Take up the challenge – reflection on POLLOGIA competition

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Abstract

In the school year 2008/2009 we started organising POLLOGIA - national competition on programming in Logo for lower secondary school students (gymnasium). It was done in cooperation with Microsoft's educational programme "Partners in Learning". The POLLOGIA competition is based on the experience gained during organisation of local competitions for Mazovia District – Logia (for lower secondary school students) and miniLogia (for primary school students).The tasks on this competition are from turtle graphics, operations on words and lists. Competition has three stages. In the article we describe our experience and difficulties connected with organising POLLOGIA, students' problems and organisational issues.

Figure 1. POLLOGIA competition logo

Keywords

Logo, Imagine Logo, programming in Logo, competition, lower secondary school, gymnasium

Difficult beginnings

In the school year 2008/2009 we started organising **POLLOGIA** - national competition on programming in Logo for lower secondary school students (gymnasium). It was done in cooperation with Microsoft's educational programme "Partners in Learning". This long-term educational programme empowers students and teachers to realize their full potential, by partnering with education and government leaders through providing education resources – tools, programmes, and practices.

Figure 2. LOGO Web portal in Microsoft's educational platform "Partners in Learning"[1]

Figure 1. LOGO Web portal in Microsoft's educational platform "Partners in Learning"

The POLLOGIA competition is based on the experience gained during organising of local competitions for Mazovia District – Logia (for lower secondary school students) and miniLogia (for primary school students)[2]. Prepare a competition for the whole country requires a different organisational and pedagogical approach. Following the rules of Eight Big Ideas Behind the Constructionist Learning Lab[3], especially the one about hard fun, we started POLLOGIA competition.

Firstly, we realised that the competition required some promotional actions to be taken to popularise the idea. We prepared leaflets and posters to send them to every lower secondary school in Poland (about 6500). The magazine "Teachers' voice" took the patronage under the competition.

Secondly, there were some obstacles of organisational nature. Whereas first stage of the competition did not need access to school laboratories, in the second one, the organisers had to secure school laboratories on a specific day and strict hours. The third stage was organised in Warsaw, so we had to think about accommodation for 30 students and their guardians. This was connected with some financial problems, since students were from various regions of Poland.

We also faced problems in the field of the level of students' preparation. Logo language is not taught in every secondary school, its popularity differs in various regions of Poland.

[1] LOGO Web portal in Microsoft's educational platform "Partners in Learning" http://www.pdp.edu.pl/logo

[2] Borowiecka, A. and other (2008) – Konkursy Informatyczne LOGIA i miniLOGIA, OEIiZK

[3] "The third big idea is hard fun. We learn best and we work best if we enjoy what we are doing. But fun and enjoying doesn't mean "easy". The best fun is hard fun. Our sports heroes work very hard at getting better at their sports. The most successful Carpenter enjoys doing carpentry. The successful businessman enjoys working hard at ma king deals." Gary Stager, Papertian Constructionism and the Design of Productive Contexts for Learning

For example in Mazovia district there is a tradition of logo programming competitions. As a result, students and teachers are familiar with logo environment and programming competitions issues. We also considered the problem of teachers' preparation from methodical and organisational point. We thought about popularising constructivisticts ideas. Along with competition tasks we prepared some materials which were helpful in preparation for the competition.

Challenges for students

Generally speaking the tasks on POLLOGIA competition differ in terms of difficulty not only between stages but also among one stage. We plan various tasks to meet expectation of different level preparation and experience from students' perspective. As an exemplification, tasks from the second stage there will be presented. There were three tasks – a graphical one, a recursive function and a task where operations on words were needed.

Chain Problem

The first tasks was to write a procedure **LZ :x :y :**z with three parameters which describe accordingly a number of red, green and yellow elements in the chain. The width or height of a picture should be not less than **400**.

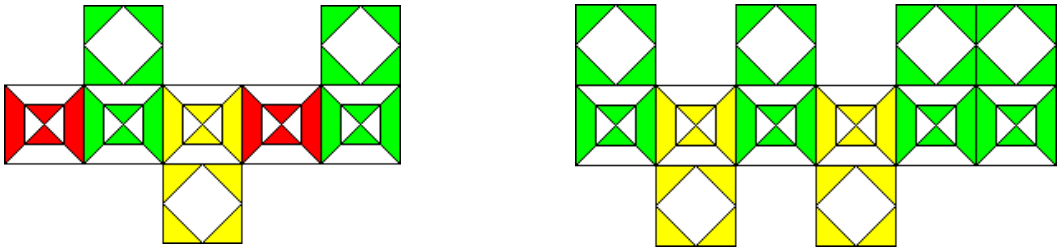

Figure 3. Examples of calling function LZ

The difficulties connected with this task were to apply appropriately repeat instructions to avoid problems with missing elements (x, y, z were not necessary equal) and with the constraint of width/height of the picture. Students had to notice that the algorithm for short chains and long one was different. In the latter, they had to divide the width of the picture by numbers of elements, whereas in the former, they had to consider not only a number of elements but also its location.

Multiple Problem

The second task had to differentiate students. Pupils with less knowledge could present a solution only partly corrected and those with more experience – the full correct. The task was to write a function described in recursive way. When we have a and b, we have to count the last digit of Ln value from correlation as described below:

$$L_1=a,\ L_2=b,\ L_3=L_1*L_2,\ L_4=L_2*L_3,\ \ldots\ L_n=L_{n-2}*L_{n-1}$$

Students had to write a function **LN :a :b :n** where **a,b∈<1,100>** and **n∈<3;1000000000>**. The additional constraint was to avoid long waiting for the result when the computer counts.

We will present the solution in three steps according to the level of difficulty.

Solution Number 1 – correct only for very small n

The function is written directly from the definition of the given task. We take two numbers **a** and **b**, and next we multiple them. We repeat this activity **n-2** times. The result of this function is the last digit of the counted number.

```
to LN :a :b :n
  repeat :n-2
   [
     let "c :a*:b
     let "a :b
     let "b :c
   ]
  output last :c
end
```

Solution Number 2 – for small n

It is not difficult to notice that when we are interested in the last digit only, we do not have to consider the whole numbers but only concentrate on the last digit. Therefore we can cut number in each iteration.

```
to LN :a :b :n
  repeat :n-2
  [
    let "c last :a*:b
    let "a :b
    let "b :c
  ]
  output :c
end
```

Solution Number 3 – for small and big n

Analysing the sequences described by formula given in the task, one can notice some regularity.

For example:

For initial numbers 0 i 0 we get 000000000000…

For initial numbers 1 i 1 we get 111111111111…

For 2 i 1 we get 212248212248212248…

For 3 i 1 we get 313397313397313397…

….

For 9 i 9 we get 991991991991991991…

Every digit is repeated at least every six places. Therefore, when for given initially numbers we generate the six first digits, we can find even a distant element very fast.

```
to LN :a :b :n
  let "temp word last :a last :b
  repeat 4
   [
    let "c last :a*:b
    let "a :b
    let "b :c
    let "temp lput :c :temp
   ]
  output (item 1+mod :n-1 6 :temp)
end
```

In such kind of task newbie students can solve it in the way similar to presented in solution number one, the better ones in number two and more experienced ones in number three. This was typical differencing tasks to help us to engage all students, on the one hand, and to choose the best ones, on the other.

Ciphered words

The third task was to cipher a word in a specific way. When you have a word **w** to be ciphered and a key **k**, you write down letters in a table as described below. In the first row you put first **k** letters from the left to right, in the second one, you put the next **k** letters, but from right to left, in the third one – like in first one from left to write, etc. You read the ciphered word when you look at subsequent columns.

For example, when you want to cipher a word **"eurologo2010paris** with key **6** you have to prepare a table like this

↓	↓	↓	↓	↓	↓
e	u	r	o	l	o
0	1	0	2	o	g
p	a	r	i	s	

The ciphered word will be **e0pu1ar0ro2ilosog**. In this task students have to be fluent in using operation on words, they have to know how to extract specific element and build new words. Also some mathematical knowledge is needed.

```
to cipher :w :k
  let "temp "
  repeat :k
   [
     let "x repCount-1
     repeat  1+(count :w)/:k
     [
      let "y repCount-1
      ifElse mod repCount 2=1
        [let "nr :y*:k+(1+mod :x :k)]
        [let "nr :y*:k+(:k-mod :x :k)]
      if :nr<=count :w [let "temp lput item :nr :w :temp]
     ]
   ]
  output :temp
end
```

By solving such tasks, students learn how to

- efficiently use the most important procedures and functions in Logo including operation on words and lists;
- apply iteration and recurrence;
- divide a problem into sub-problems, to form procedures with – and without - a parameter;
- be able to scale a drawing and to find proportions;
- test procedures with parameters – for different values, with special consideration of boundary conditions.

Organisational issues

The POLLOGIA consists of three stages. At the first level, which lasts about six weeks – students independently solve three graphical tasks. Beforehand, students have to create an account on the platform. At that stage, tasks can be solved at home or at school. The

standard task is to write a procedure which would draw an expected picture on the screen. Students have to upload their solutions via a special form on the platform. Tasks are assessed and the results are published on the platform. To our surprise in first stage students from 15 districts (out of 16) took part. For the second one were qualified about 160 students.

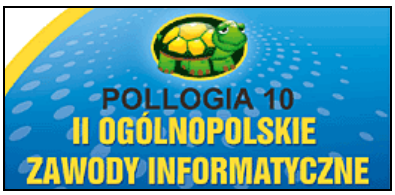

Figure 4. POLLOGIA competition promotional poster

At the second stage – regional one – participants solve three tasks. One is usually graphical, one with function with arithmetic operation and one with operation on words. The competitions are conducted at schools. The tasks are sent to teachers in ciphered *pdf* format and a password is published at a certain time on the platform. The time for solving the tasks is limited to 120 minutes. After the competition, students upload their solutions on the platform. The team of experts assess all answers according to the established criteria and presents outcomes in points along with a list of participants of the third stage (finalists).

The third stage is organised in one place. Thirty participants from different districts of Poland solve three algorithmic tasks. The time is also limited to 120 minutes. The tasks at this stage are similar to those of the second, but they are more difficult. They also include problems connected with processing lists. The finalists were from Wroclaw, Katowice and Warsaw area.

During the competitions we met a lot of gifted students. In terms of preparation there are questions as flowing:

- How much support do students received from their teachers?
- Did they work independently or some else helped them?
- What is the influence of school computer science lessons?

We face the problem connected with dialect Logo. There is a lack of free implementation of Logo in Polish language. This could be an obstacle for some students. We turn to creators of Imagine Logo to prepare a simplified version of Imagine Logo. In this version, called ImagineLite, there is only an interpreter and possibility to save procedures as text files. In this place, we would like to acknowledge the creators of Imagine for permission, especially Peter Tomcsanyi, for his contribution.

Summary

Summing up, the organisation of POLLOGIA competition was a big challenge for students who prepared and participated, for their teacher and for us – organisers. It took time and effort but we can say after *Eight Big Ideas Behind the Constructionist Learning Lab*, that it was fun, but hard fun. We decided to continue … and this year is the second edition of the competition.

References

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