

Logo in Polish Schools - cases

Wanda Jochemczyk, wanda@oeiizk.waw.pl

Witold Kranas, witek@oeiizk.waw.pl

Katarzyna Olędzka, katarzyna@oeiizk.waw.pl

All from Computer Assisted Education and Information Technology Centre (OEIIZK), Warsaw, Raszyńska 8/10

Abstract

Logo is widely used in Polish schools on first two levels – primary school and lower secondary school. We will present different examples of Logo use.

In early years we use microworlds (made in Imagine) helping young pupils to learn elementary skills: drawing, reading, writing, calculation, understanding environment. In primary school there is an introduction to computer science and ICT use. In lower secondary – some elements of algorithmic – an introduction to programming. Finally in upper secondary – microworlds – animated models helping to understand fundamental topics in different subjects of study. There are some questions arising concerning Logo use.

Seymour Papert (1999) wrote: *“The rapid and accelerating change that marks our times means that every individual will see bigger changes every few years than previous generations saw in a lifetime. So this is a choice we must make for ourselves, for our children, for our countries and for our planet: acquire the skills needed to participate with understanding in the construction of what is new OR be resigned to a life of dependency.”*

So the main question is: What is changing in our school Logo use? Educational system is changing slowly. We try to work simultaneously with teachers and pupils to accelerate the changes. Logo competitions and common e-learning platform described here are the examples. We are introducing Logo in modern object-oriented environment Logomocja – Imagine. We use animations and models also prepared in Imagine. But there are still some classic problems – mainly programming techniques – a very demanding problems for pupils and teachers. This problems need a good didactic methods helping our pupils to achieve understanding. It's important task for Logo community.

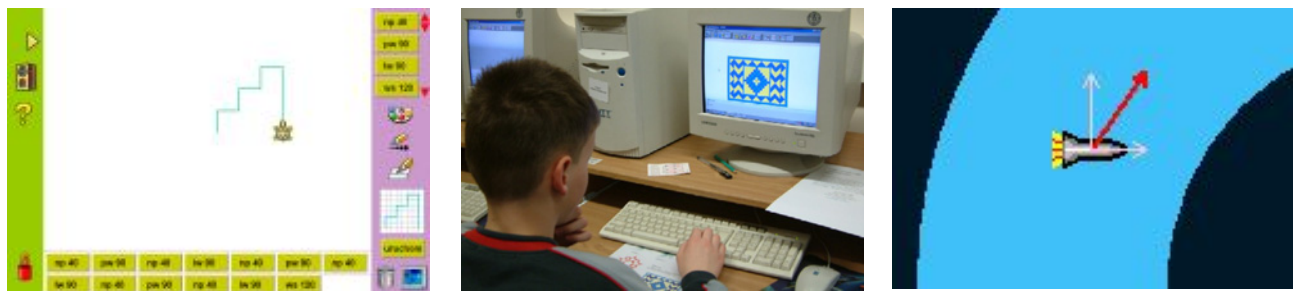


Figure 1. Logo in Polish schools - examples

Keywords

Logo; Computer Science; education in Poland; informatics; Logo competition; Imagine; Logomocja

Computer Science in Polish schools

Computer Science is a school subject in Poland since 1987 (it was not obligatory in first years). In a present school system it's represented on three levels:

- Primary school – 80 hours course (2 hours in timetable) called Informatics (pupils age 10 – 12). It's typical ICT course preparing to use computer.
- Lower secondary school (gimnazjum) – 80 hours course (2 hours in timetable) called Informatics (pupils age 13 – 15) This course has some elements of programming (algorithmics).
- Upper secondary school (liceum) – 80 hours course (2 hours in timetable) called Information Technology (pupils age 16 – 18). On this level students may also choose Informatics as a subject (with 200 hours course – 5 hours in timetable).

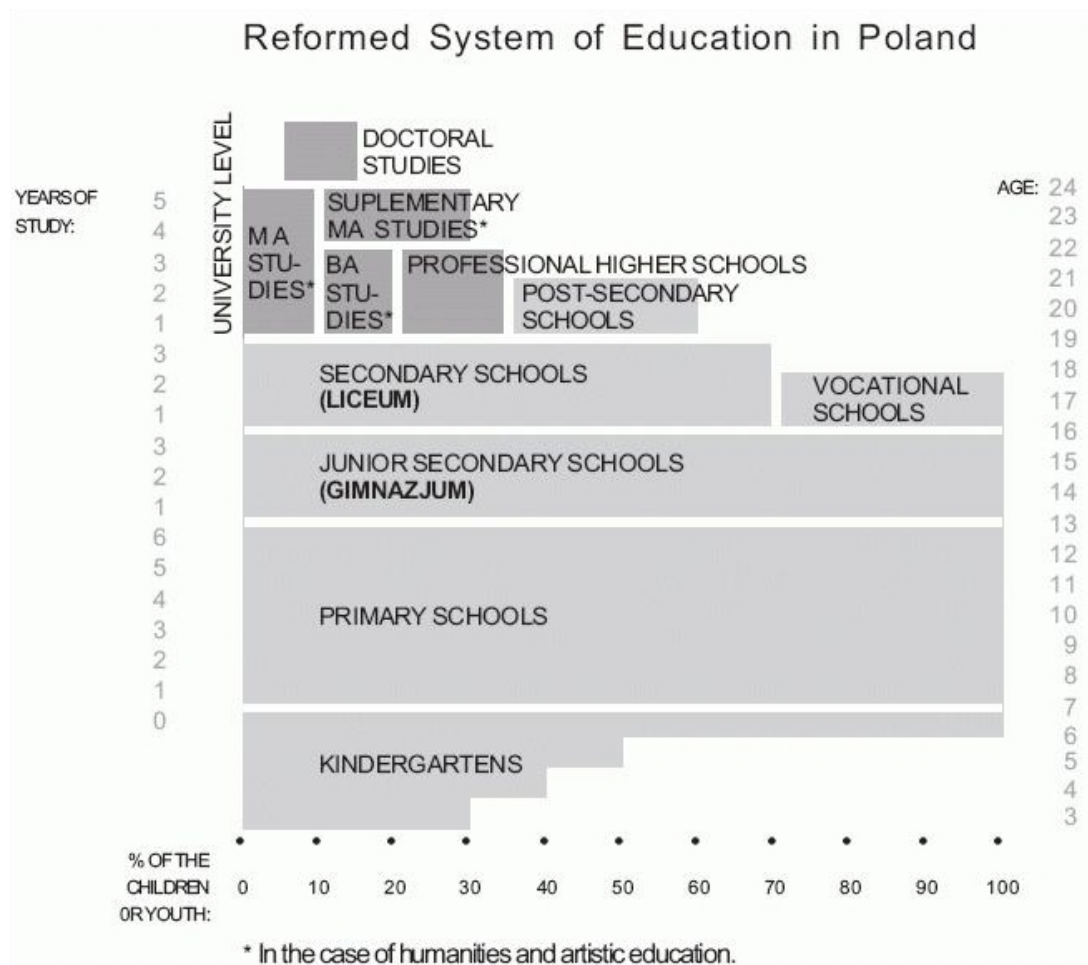


Figure 2. Polish system of education (source Art Academy Kraków)

In early years

First three years of primary school are called integrated teaching. One teacher is teaching the class. Only few additional subjects are thought by others. We notice a growing interest in using ICT among teachers in first three grades. We prepared a workbook for young pupils titled *Lessons with computer for integrated teaching* [Jochemczyk et al. 2006] as an introduction to ICT. The idea of this workbook was presented on Eurologo2005 Conference in Warsaw [Jochemczyk & Olędzka 2005 a].

Building elementary ICT skills

There is more than a hundred different microworlds on a disk enclosed in a workbook. Here is one example: building a vicinity plan. Drawing a vicinity plan is a topic in second grade curriculum. A microworld allows to construct this plan out of a symbols placed in a legend.

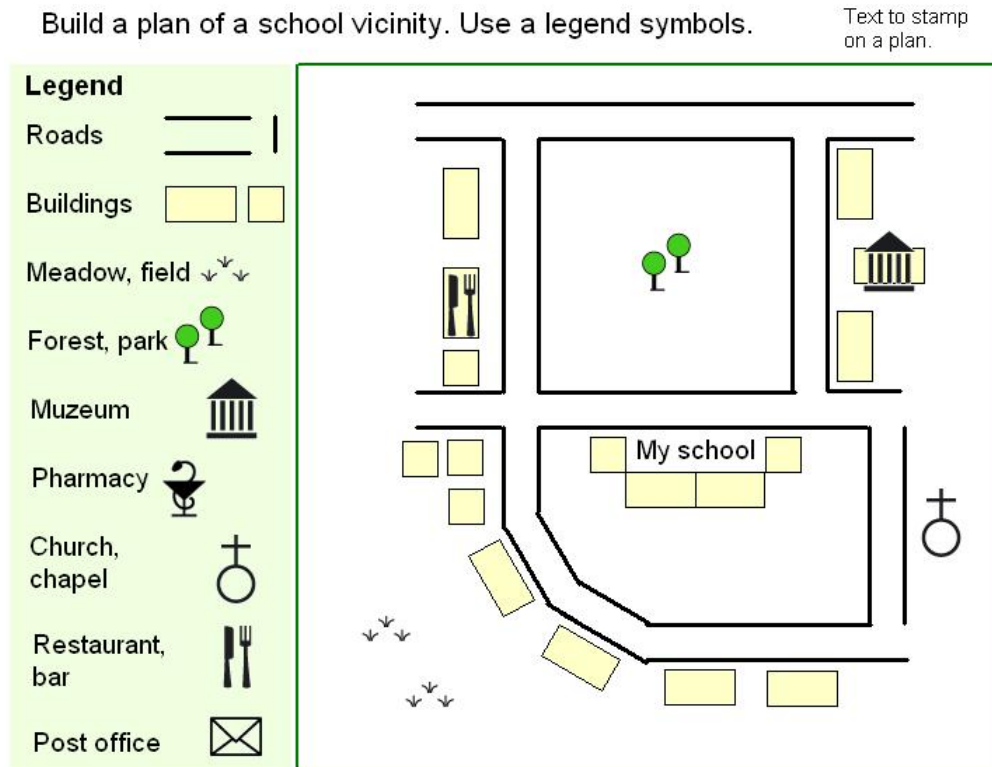


Figure 3. Building a school vicinity plan

It is possible to insert roads and buildings by dragging a piece of road or a building on a plan. It's also possible to rotate it by clicking a right mouse button and drag it to another place. In a legend there are some typical symbols. Those symbols may be dragged on a plan. It is possible to insert a text by clicking a right mouse button anywhere on a plan. The text should be written in a blue window. If an element is dragged outside a plan it's deleted.

Introducing simple turtle drawing

In our workbook two units are devoted to programming in the Logo. It is the first step in programming for children. They can easily learn how to solve some turtle graphic problems.

Pupils can control a way the turtle moves. They start with simple drawings, the turtle can go forward, backward, turn right, left and change a pen colour and pen width. They steer a turtle using buttons. The next step is to drag and drop Logo instructions to build a list of commands. Pupils learn how to create their own procedures.

Teacher can carry next lessons in computer lab in Imagine environment. During a lesson children write commands in a command line. Than they start to write simple procedures without parameters.

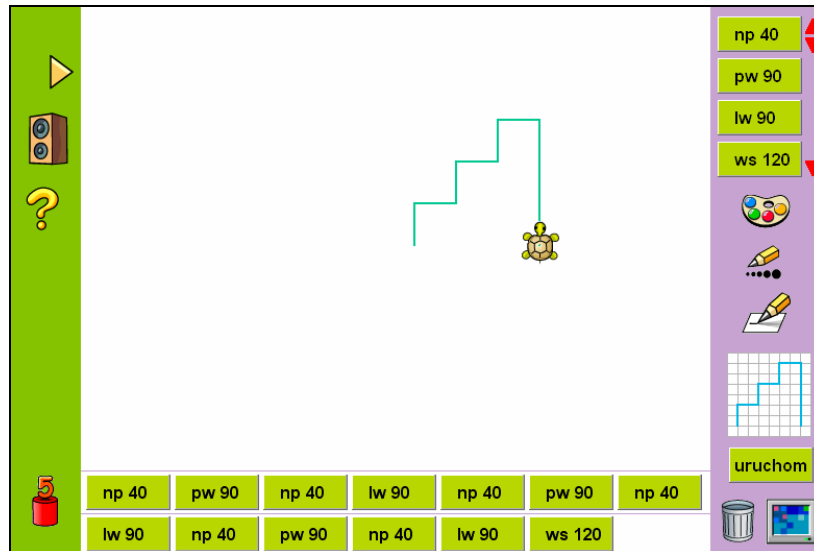


Figure 4. Build a list of commands.

Primary school

Teaching Logo

According to a basic (state, obligatory) curriculum Computer Science course in primary school is rather ICT course. A main aim is to learn how to use ICT with a stress on pictures, texts and communication. The course is usually done in 4th to 6th grade (pupils 10-12 years old). From our point of view it's occasion to introduce also some elements of programming using Logo. As environment we use Logomocja – Polish version of Imagine. Logo lessons are a part of schoolbook *Lessons with computer for primary school* [Jochemczyk et al. 2004].

On this basis we prepared a cycle of lessons on the Moodle e-learning platform. It was the innovative idea. There were different topics for each month: *First lesson with computer* in September, *Adventures of Mr Spelling* in October, next was *Round the Christmas Tree*, *Together with the Turtle* etc. Each lesson included different activities like quizzes, assignments, forums, creating dictionary or database. Many of the lessons were based on Imagine environment. Sometimes a task was to write a procedure, otherwise to create a multimedia project using events and processes or just play an educational game.

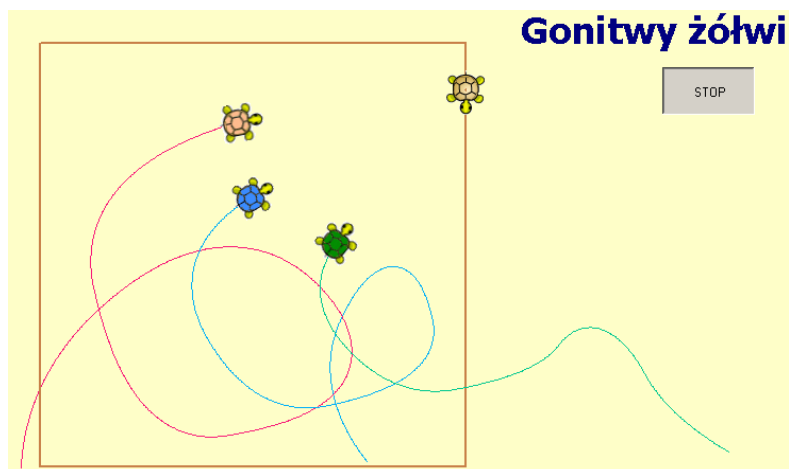


Figure 5. Turtle chasing – project.

In addition, we systematically met with teachers. At these face-to-face meetings we worked with teachers who played a role of pupils. They carry out all tasks included in a lesson to learn how to work on the Moodle platform and to give us a feedback. After each meeting there were prepared methodical materials. In the next step, teachers realized these lessons with pupils.

Lessons met a great teachers and pupils interest. Elements of distance learning in combination with introduction to programming skills and advanced use of Imagine environment were inspiring and professionally developing challenge. From teachers' reports we know that pupils look forward to participate in those lessons.

Working with gifted pupils - Logo competition

Polish Logo competition for primary school children is described in [Jochemczyk & Olędzka 2005b]. This year there was a fifth edition of the competition. Here we will introduce one task from a final stage of the first competition. Similar competition in Slovakia is described by Tomcsanyiova & Tomcsanyi (2005).

Task EKI

Write a procedure **EKI :n**, which will draw in the middle of a screen, as large as possible drawing alike on the pictures. Parameter :n, means the complexity of a drawing. For :n=1 it is a big square divided to four similar squares Upper left square is empty, and three remaining include a letter E, like shown on the first picture. Parameter :n can have values from 1 to 5.

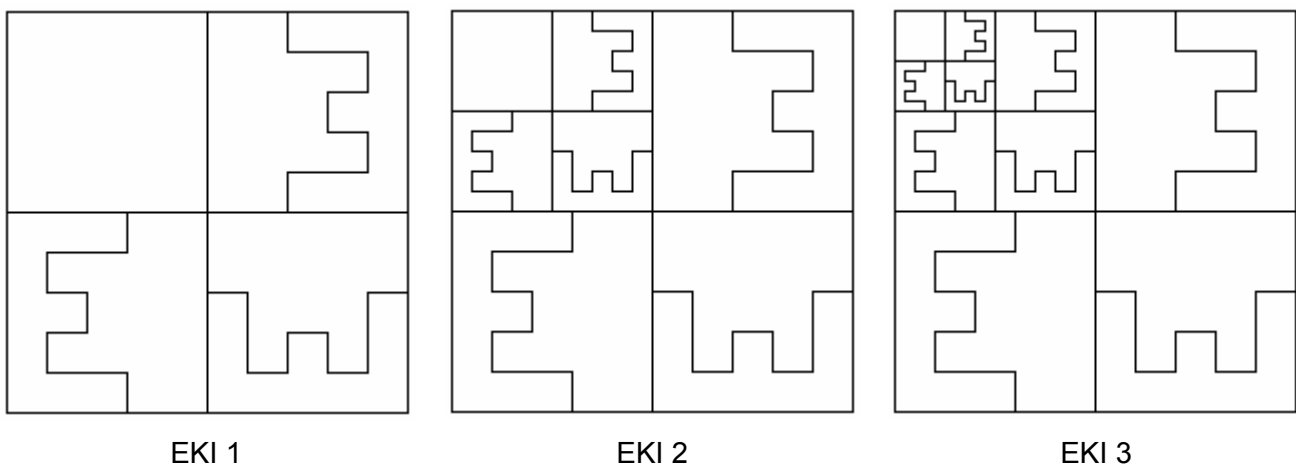


Figure 6. Results of EKI procedure

The task is “algorithmic” in a sense that most important is a drawing algorithm containing loop. It was a demanding task for 12 years pupils.

We were dreaming about solutions like:

```
to EkiSquareR :n :size
  if :n = 0 [stop]
  repeat 3 [SquareWithE :size / 2 right 90]
  square :size / 2
  pu forward :size / 4 right 90 forward :size / 4 pd
  EkiSquareR :n - 1 :size / 2
end
```

where `SquareWithE` draws a square with E shape (upper right corner of EKI 1 picture).

Only 25% of pupils managed to write a procedure which has a satisfactory effect. Among them there were some step by step solutions. Only about 15% of pupils were able to organize a loop

using parameter. All this solutions used iteration loop REPEAT with variable changes inside a loop. Typical solution (main part) was similar to:

```
to EkiSquare :n :size
  repeat :n
    [3SquaresWithE :size
     forward :size / 4 left 90 pu forward :size / 4 right 90 pd
     let "size :size / 2]
end
```

where 3SquaresWithE draws a picture EKI 1.

This shows that probably best pupils are studying other languages like Pascal or C – mainly outside of a school. Talks with them are supporting this guess – for some of them Logo was not the first programming language.

Lower secondary school

Teaching recurrence

Trying to teach fundamental algorithms on middle level of education we introduce operations on words and lists in Logo. Then we try to use recursion and to prepare pupils for understanding of fractal constructions. The idea how to do that was described by Brian Harvey (1985). First procedure is “eating” words. It’s an example of tail recursion.

Procedure definition	? EAT "turtle
	turtle
to EAT :word	turtl
print :word	turt
if empty? butLast :word [stop]	tur
EAT butLast :word	tu
End	t

The second procedure is “eating” and then turning back words. Here we have non tail recursion. We ask pupils: “What will happen if we add anything after recursive call” and encourage them to experiment. Then we show the result of NOTCH procedure (shown below) and ask them to obtain the same result by changing procedure EAT.

Procedure definition	? NOTCH "turtle
	turtle
	turtl
to NOTCH :word	turt
print :word	tur
if empty? butLast :word [stop]	tu
NOTCH butLast :word	t
print :word	tu
End	tur
	turt
	turtl
	turtle

Often pupils are astonished with the solution and some of them ask “How it is possible?”. This is much harder question. To answer we have to trace deeply NOTCH procedure. The best “tracing” is to let pupils to act as Logo procedures. So we are preparing a show. We have lines of NOTCH procedure. Needed actors should play the roles of : NOTCH, print, if, empty?, butLast, stop, NOTCH (we should be prepared for this next NOTCH), end.

Instead of costumes there are sheets of paper with names of procedures. Than we have a “dress rehearsal” – pupils have to say what their procedure is doing. A final performance has

some dramatic moments. The first - when we come to NOTCH call inside NOTCH – we resolve it by engaging another actor with NOTCH role – this actor is now taking a lead. The next moment is when we come to the first STOP and his role is to fire out the latest NOTCH.



Figure 7. Pupils performing NOTCH procedure

There is some fun and a play message is when we hear “Now I understand”.

Upper secondary

There is only one schoolbook proposing to teach Logo during ICT course on upper secondary level, prepared by team from our Centre guided by Andrzej Walat (2002). Logo part is mainly devoted to artistic turtle graphics – production of series of pictures, mainly square variations.

We rather try to use models – animations prepared in Imagine. Here is one example – a microworld *Velocity an Force*. The microworld is a product of CoLabs project guided by Marta Turcsanyi-Szabo. Some interesting CoLabs project results were presented by Marta Turcsanyi-Szabo and Ivan Kalas at Eurologo2005 [Kalas & Turcsanyi-Szabo 2005]. The idea was developed by Andrzej Walat, programming is done mainly by Witold Kranas, many improvements are due to Katarzyna Olędzka.

The microworld is developed to support applied mathematics and physics teaching / learning on secondary education level (age 12 - 18). The aim of this microworld is to introduce vectors in physics and to analyze the role of velocity and force (acceleration) vectors. It helps to understand how force is changing velocity vector and thus how force rules the body movement (second Newton’s Law). It contains 2 important examples:

- body movement in uniform gravitational field – near the Earth surface – to analyze different kinds of “shots”,
- body movement in central gravitational field, for example satellite or planetoid movement.

The example of steering the body movement on a round track gives the possibility to understand the role of centripetal force.

Learning with models

1. Free control (steering a rocket in space). A task is to steer the movement of a rocket. A rocket is somewhere deep in space, far from other bodies. The only force changing its movement is due to rocket engine. Steering centre is a black arrow of a force vector. Force value and direction may be changed by dragging black arrow. It’s also possible to change initial velocity vector.

2. Constant gravity (throwing a stone). A task is to throw a stone by setting initial velocity. Then the motion of a stone is under gravity force directed top-down. You can set initial velocity vector. During the motion it's possible to watch how velocity is changing due to gravitational force.

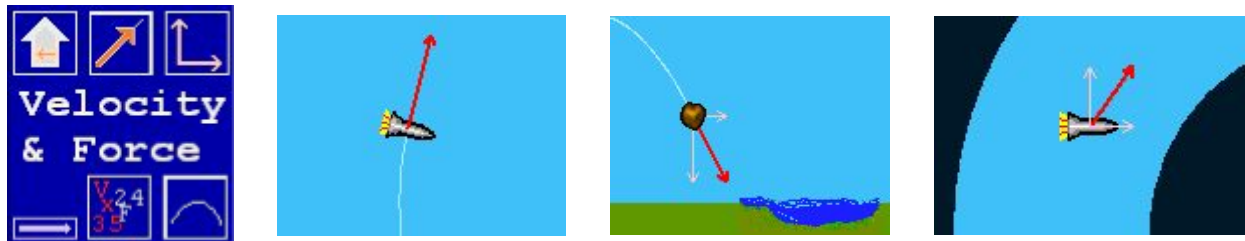


Figure 8. Pictures from Velocity & Force microworld

3. Central gravity (launching a planetoid). A task is to let a little planetoid move around the Sun. The only force acting on a planetoid is gravitational pull from the Sun. It's possible to change initial velocity vector. The force vector is dependent only on the distance from the Sun. It's worth trying how the planetoid is moving when it starts with different velocity values.

4. Round track (controlling circular movement). How can be circular motion achieved? A task is to steer the rocket in such a way, that it could move inside round track. It's necessary to control movement all the time by changing force vector.

5. Painted track (game for two). A track may be painted with a pencil. A task is to control movement on a track by changing force vector.

The exercises are "open". There are possibilities of different kinds of activity, gathering the experience, answering questions: what will happen when we change...?

The microworld is used to help Physics teacher. It is useful to improve understanding of the Newtonian laws of motion and also for summing up classic dynamics. Students like a "game way" of presenting motion problems.

Instead of conclusion – a bunch of questions

We (at least two of us) started our educational Logo activity about 20 years ago. In those happy days we were giving Logo programming courses focused mainly on programming techniques, developing Polish versions of Logo language, preparing some code examples and educational materials. Then blowing begun and IT started with Windows, games and Internet. Now there is a diminishing interest in programming courses but what's instead? Computer driving licence training? Maybe for teachers, pupils rather don't need it.

Is Logo still useful in education? We like the examples we presented here. But we have a feeling that nowadays many of them are either too hard for teachers and students or out of their interests. We try to shift a bit to educational microworlds prepared in Imagine helping to learn different subjects. But this direction means focusing rather on subject matter not on programming language. So what's the main reason to use Logo in education? Not least is – to have some fun in teaching/learning.

Sorry for this very personal summary of our work. We are looking toward the discussion during a conference.

References

Harvey, B. (1985) *Computer Science Logo Style. Vol. 1: Intermediate Programming*. The MIT Press, Cambridge, Massachusetts

Jochemczyk, W. and Olędzka, K. (2005 a) *Imagine in educational projects for young children*. In Proceedings of EuroLogo 2005. Edited by G. Gregorczyk et al. Warsaw. pp. 386 – 389.

Jochemczyk, W. and Olędzka, K. (2005 b) *Logo competition for primary school children*. In Proceedings of EuroLogo 2005. Edited by G. Gregorczyk et al. Warsaw. pp. 383 – 385.

Jochemczyk, W.; Krajewska-Kranas, I.; Kranas, W. and Wyczółkowski, M. (2003) *Lekcje z komputerem Podręcznik dla ucznia gimnazjum*. WSiP, Warszawa.

Jochemczyk, W.; Krajewska-Kranas, I.; Kranas, W.; Samulska, A. and Wyczółkowski, M. (2004) *Lekcje z komputerem Podręcznik dla szkoły podstawowej Klasy 4-6*. WSiP, Warszawa.

Jochemczyk, W.; Krajewska-Kranas, I.; Olędzka, K.; Opęchowski, W.; Samulska, A.; Wilk, E. and Wyczółkowski, M. (2006) *Lekcje z komputerem w nauczaniu zintegrowanym Zeszyt ćwiczeń*. WSiP, Warszawa.

Kalas, I. and Turcsanyi-Szabo, M. (2005) *Collaboration – a tool for learning*. Proceedings of EuroLogo 2005. Edited by G. Gregorczyk et al. Warsaw. pp. 54 – 65.

Papert, S. (1999) *Introduction: What is Logo? And Who Needs It?* In: *Logo Philosophy and Implementation*. Logo Computer Systems Inc., USA.

Tomcsanyiova, M. and Tomcsanyi, P. (2005) *Logo programming competition in Slovakia*. In Proceedings of EuroLogo 2005. Edited by G. Gregorczyk et al. Warsaw. pp. 377 – 382.

Walat, A. ed. (2002) *Technologia Informacyjna Podręcznik do kształcenia podstawowego w liceach i technikach*. Oficyna Edukacyjna Krzysztof Pazdro, Warszawa.

Moodle e-learning platform: <http://www.e-nauczanie.wsip.com.pl>