

# COMPARISON OF CARTOGRAPHIC LANGUAGE OF PUPILS IN THE 4TH GRADE OF PRIMARY SCHOOL (CASE STUDY OF THE SLOVAK REPUBLIC AND CZECH REPUBLIC)

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## **Abstract**

*Pupils acquire the first cartographic knowledge and skills already in primary education, particularly, within the subject called "Regional Studies (in Slovak - Vlastiveda)". The aim of the paper is a comparative analysis of the ability of pupils in the 4th grade at primary schools to use cartographic language in real life using a selected sample from the Slovak Republic and Czech Republic. In the first step, the researched group of pupils was motivated by dialogs and discussions about maps. The next step was the implementation of the survey which was based on text assignment (story) containing various information. On the basis of this story, pupils should construct a map. Assessment of the level of using cartographic language by individual pupils was carried out through 11 selected criteria (e.g. spatial links, hierarchy, relative distance, elevation, qualitative and quantitative characteristics). Finally, we compared the results between pupils in the Slovak Republic and Czech Republic.*

**Keywords:** national educational program, geography, cartographic language, mental map

## **INTRODUCTION**

Getting to know the real world has always been inextricably linked to a map. Although the use of map and search for information in it, according to some investigations, can be performed also by preschool children (MRÁZKOVÁ, 2013), cartographic knowledge, abilities and skills, cartographic literacy and competence is being acquired by the pupils only during the school attendance.

"The aim of this study is to discover how children graphically represent objects of the real world, how they apply cartographic methods and process provided data" (GAJDOŠÍKOVÁ, 2014). We extend previous research that passed in 2011 and is described in three papers (GAJDOŠÍKOVÁ, 2011, 2013, 2014). We adopted the same method of research to make an international comparison of one age bracket. This age group should be in phase of concrete operational stage according to Piaget theory of mental development (see PIAGET, INHELDER, 1997).

The method used in previous research (GAJDOŠÍKOVÁ, 2011) has proven to be quite difficult for the overall processing. "Children had to cope with a lot of information and activities at once by which the application of their cartographic knowledge, which they have not sufficiently experienced so far, might be decreased. Another consequence or cause of this fact could be an increase of errors" (GAJDOŠÍKOVÁ, 2013). On the other hand, it can serve us to monitor the diversity of geographical knowledge or cultural backgrounds.

We also evaluated how much is the cartographic knowledge embraced in Slovak and Czech learning materials and compared them. It is important to know "how children use the information gained from these materials. We wished to

examine the children's own way of creating map symbols – to determine how much abstraction and generalization they use in their works” (GAJDOŠÍKOVÁ, 2014).

The manner of thinking of children and maps and their cartographic creations didn't change from previous works. The value of graphic "understanding is increasingly important in the contemporary society. To be able to correctly read all these graphics and especially maps (as one of the most complex graphical representations) and use it effectively, we need to raise awareness and educate in this area. How to quickly, easily and clearly inform or warn the population of all ages, even of different nationalities and different mother tongues? Graphically. That is why the education has to start with children. For that reason this work is focused on the research into knowledge of children and their abilities." (GAJDOŠÍKOVÁ, 2014). According to *The Power of Maps* by Denis Wood: "The map is not an alien form that came from outer space but a synthesized system of supersigns we all grew up with (that grew up with us). Of course the map is something we have to learn, as we have to learn everything in our culture, but because the map is so continuous with so much of it, this is not something that is terrible hard to learn" (WOOD, 1992).

From that point of view, it is attractive to compare cartographic abilities of children from different nations, countries and even cultures. We started with contrasting two nations which are very close to each other (and even the school system and curriculum are very similar – see below chapter Comparison of cartographic education in...). Nevertheless it has been almost 23 years since dissolution of formal Czechoslovakia and nowadays children have already been born in new young countries.

## **THEORETICAL ISSUES**

The map is one of the possible ways to represent reality. The theoretical cartography describes the communication between the map and the user by the entire concept of cartographic/map language. Cartographic language can be seen as a parallel to linguistic language. PRAVDA (2004) alleges that cartographic language is a communication system which asserts itself where the usual language is not able to fulfill its function - specifically, it is in the description of the geographical space in which cartographic language tries to describe not only the real situations but also imagined ones. This language was gradually created during a long and complex development and therefore it can be substantially used in all developed countries to build conversation between states and nations. Language of a map can be considered as a universal 'tool' of communication although on a limited field of activity (MAULE, 2002).

The work with map includes a number of activities – its reading, analysis, interpretation and creation. "Correct map reading is a universal interdisciplinary ability that requires understanding of functions, principles and limitations of cartographic representation. Without this understanding, we cannot utilize maps in our daily lives" (GAJDOŠÍKOVÁ, 2014). Different groups of people perceive the map differently (KONEČNÝ, ŠVANCARA, 1997).

"Children can be considered as beginners in contact with any symbolic medium" (GAJDOŠÍKOVÁ, 2014). "Hence, from an educational perspective the acquisition of cartographic language by novice and inexperienced map users is considered to be a key issue in contemporary educational issues, education in various semiotic systems is a crucial component of individual social skills. Visual communication and cartographic design should be taught across the curriculum and tied to several subjects" (GORIA, PAPADOPULOU, 2012).

When children read maps, they should be able to orient in them, correctly locate themselves, use the scale, and even create a map. Therefore, the correct map reading can help pupils to achieve higher level of knowledge also in other fields (MYRIDIS et al., 2007). Yet the level of not only cartographic skills, but also more broadly achieved level of thinking can be seen in the proposed cartographic signs by pupils (ŠAŠINKA, 2012).

Children in concrete operation stage according to the Piaget's theory are fully focused on understanding the surrounding real world. This typical feature of the school children can be observed in their speech, drawings, written expressions, reader's interests and also in the game (LANGMEIER, KREJČÍŘOVÁ, 1998). By the fact that the way of thinking is being extended in this period, children can understand a division of map symbols for points, lines, polygons, and that lines may represent boundaries. They are able to orient in the map, understand the coordinate system (MYRIDIS, et al., 2007). However, it has to be noted again that such developmental changes of thinking do not arise suddenly and there can also be significant differences among individuals (LANGMEIER, KREJČÍŘOVÁ, 1998). Behind this is a factor of intelligence and environment (family, social, etc.) in which they grow up (MYRIDIS et al., 2007). Contrary to original Piaget assumptions, "it was repeatedly shown that many of the mentioned thought skills are dependent on learning and may be supported and accelerated by appropriate training" (LANGMEIER, KREJČÍŘOVÁ, 1998).

Children's abilities of perceiving the map is elaborated in the work of BANDROVA, MILANOVA (2011). It is important to find out what children are able to understand and it is necessary to find out what knowledge about the representation of objects they have, how they are prepared to use the map, and what they expect will be shown on the

map. Based on this, it is possible for them to create maps. Maps creation for children must be preceded by the research with the purpose of standardization.

Maps created by children often reflect the background in which they grow up as well as the work of teachers in the school (ANDERSON, 2003). Mainly the younger ones are not able to skip individual details when creating the map such as windows, doors, etc. (MYRIDIS et al., 2007). This appeared also in the work of GAJDOŠÍKOVÁ (2011) when children included things such as "flowers, grass and other plants, sun and clouds, traffic signs, benches, etc. Regarding the pupils of the 4th grade, 60% of them added non-essential elements to the map". Children already have certain skills working with maps and some knowledge are gained instinctively and logically. However, they lack complete picture of a map itself and skills for general processing of information with the help of maps. By the fact that they do not unite some information and knowledge mutually, they miss out another valuable information. It raises the question whether this it is just the issue of teaching about maps or the overall education of children (GAJDOŠÍKOVÁ, 2013).

## **COMPARISON OF CARTOGRAPHIC EDUCATION IN PRIMARY SCHOOLS IN THE SLOVAK REPUBLIC AND CZECH REPUBLIC**

"On the first degree of primary schools (age: 7-11 years), children encounter maps marginally as a part of subjects like Introduction to environment and society and Local history that cover a quite large realm (ranging from geography trough ecology to basics of social sciences" (GAJDOŠÍKOVÁ, 2014).

In the Slovak Republic in terms of primary education (ISCED 1), pupils acquire basic cartographic knowledge through the subject "Regional Studies" (in Slovak - Vlastiveda) which is the same in the Czech Republic. The subject is included within the national educational program in the educational field of Nature and Society and it is taught in the second, third and fourth grade of primary school. Time allocation for the subject Regional Studies is one lesson a week (Štátny vzdelávací program Vlastiveda, 2011). However, there are planned changes which will be in effect from the school year 2017/2018 in terms of an innovative national educational program regarding inclusion of geography in the educational field and the increase of lessons. The subject Regional Studies was included in the educational field of Man and Society and it will be taught in the third grade of primary school (1 lesson per week) and in the fourth grade of primary school (2 lessons per week) (INOVOVANÝ ŠTÁTNY VZDELÁVACÍ PROGRAM VLASTIVEDA, 2015).

Especially in the subject of Regional Studies, an emphasis is put on orientation in space and orientation through using maps. Basic cartographic competences are acquired and developed by pupils through thematic units: Journey to school and back; Surroundings of the school and residence (orientation in the surroundings); Orientation in the map and plan of the town; Plan; Map; Discovering Slovakia; Traveling around Slovakia. From the aspect of cartographic education, an important function is played by performance standards that include specific requirements for the pupils e.g. to draw a diagram of the road to school and to mark important objects along it; to draw buildings in the town into the plan of the town; to read the plan according to map signs; to orient according to plan; to create a plan of familiar environment, etc. (ŠTÁTNY VZDELÁVACÍ PROGRAM, 2011). When educating, the emphasis is put on working with the map, stories and illustrations.

To draw a parallel between Slovakia and Czech Republic, Czech framework educational program for primary education (RÁMCOVÝ VZDĚLÁVACÍ PROGRAM PRO ZÁKLADNÍ VZDĚLÁVÁNÍ, MŠMT, 2013) provides for disciplines, such as Man and His World in the first level of primary education, the following requirements: first, the pupils are required to do simpler tasks such as mark their place of residence in a simple plan, draw a road to a certain place, include their municipality into administrative division, distinguish natural and artificial elements in the landscape, etc.

Gradually, however, the demands should increase and at the end of the first level pupils should determine the cardinal directions in nature and by using the map, orient themselves according to maps, distinguish between sketches, plans and basic types of maps, search for simple information on natural conditions and human settlements on maps of the republic, Europe and the hemispheres, search for typical regional peculiarities of nature, settlements, economy, and culture. Pupils should meet with general geographic maps and thematic maps (content, graphics, legend) as well as orientation points, lines and cardinal directions. Furthermore, the maps are mentioned in educational program in the field of Man and the History where pupils are required to know orientation in timeline and historical maps (RÁMCOVÝ VZDĚLÁVACÍ PROGRAM PRO ZÁKLADNÍ VZDĚLÁVÁNÍ, MŠMT, 2013).

Pupils of the 4th grade in the subject of Regional Studies encounter with maps only in one chapter – it is a hand map and wall map, map cutout and mostly with the map of Czech Republic (they learn its shape and division). They learn that the map is generalized and may be at different scales, they recognize cardinal directions and elevations by color hypsometry. However, they do not learn about the legend in detail and they only learn some individual map signs. There is no note about the fact that the legend is a necessary part of the map and must be complete (GAJDOŠÍKOVÁ, 2011).

This shows that Slovak and "Czech geography textbooks are usually very brief in explaining cartographic principles - if cartography is discussed at all - it is a matter of one chapter. Maps are not a prominent type of visual representation included in these textbooks, they are usually outnumbered by charts, diagrams or photographs. Children can encounter maps also in different classes, mostly in history class. However, the maps included in geography textbooks take various forms, which implies that authors assume (justifiably or not) that children are able to understand these maps correctly. In the 4th class, pupils are introduced to very basic concepts of cartography. Cartography and practical utilization of maps is taught inconsistently. Geography textbooks lack unified information structure. However, by combining various teaching materials, can children obtain relatively complex knowledge. The role of teacher is therefore central to the process of cartographic education" (GAJDOŠÍKOVÁ, 2014).

## **METHODS OF RESEARCH**

The field research took place in 2011 at primary schools in Brno (Czech Republic) and in 2016 in Nitra (Slovakia). There were 45 pupils in Brno and 43 pupils in Nitra (9-11 year-old). We also had an opportunity to collaborate with specific group of children with diagnosed ADHD (Attention Deficit Hyperactivity Disorder) in Slovakia (9 pupils from the whole group of 43 pupils). We use the same methodology of research as described in the paper of GAJDOŠÍKOVÁ (2014):

### **"Introduction phase"**

During a short presentation that preceded the actual research we introduced the children to the cartographic principles. The aim of this introduction was to get the pupils used to researchers and to induce an atmosphere of trust, so that children would not be afraid to ask any questions.

Also, to let them to penetrate cartographic topic and then continually move on to actual research in positive mood and good working environment. We stressed that the task was to create a map with use of map signs so the pupils would not forget about this requirements during the research.

First, we raised questions such as: "What is a map?", "Where did you meet maps?", "What types of maps do you know?". Then we showed them tourist and cycling maps, school atlas, town plan, and we also mentioned other sources such as websites, magazines, maps used in weather forecasts etc. Other questions followed: "What is a map sign?", "How does it look like?", "What is a map legend?", "What is contained in a map legend?", "Must every map have a legend?", "What is it used for?", "Is it any good?". We used examples of map legends and map signs taken from the aforementioned map products. The aim of this section was to show different maps and map signs, revise cartographic terms and to emphasize that children are going to make draw maps, not artistic pictures.

### **During the research**

During the time they were creating their maps, we assured them repeatedly that they cannot do anything wrong. In many cases, children can be afraid of making mistakes, since they expect and want to avoid some kind of penalty (e.g. in form of poor marks), or they are just uncomfortable with an idea of making a mistake. Therefore, setting a positive mood is an important part of research work with children. Pupils were often hesitating, as for most of them it was the first time they ever attempted to draw their own maps.

### ***Creating a map according to textual description***

In the first part of the session, children read a story, in which they were introduced to a character called Klára, who is going to visit her friend to a place where she never was before. Children were asked to help Klára to get to the location by drawing a map based on a verbal description of a path to her destination. Children designed their maps according to the route description which was contained in a letter from Klára.

This method presents a real-life situation and motivates the children by asking them for help for the fictional character. This form of assignment, not only lets us to observe their idea of map signs, but also helps to trace their reasoning (line of thinking), and their ability to apply what they have learned in class and their understanding of cartographic principles. The main goal is not only to determine how children process offered data but also to find out which type of data they prefer.

### ***The route description***

13 objects were mentioned in the description – these were objects of point, line or polygon character. Some of these objects were semantically close (chapel - church), most of them were stable, but we also mentioned a dynamic feature (a car).

We observed the associativeness of the signs, but also how the children filtered information from the text and what they decided to be an appropriate information to visualize (roof color, car) and what not. We also wanted to find out if they employ some kind of hierarchy with their signs, depiction of qualitative and quantitative characteristics of the objects. Other research questions were: Do they perceive spatial links (along the right side of the pond) and relative distances? Do they take into account some additional characteristics of the objects (elongated pond, winding road)? Do they distinguish between more and less important information?, etc." (GAJDOŠÍKOVÁ, 2014).

The descriptions were written in native languages of children. Researchers were native speakers and always read the description together with pupils to make sure they understand the text. Czech and Slovak language are very similar and they are from the same language group. That helped us to translate the route description very faithfully. We slightly changed conditions of the research by letting some examples of maps on children's work desk.

## COMPARISON OF RESEARCH IN CZECH REPUBLIC AND SLOVAK REPUBLIC

Assessment of the level of using cartographic language by individual pupils was carried out through 11 selected criteria (Table 1).

*Table 1. Comparison of results of map indicators evaluation drawn by pupils of primary schools from the Slovak Republic and Czech Republic by gender*

Indicator	boys SR (%)			boys CR (%)			girls SR (%)			girls CR (%)		
	yes	no	partially	yes	no	partially	yes	no	partially	yes	no	partially
Hierarchy	21.74	39.13	39.13	66.67	8.33	25.00	30.00	20.00	50.00	23.81	19.05	57.14
Cardinal directions	95.65	4.35	0.00	58.33	37.50	4.17	90.00	10.00	0.00	66.67	28.57	4.76
Spatial links	13.04	17.39	69.57	50.00	8.33	41.67	25.00	25.00	50.00	19.05	9.52	71.43
Relative distance	26.09	73.91	0.00	62.50	37.50	0.00	10.00	90.00	0.00	61.90	38.10	0.00
Specifying characteristics	4.35	0.00	95.65	33.33	4.17	62.50	5.00	0.00	95.00	28.57	9.52	61.90
Elevation	17.39	26.09	56.52	45.83	12.50	41.67	60.00	15.00	25.00	38.10	19.05	42.86
Associativeness	26.09	56.52	17.39	20.83	45.83	33.33	25.00	35.00	40.00	9.52	66.67	23.81
Qualitative characteristics	8.70	0.00	91.30	41.67	4.17	54.17	5.00	0.00	95.00	4.76	14.29	80.95
Quantitative characteristics	43.48	56.52	0.00	45.83	54.17	0.00	65.00	35.00	0.00	28.57	71.43	0.00
Unstable elements	69.57	30.43	0.00	54.17	45.83	0.00	75.00	25.00	0.00	47.62	52.38	0.00
Other non-essential elements	78.26	21.74	0.00	66.67	33.33	0.00	70.00	30.00	0.00	52.38	47.62	0.00

### Hierarchy

Part of the analysis of cartographic language of selected pupils in 4th grade of primary school was the assessment of hierarchy of certain objects (2 relations - paved road and tread path; chapel and church). A total of 47% of pupils from the Czech Republic and only 26% from Slovakia used hierarchy in both relations. As for their partial use, it was relatively balanced (Czech Republic - 40% and Slovakia - 44%). Moreover, we recorded the difference between genders. In the Czech Republic it was dominated by boys (up to 67% of boys used the full hierarchy compared to 24% of girls) and in Slovakia (girls - 30% and boys - 21%). When assessing the partial hierarchy, we found that the relation of roads was preferred by boys from both the Czech Republic and Slovakia and girls only from Slovakia. The second relation chapel - church was drawn by more girls from the Czech Republic.

### Cardinal directions

In both countries it was confirmed that most of the pupils can correctly identify the cardinal directions (62% of pupils from Czech Republic and 93% from Slovakia). There were no gender differences. Findings suggest that pupils are aware of the importance of respecting the correct cardinal directions.

### Spatial links

An important part of cartographic education, not only elementary, are spatial links. As part of the research, they were assessed based on the correct spatial drawing of four situations: two cross-roads, bridge, "behind the church to the left". Most pupils (Czech Republic - 56%, Slovakia - 60%) expressed spatial links partially. In terms of gender difference the spatial links were wholly or partly understood more by boys from the Czech Republic and also Slovakia. Regarding the more detailed examination of the partial spatial representation we found out that: the information "behind the church to the left" was not drawn in the Czech Republic by 60% and in Slovakia by 56% of pupils; the bridge was omitted by

48% of pupils from the Czech Republic and only 33% of pupils from Slovakia; cross-road near the pond was not correctly drawn by 32% of pupils from the Czech Republic and 49% of pupils from Slovakia; cross-road near the chapel was omitted or not correctly drawn by only 16% of pupils from the Czech Republic and 56% of pupils from Slovakia.

### **Relative distance**

A relative distance on the map was expressed by the statement from the story: "Go further down the road about as much as you went from the pond to the chapel." made problems to pupils from Slovakia. Up to 81% of them did not correctly estimate the relative distance whereas it was only 38% of pupils in Czech Republic. This information was either incorrectly drawn or considered not important by 90% of girls and 74% of boys from Slovakia while in the Czech Republic it was only 38% regarding both girls and boys.

### **Specifying characteristics**

In this category, we studied whether pupils drew specifying characteristics of the story: elongated shape of the pond; winding road that turns to the forest; go uphill along the alley. We found significant differences between both countries. All of the specifying characteristics were drawn by 31% of pupils from the Czech Republic and only 5% of pupils from Slovakia. Gender differences were not recorded. Most pupils drew at least some of the evaluated characteristics while the most frequent was elongated shape of the pond. As the most problematic seemed to be the alley (it was omitted by 86% of pupils from the Czech Republic and 63% of pupils from Slovakia) and "go uphill" (Czech Republic - 68%, Slovakia - 53%). Slovak pupils had also problems with winding road (49%) and "turning to the forest" (51%).

### **Elevation**

42% of pupils from the Czech Republic drew the elevation at all references in the route description and the same proportion only partially. A similar relation was observed particularly among boys and also girls. From the sample in Slovakia, all the elevations were drawn by only 37% of pupils and 42% were drawn partially. A large deviation between the Czech Republic and Slovakia was recorded between the genders. All disclosed information about elevations was drawn only by 17% of boys (Czech Republic - 46%) and 60% of girls (Czech Republic - 38%) and partially by 57% of boys (Czech Republic - 42%) and 25% of girls (Czech Republic - 43%). In both countries, as the most commonly used method was drawing "hills" (Czech Republic - 76%, Slovakia - 28%). Other methods were used by pupils from the Czech Republic only marginally while in Slovakia up to 26% of pupils used the descriptive method as well as color hypsometry. Once again we recorded gender differences in each country. As for girls in the Czech Republic, it was dominated by drawing "hills" method (88%) while girls in Slovakia used diverse methods in terms of elevation expression ("hills" method - 33% description - 24%, uphill road - 22%, etc.). Boys in the Czech Republic used mostly the "hills" method - 67%. Boys from Slovakia used besides this method (34%) also other methods (e.g. description - 26%, color hypsometry - 22%, etc.). In most cases pupils used two parallel and occasionally even three different methods for drawing the elevation - "hills" method, elevation point, description (Figure 1).

### **Associativeness**

When assessing the similarity of signs, we focused on two relations among 4 objects (church - chapel, village - cottage area). Most pupils from Czech Republic (56%) did not use associativeness in the creation of map while regarding the pupils from Slovakia, it was only 47%. In case of partial associativeness we did not identify any significant differences in both countries (Czech Republic - 29% Slovakia - 28%). As for gender differences, they were in female pupils from Slovakia where associativeness was not used only by 35% of them and up to 40% of them used it at least partially. After more detailed examination of the partial associativeness in both countries, we can conclude that the majority of pupils in this case used the similarity of objects regarding the relation church - chapel.

### **Qualitative characteristics**

Through this category, pupils should express differences in quality between individual objects: church - chapel (Figure 2), village - cottage area, asphalt road - field road, station. All differences were drawn only by 24% of pupils from the Czech Republic and only 7% of pupils from Slovakia. Mostly, they drew qualitative characteristics partially (Slovakia - 93%, Czech Republic - 67%). Boys drew these characteristics more than girls. Pupils from the Czech Republic chose mostly drawing roads (73%) and stations (70%). The same proportion of pupils (53%) from Slovakia chose representation of the bus station, roads, houses and cottages.

## Quantitative characteristics

The story of Klára included also quantitative data (large and small village) which pupils in Slovakia usually drew in maps (53%), however, in the Czech Republic it was only 38%. By gender, it was dominated by girls in Slovakia (up to 65% of girls drew this relation in the map) and boys in the Czech Republic (46%).

## Unstable elements

When evaluating research, we also studied the occurrence of unstable elements in the map (e.g. pupils drew cars, people, animals and others). Up to 72% of pupils from Slovakia used in their maps unstable elements while in the case of the Czech Republic it was only 51% of pupils. In Slovakia up to 75% of girls (Czech Republic - 48%) and 70% of boys (Czech Republic - 54%) drew unstable elements in the map. The most common element among pupils from both countries was the car. We assume that the main reason was that the car was mentioned in the story of Klára. Therefore, children cannot identify elements that do not belong in the map (whether referred to in the story or included in the map) by their own initiative.

## Other non-essential elements

The eleventh studied attribute were non-essential elements that were inserted in the map by pupils e.g. traffic light, sun, corn, red roof, waves in the pond, flowers, number of cottage, etc. In this category we recorded a high occurrence of non-essential elements in both countries (Czech Republic - 60%, Slovakia - 74%). Gender differences were more pronounced for girls (up to 70% of girls from Slovakia and only 52% of girls in the Czech Republic added non-essential elements). Pupils from the Czech Republic drew mostly red roofs and in the case of pupils from Slovakia it was waves in the pond as well as red roof.

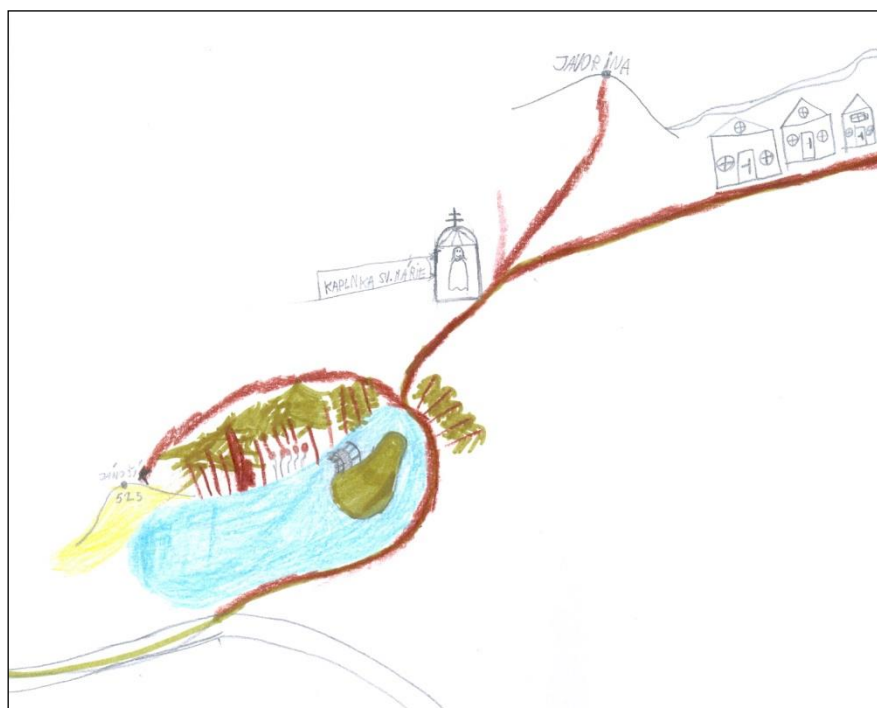


Figure 1. Sample of drawing by 10-year-old boy



*Figure 2. Sample of drawing by 9-year-old girl*

## **CONCLUSION**

From partial analyses of individual attributes and subsequent synthesis we can conclude that selected pupils from 4th grade from the Czech Republic were more successful or better coped with 6 criteria: hierarchy, spatial links, relative distance, specifying characteristics, elevation, and qualitative characteristics. On the contrary, pupils from Slovakia achieved better results in drawing cardinal directions, associativeness, and quantitative characteristics. These pupils also drew more unstable elements and other non-essential elements in the map. As it is clear from Figure 3, the largest differences between countries were found in four criteria: cardinal directions, relative distance, specifying characteristics, and qualitative characteristics.



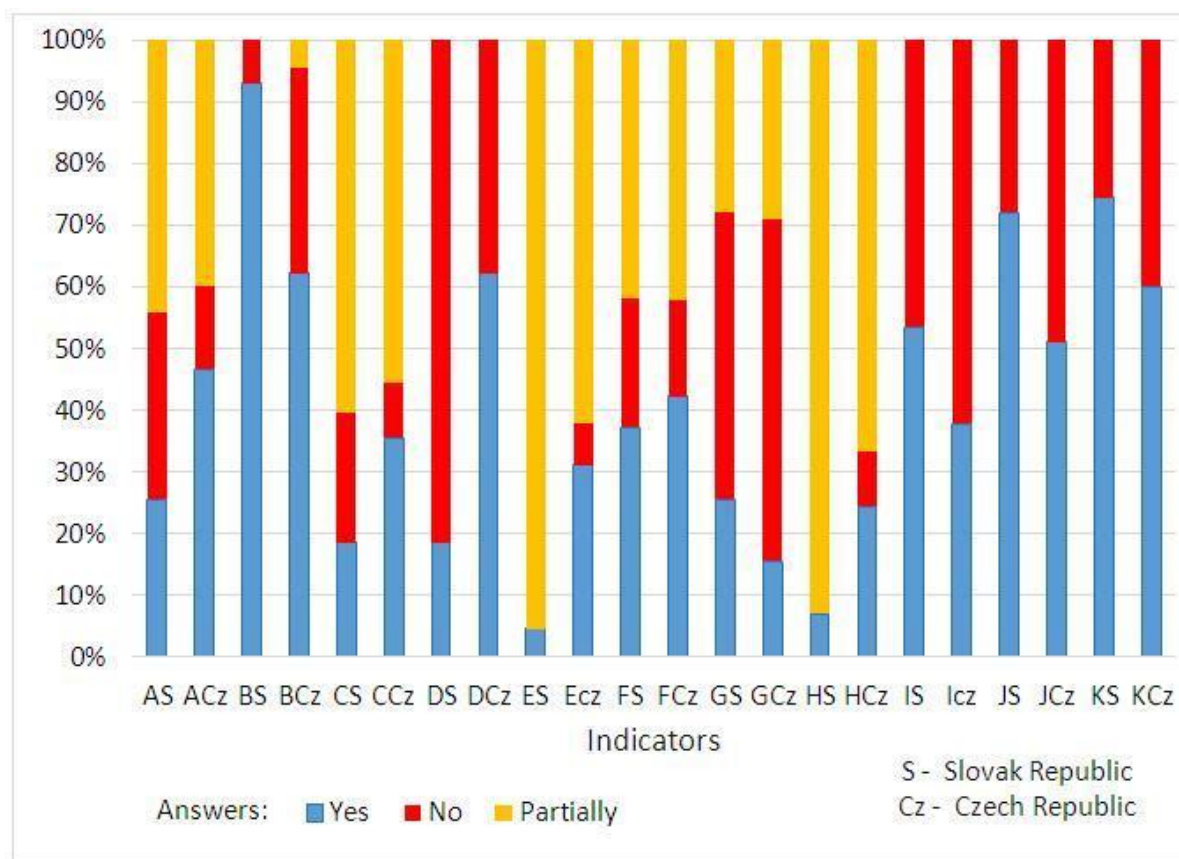


Figure 3. Comparison of results of map indicators evaluation drawn by pupils of primary schools from the Slovak Republic and Czech Republic; Source: own research 2011 (Czech Republic), own research 2016 (Slovakia)

Note: Indicators: A-hierarchy, B-cardinal directions, C-spatial links, D-relative distance, E-specifying characteristics, F-elevation, G-associativeness, H-qualitative characteristics, I-quantitative characteristics, J-unstable elements, K-other non-essential elements

In terms of expression of other cartographic information, we found that three boys from the Czech Republic drew also map key while this was not the case at all in Slovakia. North arrow was drawn by 6 pupils from the Czech Republic (3 boys and 3 girls), in Slovakia it was only 1 girl. Differences in both countries were found also in understanding the significance or importance of the displayed objects. In the Czech Republic up to 65% of pupils omitted the alley (Slovakia - 42%) and 46% omitted the information "behind the church uphill" (Slovakia - 42%). Pupils from Slovakia put the least emphasis on the winding road which was not drawn by 52% (in the Czech Republic only 13% out of the total number of pupils). In the Czech Republic 16% of pupils (3 boys and 4 girls) included all objects in their drawings while in Slovakia it was only 7% (2 boys and 1 girl).

Results from the Slovak side could be partially influenced by the fact that 9 pupils from the whole group of 43 pupils had ADHD (Attention Deficit Hyperactivity Disorder) diagnosis. Our approach to these pupils did not differ from others and all these children were fully integrated to the class. Only advantage was in higher verbal motivation of ADHD pupils. Outcomes show that their results, in general, did not differ from other pupils nevertheless this fact needs more comprehensive study.

The previous research, held in the Czech Republic, "studied, besides other things, how children can cope even with difficult assignment to draw the map. In many cases, children coped with this difficult situation very well and often in interesting way. Apparently smaller and mostly not unified understanding of cartographic knowledge had logical impact on the outcome of the research. Yet children coped and dealt with more complex tasks and in many ways exceeded expectations" (GAJDOŠÍKOVÁ, 2013). This fact can be fully stated also based on the progress of research in Slovakia. It was clearly confirmed that children were not even inspired by the given maps which were in Slovakia, unlike in the Czech Republic, available for them throughout the whole research. It is therefore important to continue in the investigations e.g. why this advantage was not used by the pupils.

## REFERENCES

- BANDROVA, T. – MILANOVA, Y. 2011. Cartographic Application on the Base of Children's Understanding of Early Warning and Disaster/ Crisis Management. In 25th International Cartographic Conference, CD Proceedings, 3-8 July, 2011, Paris, France. Available at: [http://icaci.org/files/documents/ICC\\_proceedings/ICC2011/Oral%20Presentations%20PDF/A3-Maps,%20GIS%20&%20hazards%20and%20disasters/CO-019.pdf](http://icaci.org/files/documents/ICC_proceedings/ICC2011/Oral%20Presentations%20PDF/A3-Maps,%20GIS%20&%20hazards%20and%20disasters/CO-019.pdf)
- GAJDOŠÍKOVÁ, B. 2011. Kartografický jazyk děti: analýza a optimalizace. Bakalářská práce. Masarykova univerzita, Přírodovědecká fakulta. Available at: [http://is.muni.cz/th/324289/prif\\_b/](http://is.muni.cz/th/324289/prif_b/).
- GAJDOŠÍKOVÁ, B. 2013. Kartografický jazyk děti: analýza, tvorba legendy a její evaluace pro krizový management. Diplomová práce. Masarykova univerzita, Přírodovědecká fakulta. Available at: [http://is.muni.cz/th/324289/prif\\_m/](http://is.muni.cz/th/324289/prif_m/).
- GAJDOŠÍKOVÁ, B. 2014. Cartographic language of children. In 5th International Conference on Cartography and GIS : 15 - 21 June 2014, Riviera, Bulgaria. Sofia: Bulgarian Cartographic Association, 2014. ISSN 1314-0604, pp. 466 - 476.
- GORIA, S. – PAPADOPOULOU, M. 2012. Icons versus symbols: investigating preschoolers' cartographic design. Online Journal for theoretical cartography, metacarto-semiotics, Vol. 5. Available at: [http://meta-cartosemiotics.org/uploads/mcs\\_vol5\\_2012/MCS\\_Vol5\\_2012\\_Goria.pdf](http://meta-cartosemiotics.org/uploads/mcs_vol5_2012/MCS_Vol5_2012_Goria.pdf).
- INOVOVANÝ ŠTÁTNY VZDELÁVACÍ PROGRAM VLASTIVEDA. 2015. Bratislava: ŠPÚ, 8 p. Available at: [http://www.statpedu.sk/sites/default/files/dokumenty/inovovany-statny-vzdelavaci-program/vlastiveda\\_pv\\_2014.pdf](http://www.statpedu.sk/sites/default/files/dokumenty/inovovany-statny-vzdelavaci-program/vlastiveda_pv_2014.pdf)
- KONEČNÝ, M. – ŠVANCARA, J. 1997. (A)percepce map vybranými skupinami populace. Kartografické listy / Cartographic Letters, 1997, 5, pp. 23 - 28. ISSN 1336-5274.
- LANGMEIER, J. – KREJČÍŘOVÁ, D. 1998. Vývojová psychologie. Praha: Grada Publishing, 1998. 368 p. ISBN 978-80-247-1284-0.
- MAULE, L. 2002. Mapové znaky. Kartografické listy / Cartographic Letters, 2002, 10, pp. 36 - 43. Available at: <http://gis.fns.uniba.sk/kartografickelisty/archiv/KL10/5.pdf>.
- MRÁZKOVÁ, K. 2013. Kartografické dovednosti ve výuce zeměpisu. 2013. Disertační práce. Masarykova univerzita, Available at [http://is.muni.cz/th/129111/pedf\\_d/Disertacni\\_prace.pdf](http://is.muni.cz/th/129111/pedf_d/Disertacni_prace.pdf).
- MYRIDIS, M. – CHRISTODOULOU, A. – KALYVA, E. – KARANIKOLAS, N. – LAFAZANI, P. 2007. Cartography and children. Designing a multimedia educational tool. Available at: <http://karanik.webpages.auth.gr/main/images/papers/conferences/cartography%20and%20children.%20designing%20a%20multimedia%20educational.pdf>.
- PIAGET, J. – INHELDER, B. 1997. Psychologie dítěte. Praha: Portál, 1997. 143 p. ISBN 80-7178-146-0.
- PRAVDA, J. 2004. O chybách na mapách. Kartografické listy / Cartographic Letters, 2004, 12, pp. 92 - 103. Available at: <http://gis.fns.uniba.sk/kartografickelisty/archiv/KL12/10.pdf>
- RÁMCOVÝ VZDĚLÁVACÍ PROGRAM PRO ZÁKLADNÍ VZDĚLÁVÁNÍ, MŠMT. 2013. Available at: <http://www.msmt.cz/file/29396/download/>
- ŠAŠINKA, Č. 2012. Interindividuální rozdíly v percepci prostoru a map. Disertační práce. Masarykova univerzita, Available at: [http://is.muni.cz/th/44276/ff\\_d/](http://is.muni.cz/th/44276/ff_d/).
- ŠTÁTNY VZDELÁVACÍ PROGRAM VLASTIVEDA. 2011. Bratislava: ŠPÚ, 12 p. Available at: [http://www.statpedu.sk/sites/default/files/dokumenty/statny-vzdelavaci-program/vlastiveda\\_isced1.pdf](http://www.statpedu.sk/sites/default/files/dokumenty/statny-vzdelavaci-program/vlastiveda_isced1.pdf)
- WOOD, D. 1992. The Power of Maps. New York: Guilford Press, 1992. 248 p. ISBN 0-89862-492-4.

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