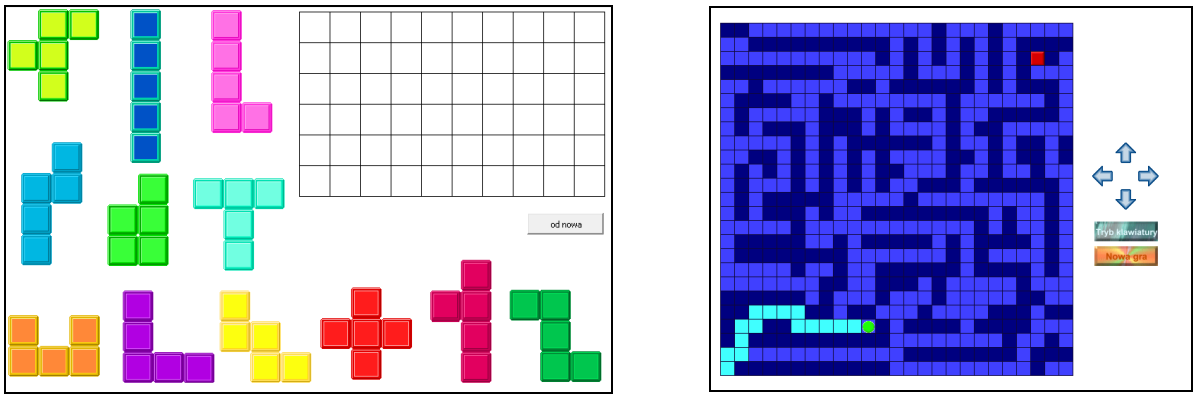


Figure 3. Pentomino and The Maze

Using Imagine Logo network features the implementation of a network game called *Treasure* was prepared. The goal of this game is to find three gold bars. There are two players and they have one board. The first person clicks on one of the squares. If a gold bar is there, the player gets a point and has another move, if not, the information about a distance to the nearest treasure is shown, and the second player has his turn. The game continues until all the gold bars are found. The one who has more gold bars is the winner. In this game you have to combine strategic issues with some psychological. When you try to find a treasure, you are also giving some information to the opponent where the treasure can be.

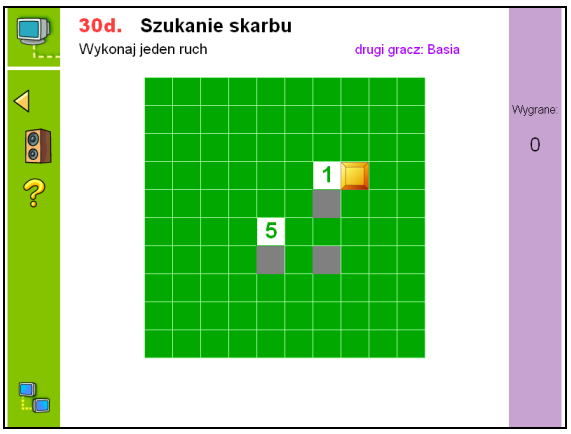


Figure 4. A network game - Treasure

We can ask after Seymour Papert "What will children learn by making a game? They will learn some technical things, for example to program computers. They will learn some knowledge traditionally incorporated in the school curriculum, for example in order to make shapes and program movements, they will have to think about geometry and about numbers. They will develop some psychological, social and moral kinds of thinking. Most important of all in my view is that children will develop their sense of self and of control. For instance, they will begin to learn what it's like to control their own intellectual activity."[4] We encourage teachers and students to work and play in Logo environment. It is a good instrument to create open exercises, stimulate thinking and make one's own creative activity.

[4] Ibid., p. 47

Storytelling

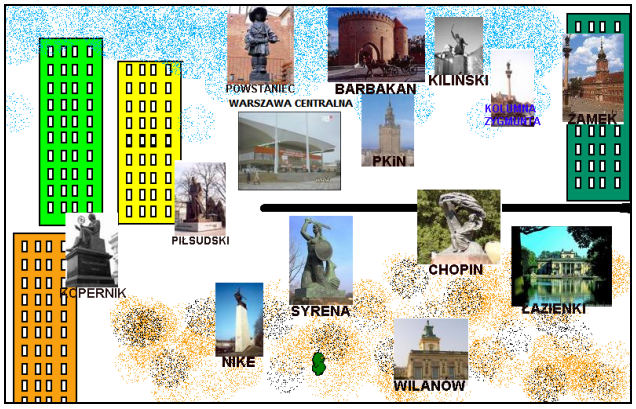
A very popular activity which teachers do with children is storytelling. During preparation of animate presentation students have to gain new knowledge about the world, they improve their understanding of human nature and feelings. Students also practise their language skills. They have to think what they want to say, choose a right medium – a written text, recorded voices, sounds, images or animations, and use their skills and imagination to prepare the entire story. What really counts when one has to create a good story is a concept and understanding of sequence. Students and teachers are really engaged in creating such projects. Though, it requires a major investment in time and effort.

"In my vision of this field its professionals will need special combinations of competences. Apart from a foundation in scientific knowledge and technological skill they will need high degrees of psychological sensitivity and 'artistic' imagination. For the ones who will make the greatest social contribution will be those who know how to mold the computer into forms which people will love to use and in ways which will lead them on to enrichment and enhancement...."[5]

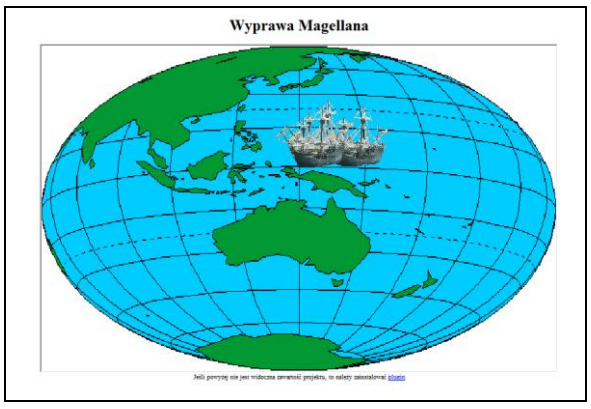
In terms of programming, one can start with very simple commands. As Seymour Papert suggests in *The Connected Family* the first step is to use HIDETEXT and SHOWTEXT commands, next you can name turtles and the work continues. If you are really engaged in making story, you will find that more programming skills are needed. Seymour Papert presents examples of operation on the picture that even a small child can do. They are as follows:

- make the picture disappear and reappear in response to a click on a colour or on a button or on an icon or on the picture itself,
- make the picture change size; for example shrinking it to stamp size and expanding it to full-screen (or any other) size,
- make the picture move.[6]

Below there are examples of the projects which were created by the teachers during our workshop.



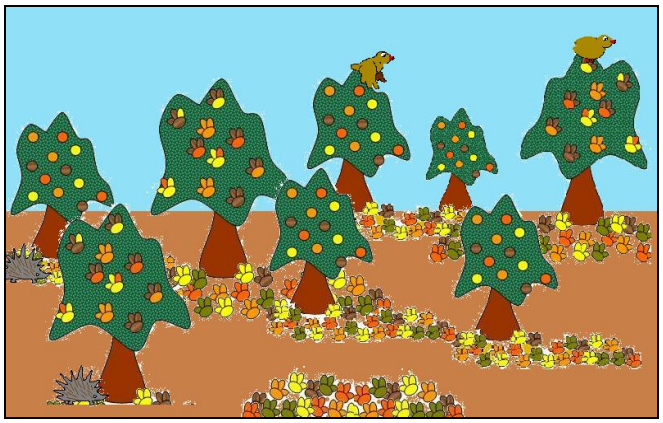
Walking in Warsaw - author Barbara



Ferdinand Magellan's Voyage - author Katarzyna

[5] After http://www.users.on.net/~billkerr/a/papert.htm, Solomon, Cynthia. Computer Environments for Children: A Reflection on Theories of Learning and Education. The MIT Press, 1987, after http://www.users.on.net/~billkerr/a/papert.htm

[6] Papert (1996), p. 133



Hedgehogs – author Małgorzata

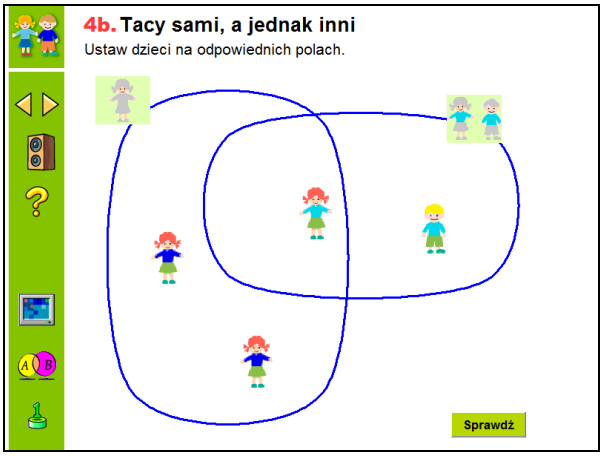
Existential problem - author Bożena

Figure 5. Teacher's story

Making such animated stories leads to thinking about some moral issues and present them in an unconventional way. It is worthy to notice that storytelling and creating animations with descriptions and sounds are perfect ways to present some scientific ideas.

Powerful Ideas in Mind-Size Bites[7]

Working in microworlds it is like understanding scientific matters in a way we get familiar with another person. Children learn playing in microworlds and not just learning some facts by heart.



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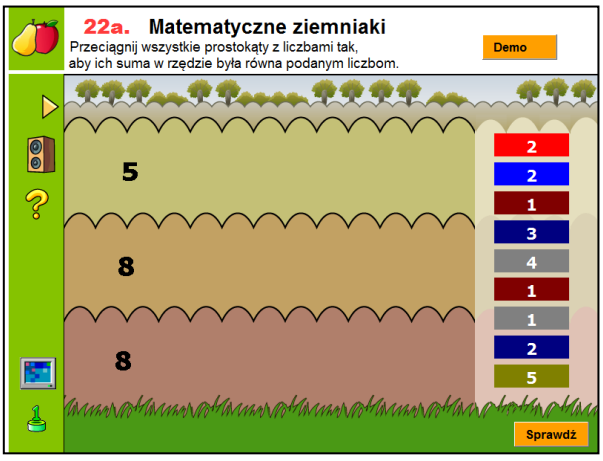
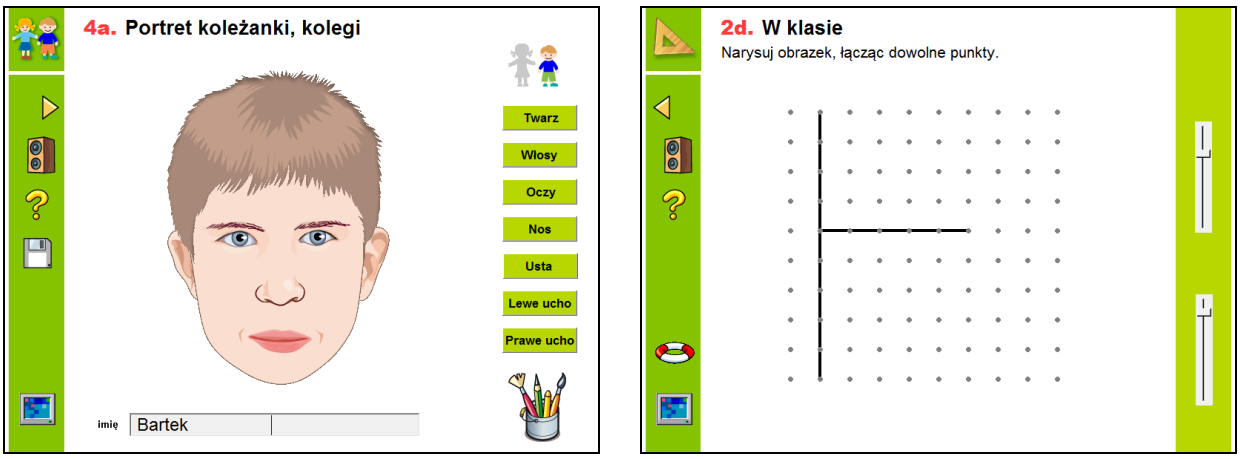


Mathematical potatoes

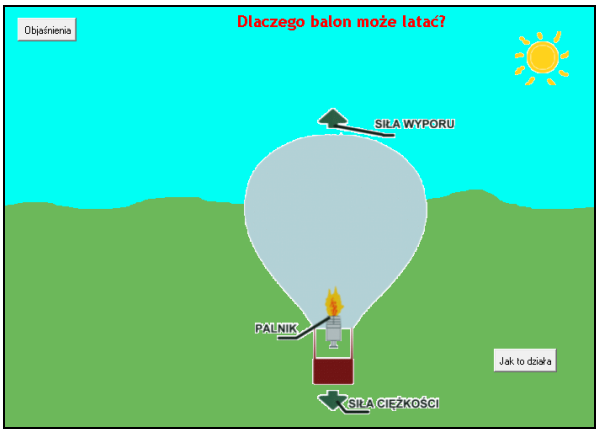
[7] This tittle comes from Seymour Papert "MINDSTORMS, Children, Computers, and Powerful Ideas"



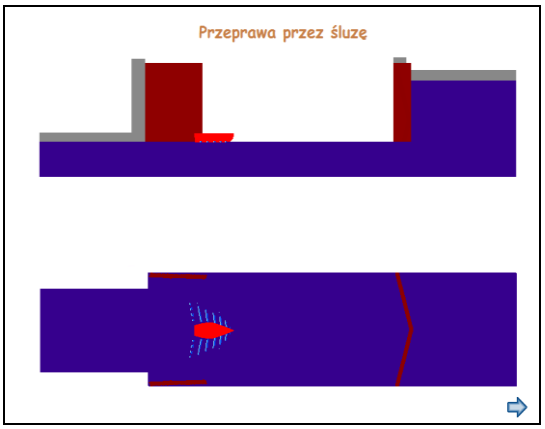
Friend's portrait *Dots*

Figure 6. Examples of applications

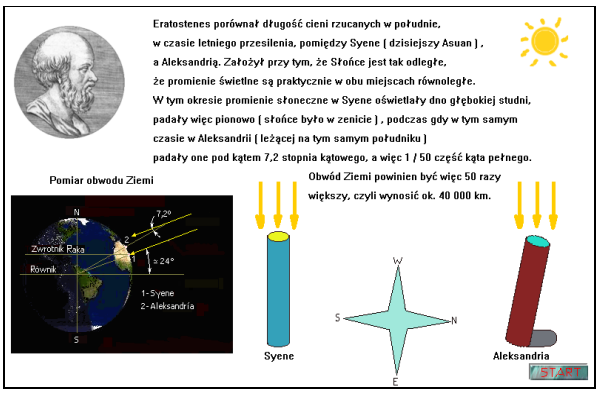
The learning process is deeper and more richly interconnected if playing in microworld is combined with creating. A creator needs to bring together programming skills and the projects' subject domain - like mathematics, computation, physics or other branch of science. Even a tiny part of making such project can give students a deep and broad learning experience. Above all, students are ready to put much effort and spend a lot of time to make their project interesting.



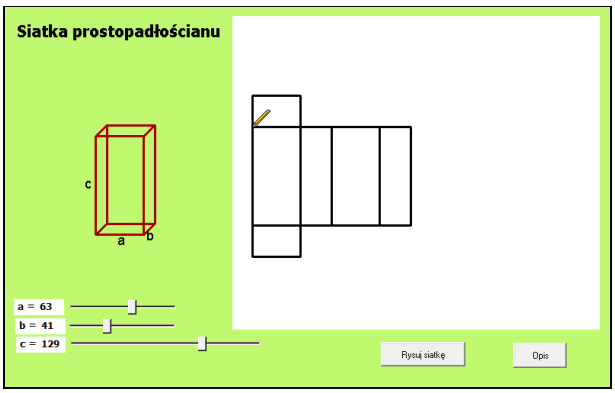
Why can balloons fly? Author Katarzyna



The Sluiceway author Sławomir



The Earth circumference – author Wiktor



Cuboids Nets – author Zofia

Figure 7. Teacher's applications

Making such projects one should define a model by identifying the major factors in a system and discerning rules that govern those factors. As a consequence, this process of hypothesizing, implementing and testing provides an excellent way to learning. It is a fertile ground for learning general thinking skills. These include problem decomposition, component composition, representation, abstraction, debugging, and thinking about thinking.

On the whole, multimedia projects presented in this article were created during workshops we organised for teachers and during courses for students. Computer Assisted Education and Information Technology Centre organised also the competition on creating multimedia projects. The competitors are primary and secondary school children. Every year a topic for the project is different. There were projects on environmental issues, on safety in the Internet, on the mystery of computers, a favourite book, on frogs during The Year of the Frog. Our teachers and students also took part in proposed activities during Eurologo 2007 in Bratislava (Logo images around us, Turtle's life, Logo in class, Imagine Logo Cup International Competition). We hope that by our effort we help children to learn by playing and to learn by programming. Last words belong to Seymour Papert "Across the world there is a passionate love affair between children and computers. I have worked with children and computers in Africa and Asia and America, in cities, in suburbs, on farms and in jungles. (…) Everywhere, with very few exceptions, I see the same gleam in their eyes, the same desire to appropriate this thing. And more than wanting it, they seem to know that in a deep way it already belongs to them. They know they can master it more easily and more naturally than their parents. They know they are computer generation."[8]

References

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Papert, S. (1996), *The Connected Family: Bridging the Digital Generation Gap*, Longstreet Press

[8] Papert (1996), p. 1