

# HOW DO HUNGARIAN PUPILS AND TEACHERS USE THEMATIC MAPS IN ELEMENTARY SCHOOLS?

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**Abstract:** *Between 2004 and 2005 Hungarian specialists organized a survey to obtain information about the use of maps by teachers and pupils in the elementary schools. Previously, a research was finished to study the presence of cartography in the Hungarian study plans and School Atlas, examining in particular how are taught and used the thematic maps in the elementary schools. The survey was designed for pupils of 7<sup>th</sup> grade, to measure their abilities reading thematic maps. This questionnaire contained four questions, each one of them asking about different practical aspects of the thematic cartography (reading of thematic maps, filling a text based on map information and how pupils represent information on a outline map). The collected data was stored in digital format and the results of the data analysis are presented using different types of charts. All the data, results, and documents are stored in a website, to facilitate the free access to the data and experiences acquired during this research. This survey was planned on the scope of an international research project in collaboration with Argentine specialists, who organized a similar survey to compare the results obtained in both countries.*

## ORGANIZATION OF THE RESEARCH

Present work was realized on the framework of an international project organized by Hungarian and Argentine specialists and entitled “Map reading by children in school age: Cartographic education and practice in Hungary and Argentina”. This project was approved for a period of two years between 2004 and 2005, under a bilateral agreement for the support of scientific research, signed by the Argentine and Hungarian government. The general aims of the project are:

- Analysis of the actual situation in the teaching of map concepts in both countries.
- Research about the use of maps by teachers and pupils in elementary schools.
- Identification of difficulties to face during the teaching of map concepts.
- Recognizing of the positive experiences of teaching map concepts in the interest of their possible mutual adoption.

The research was divided in two parts, corresponding to the number of years of the project:

- During the first year (2004) we would study the use of thematic maps in elementary schools, how pupils and teachers use these maps in their daily work after the study of the elemental cartographic concepts.
- In the second year (2005) we would study how pupils understand the methods of representation of relief in the different maps (mainly atlases, wall maps, and – in very few cases – topographic maps) used in the classrooms.

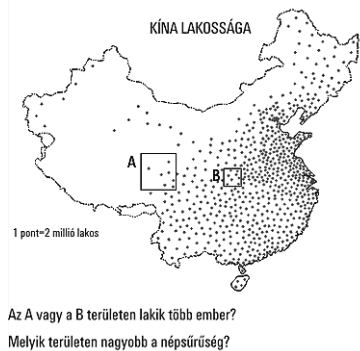
This paper presents the results obtained by the Hungarian specialists during the first year of activities, that is studying the use of thematic maps in Elementary Schools of the country.

## DESIGN AND STRUCTURE OF THE TEST

After the study of the characteristics of the Hungarian educational systems (specifically in which grades the pupils learn the elemental concepts related to maps and when they begin to apply these concepts in practice) we took the decision of applying the planned test to 7<sup>th</sup> grade pupils of Elementary Schools. To take this decision we considered that in Hungary the pupils learn elemental map concepts between grades 3 and 5. During 6<sup>th</sup> grade they use more often the maps in the subjects related to Geography and History, and by the beginning of the 7<sup>th</sup> grade the pupils should have practical experience that lets them answer the test about thematic maps.

In interest of planning a cheap survey we decided that the test should be printed in a A5 format, with a maximum of four questions designed in black and white. We had to word the questions taking into account these limitations, because

1.A térképek tartalma alapján válaszolj a következő kérdésekre:



A jelkulcsban válaszod ki azt a négyzetet, amely véleményed szerint a legnagyobb népsűrűséget ábrázolja. Utána jelöld ki a térképen a kiválasztott négyzet színével kitöltött területet.

2.A térképen levő információ felhasználásával egészítsd ki a következő szöveget:

A történészek szerint Portugália afrikai terjeszkedésének kezdete 1415, amikor a portugálok elfoglalták \_\_\_\_\_ városát Észak-Afrikában.

1434-ben Gil Eanes felfedező tújtát a \_\_\_\_\_-on, amelyet nem véletlenül "Félelem-fokznak" is neveztek, mivel addig európai tengerész nem hajózott e ponton túl. Utána éveken keresztül folytatták a felfedező utakat a kontinens nyugati partján, és az \_\_\_\_\_ évben Diogo Cão utazó elérte a Kongo-folyó torkolatát.

Öt év múlva a felfedező \_\_\_\_\_ az afrikai kontinens déli csücskére jut, amelyet ő "Viharok fokának" nevezett. Ezzel a felfedezéssel megnyílt az út India felé. E jó hír hallatán II Joao portugál király megváltoztatta a fok nevét és \_\_\_\_\_-nak nevezte.

\_\_\_\_\_ júliusában Vasco da Gama Lisszabonból indult el négy hajóval. Novemberben elérte Afrika keleti partját, amelyet felderített és néhány alkalommal partra is szállt. 1498 áprilisában lehorgonyozott Calicut kikötőjében: ő volt az első európai utazó, aki Afrika kerülesével \_\_\_\_\_-ba jutott.



Figure 1: First and second question of the test

the absence of colours could not mean an obstacle to understand the information represented in the maps.

The four questions of the test were penned after the following principles:

**1<sup>st</sup> question (Figure 1):**

We would evaluate the use of two methods of thematic representation (points and choropleths) to draw similar themes (population and density of population) in two different maps (China and Venezuela). In the point map two squares of different size were delimited, and asked in which of them live more people and which of them has the highest density of population.

In the legend of this map the pupils could read the equivalence of a point and the population number. In the second map five shades of grey were applied to identify the density of population, without any textual or numerical information about the meaning of these shades in the legend. We asked the pupils to indicate which tone of grey represented the highest density of population in the legend and the map.

The purpose of this question was to determine if pupils were able to draw a parallel between the two methods of representation, to realize that the highest density of points and the darkest choropleth areas have a similar meaning in both maps.

**2<sup>nd</sup> question:**

Filling of a text based on information represented in a historical map about the exploration of African coasts by the Portuguese navigators in the 15<sup>th</sup> century (Figure 1). History was selected because during the teaching of this subject teachers use a considerable number of maps to illustrate their explanations and the pupils work very often with maps included in textbooks, workbooks, atlases, etc. We cared to redact a text that made the pupils read the information offered in the map to fill it. In this question we wanted to evaluate how the pupils can understand the thematic information represented in a map with content that did not relate directly to a geographical subject.

**3<sup>rd</sup> question:**

Reading and joint analysis of two methods of representation (diagrams and choropleths) in the same map.

The pupils had to answer three questions related to environment protection, represented in a map of the country (Figure 2):

- In the first one pupils had to compare visually only one column of the diagrams (to identify the province with the highest volume of dangerous solid waste)
- In the second one they had to analyze all the columns of the diagrams (to identify the province with the highest volume of dangerous waste)
- In the third one they had to interpret the content of the diagrams and the values represented by choropleths (to identify the province with a relatively high volume of dangerous waste, but only a small part of this volume is stored in that county, namely, it is not translated for recycling).

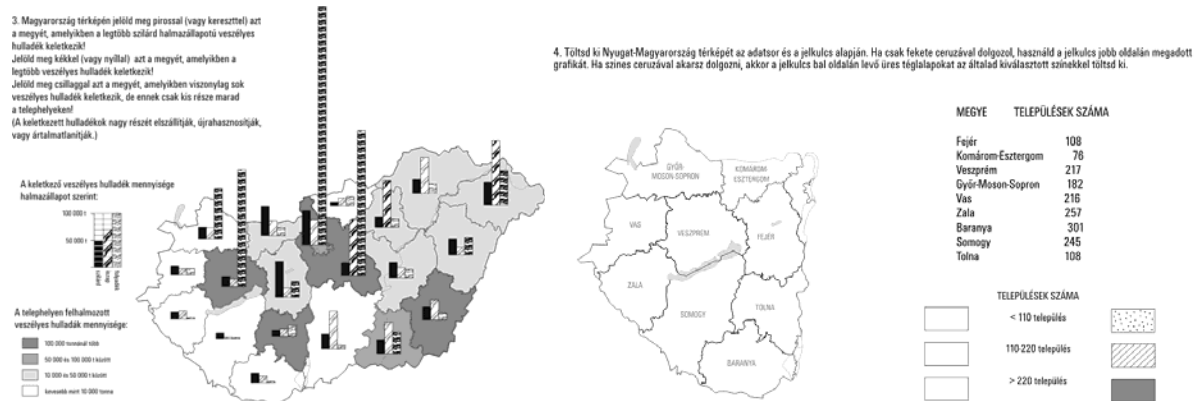


Figure 2: Third and fourth question in the test

#### 4<sup>th</sup> question:

Drawing of thematic information on an outline map, based on data and legend attached to it. We offered the choice to create their own symbolization (in black and white or in colour), and represent the selected fills in the legend. The map to fill was a map of the western provinces of the country (Figure 2).

### APPLYING OF THE TESTS

A total of 1534 pupils answered the questions of the test and the major part of them (a 72.7%) were 12 years old.

The selection of the participant schools was made in a representative way, selecting at least one school from each county, and trying to have a similar proportion of schools in cities and smaller towns (44 schools from 34 cities and 24 schools from 24 towns were asked to participate). From the sixty-eight contacted schools a total of thirty-eight sent back their answers (Figure 3).

The time given by the teachers to answer the test varied between the participant schools. In total, 138 teachers answered to a test designed for them, asking about the use of thematic maps in the classroom and other topics. One of the questions was about how much time the pupils spent on responding the questionnaire; only 73 teachers answered this question. Based on their answers, 33.3% of pupils had between 21 and 30 minutes to complete the test, and 29.2% had between 10 and 15 minutes.

### GENERAL RESULTS OF THE TESTS

The obtained results are summarized in Table 1. This table contains the results according to the answers received till March 30, 2005.



Figure 3: Geographic distribution of Hungarian schools contacted during the survey.

| <b>RESULTS OF THE SURVEY</b>  |                        |                                 |   |
|---|------------------------|---------------------------------|---|
| <b>1<sup>st</sup> QUESTION: Similar information represented by points and choroplets in different maps</b>          |                        |                                 |   |
|   | Right answers          | Wrong answers                   | No answer   |
| Map of China:<br>-Territory with highest number of inhabitants  | 1418                   | 116                             | -   |
| -Territory with highest density of population   | 1260                   | 273                             | 1   |
| Map of Venezuela:<br>-Highest density of pop. in the legend   | 1160                   | 374                             | -   |
| -Highest density of pop. in the map   | 807                    | 727                             | -   |
| <b>2<sup>nd</sup> QUESTION: Filling of text based on information represented in historical map</b>                  |                        |                                 |   |
|   | Right answers          | Answers with one or more errors | No answer   |
| Topic: Exploration of the African coasts in the 15 <sup>th</sup> century.   | 501                    | 1033                            | -   |
| <b>3<sup>rd</sup> QUESTION: Analysis of two methods of representation (diagrams and choroplets) in the same map</b> |                        |                                 |   |
|   | Right answers          | Answers with one or more errors | No answer   |
| -Reading of information represented in a column of a diagram  | 1386                   | 47                              | 101   |
| -Reading of information represented in the diagram  | 1251                   | 182                             |   |
| -Joint analysis of information represented by diagram and choroplet   | 818                    | 615                             |   |
| <b>4<sup>th</sup> QUESTION: Drawing of a thematic (choropleth) map</b>  |                        |                                 |   |
|   | Correct categorization | Wrong categorization            | Quality of work   |
| Making of a choropleth map of the West Hungarian counties   | 1147                   | 248                             | High: 1075<br>Average: 214<br>Low: 104<br>No evaluated: 3 |
|   |                        |                                 | No answer: 138  |

Table 1

## ANALYSIS OF THE RESULTS

In the 1<sup>st</sup> question there were no significant difficulties to read the information represented by points. The result of the second part of this question is interesting, because the majority of pupils did not have any difficulty to identify the highest density of population in the legend (they did not receive any written help about the meaning of the shades), but only a 52.6% of them identified correctly the data in the map. We should consider that within the 47.4% of wrong answers a part of the pupils marked the correct square in the legend, but did not pick out it in the map. We can say that only one of two pupils associated properly the similar meaning of both methods of representation in the maps, having the needed ability and practice to recognize that the darker shade of a color is used to represent higher data values. It can be considered also an ambiguous result, reflecting that about a half of the pupils had difficulties to complete this kind of exercise.

At first sight the results of the 2<sup>nd</sup> question are not satisfactory: the 67.3% of pupils made at least one error while they filled the text reading the information represented in the map. But exactly 51.6% of this group of pupils made only one

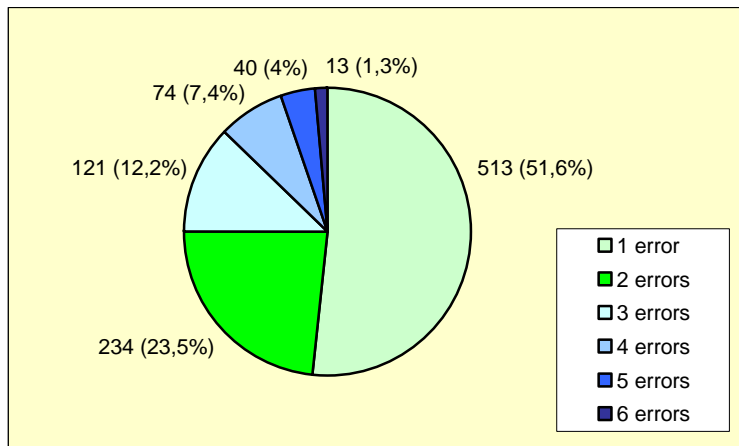


Figure 4: Number of errors in the wrong answers given to the second question of the test

mistake and 23.5% two mistakes (a total of 747 children), as shown in Figure 4. More frequent mistake made by the pupils was the change of digits of a year (for example, writing 1842 instead of 1482) or the change of the discoverers' name (writing Vasco da Gama instead of Bartolomeu Dias). This second kind of mistake is probably explained by the fact that the pupils could not read correctly the data in the map: at this point of the map four data were represented in a very small space (please note that the page format for the test was A5), but on other hand the location of the lines showing the two discoverers' routes were very close to each other.

The results of the 3<sup>rd</sup> question raised the highest interest among us, because this question evaluated the children's capacity not only to read, but also to analyze the represented information. The first part was only an introduction, asking pupils to read information drawn in a column of the diagram, and the second one required the reading of the whole diagram. A major percentage of pupils did not have difficulties to give the correct answers to these questions. The main obstacle was the final part of the question, when the children were requested to analyze diagrams and choroplets together: 40% of the answers were erroneous. A total of 101 pupils did not answer this question; they were not included in the calculated 40%. A possible reason of the questions without any response can be the lack (shortage) of time. But at same time we could observe that those pupils, who gave right answers to the first two points, did not response correctly this one. In other words, they are able to read literally the values in a diagram, but they do not have the sufficient practice to analyze values represented together by different methods in the same map.

The main aim of the 4<sup>th</sup> question was to measure the pupils' abilities to create themselves an easy (choropleth) thematic map. We can consider satisfactory the obtained result, because the majority of the pupils put correctly the given data to the appropriate categories. To detail the information contained in Table 1, a total of 1042 answers were made in black and white, and 351 pupils used colours to fill their map. We assessed these works from a graphical point of view too and more than a 70% of them obtained an evaluation of good quality in the tracing of lines, filling areas, etc. This fact demonstrates that a noteworthy percentage of the pupils denoted interest in tasks that let them express – with some liberty – their graphical abilities.

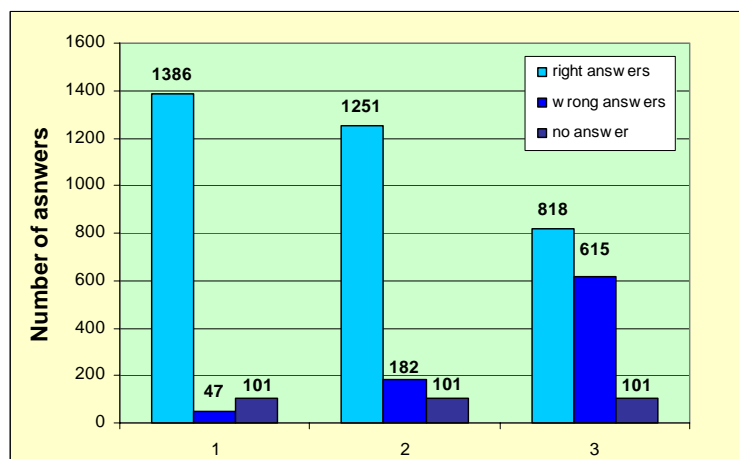
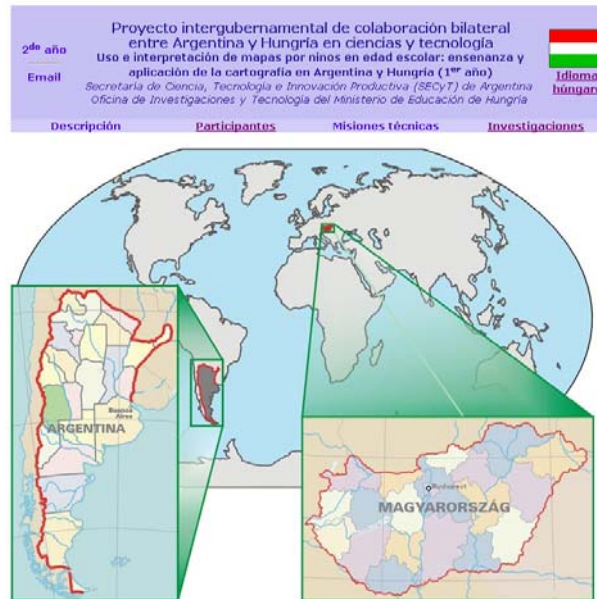


Figure 5: Analysis of answers given to the third question of the test



Lo saludamos en la página Web del proyecto!

Figure 6: Website of the project

## PRELIMINARY CONCLUSIONS

People interested in this topic can find free access to all the databases, documents, etc related to this project visiting the following site: <http://lazarus.elte.hu/hun/dolgozo/jesus/mag-arg/proyect1.htm> (Figure 6). All the documents are in two languages Spanish and Hungarian), but we plan to traduce the databases and final documents to the English language too.

At the end of the present year we are going to prepare a document to present and analyze the results of the survey. This report will sum up the positive experiences detected during the teaching and practical use of map concepts, drawing up those ideas and suggestions that could be applied mutually in both countries. We intend to send this final document to Hungarian institutions related to educational activities in the fields of geography and cartography (Ministry of Education, research institutes, teachers organizations, etc).

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