Analysis of notice boards (panels) as general information media in the outdoor mining tourism

Karol Weis[1], Pavel Hronček[2], Dana Tometzová[3], Bohuslava Gregorová[4], Martin Přibil[5], Miloš Jesenský[6] and Vladimír Čech[7]

Despite the fact that computer technologies, digitization, and social networks are used and preferred almost in all spheres of life, information boards installed as part of educational trails have an irreplaceable role in tourism. The aim of the presented study is to point out the importance of information boards in mining tourism. The first part of the study analyses the theoretical and methodological aspects and procedures of notice boards, their content classification and suitable use in situ. Methodologically correctly constructed illustrated notice boards are a suitable and often irreplaceable visual tool of old mining sites or mining trails.

The second part of the article is dedicated to a case study of preparing, making and promoting the installation of illustrated notice boards using the example of the mining educational trail in Vyhne (Central Slovakia) which was open in 2016 under the name "In the Footsteps of Mining Activities". The stationary boards installed along the trail serve their function and are actively used in mining tourism.

The third part of the study analyzes the instructions for creating external notice boards from the perspective of the recommended limits (time intervals) needed for the identification of directions and for reading and understanding pictograms, illustration and texts. The aim of the questionnaire survey carried out on a group of respondents was to verify the previously published and recommended rules for compiling the content and range of the information published on boards or to modify them according to the specific conditions defined by a particular topic and area. The research results show that the text must be well-arranged and brief, graphically interesting containing appropriate topics.

Keywords: notice boards, design of boards, basic characteristics, mining site, mining tourist trail, mining tourism, mining trail Vyhne

Introduction

Despite the age of the internet and new technologies we live in, these modern tools cannot be used as across-the-board information media in mining tourism.

The problem does not lie in their affordability but rather in signal reception, especially in historical mining locations. The reception issue is not only connected with the uninhabited areas, i.e. remote mountains and narrow valleys, but also with the mountain, foothill or valley settlements connected with mining activities. Therefore, many organizations (self-government, civic associations, and mining associations) still prefer the "traditional" way of informing tourists in situ, i.e. stationary boards.

 Over the last decade, these forms and means of informing tourist about the Slovak mining history have been used heavily. As for the expert public, they are generally called educational in-situ (in nature) installations. They are a proven and currently widely spread form of promotional and educational activities for the general public, including young people, and for the specialized groups of visitors or experts and scientists. Such stationary installations are subsequently grouped for form educational trails, educational sites and educational points.

They are associated not only with the possibility of expanding knowledge and gaining new useful information connected with visual demonstrations, often with a creative part but also with a stay in nature and landscape.

In the mining tourism, stationary panels (boards) are used to mark solitary mining elements (galleries, shafts, technical equipment, places of major events, etc.), mining sites, as well as marked mining trails and routes.

[1] *Karol Weis,* Department of Geography and Geology, Faculty of natural Sciences, Matej Bel University, Tajovského 40, 974 01 Banská Bystrica, Slovakia, *e-mail: karol.weis@umb.sk*

[2] *Pavel Hronček,* Department of Geo and Mining Tourism, Faculty of Mining, Ecology, Process Control and Geotechnology, Institute of Earth Resources, Technical University of Košice, Letná 9, 042 00 Košice, Slovakia, *e-mail: pavel.hroncek@tuke.sk*

[3] *Dana Tometzová,* Department of Management of Earth Resources, Institute of Earth Resources, Faculty of Mining, Ecology, Process Control and Geotechnology, Technical University of Košice, Park Komenského 19, 042 00 Košice, Slovakia, *email: dana.tometzova@tuke.sk*

[4] *Bohuslava Gregorová,* Department of Geography and Geology, Faculty of natural Sciences, Matej Bel University, Tajovského 40, 974 01 Banská Bystrica, Slovakia, e-mail: *bohuslava.gregorová@umb.sk*

[5] *Martin Přibil,* Museum of Industry, National Technical Museum, Kostelni 42, 170 78 Prague 7, Czech Republic, *e-mail: martin.pribil@ntm.cz*

[6] *Miloš Jesenský,* Museum of Kysuce in Čadca, Moyzesova 50, 022 01 Čadca, Slovakia, e-mail: *jesensky@kysuckemuzeum.sk*

[7] *Vladimír Čech,* Department of Geography and Applied Geoinformatics, Faculty of Humanities and Natural Sciences, University of Presov in Presov, 17 novembra 1, 081 16 Prešov, Slovakia, e-mail: *vladimir.cech@unipo.sk*

<div align="center">

State of the art

</div>

External notice boards as part of marked routes - mining trails

Several authors have dealt with the topic of nature trails in the Czech Republic (former Czechoslovakia). The first who developed the methodology of the educational trails was Čeřovský (Čeřovský, 1976, 1978a, 1978b). Currently, the issue of nature trails is largely addressed by Bizubová (1984, 1994, 1995, 2001), Bizubová et al. (1998, 1999), Suchá (1990), Bizubová & Minka (Bizubová & Minka 2001) and others. Mazúrek (1988) and Bizubová (1995) were devoted to the primary intended use of educational trails.

The nature trail can be defined as an educational tourist route marked by means of information panels, or in some other form. A route of different length and thematic focus leads to the areas of remarkable nature, landscape, history and culture. On the route, there are some important objects and evidence of mining activities selected. These are described through information panels, leaflets, guidebooks and tourist guides providing information on the origin and development of individual elements of the natural or cultural landscape. They show the landscape comprehensively in all its relations.

Educational trails can be classified according to different classification criteria *(Čeřovský, 1976, 1978a, 1978b):*

1 Based on how information is delivered:
a) Trails without a guide;
b) Trails with a guide;
c) Combined trails.

2 Based on a route length:
a) Short trails of up to 5 km;
b) Medium-length rails of approx. 5 - 15 km;
c) Long trails of approx. 15 km

3 Based on their thematic focus, we recognise:
a) Multi-thematic trails (specialization - science, culture and history, forestry);
b) Monothematic trails (mining nature trails included).

4 Based on the route duration, there are:
a) Half-day (up to about 5 km);
b) Half to all-day (approx. 5 - 15 km);
c) All-day and multi-day (approx. 15 km) routes.

5 Based on the location of a route in relation to a protected area, we recognise:
a) Trails in a protected area;
b) Trails in a wild unprotected area.

6 Based on a route shape, there can be:
a) Linear trails;
b) Loop trails.

7 Based on route passing options, there are:
a) Point-to-point trails;
b) Out-and-back trails.

8 Based on the type of transport means used, we recognise:
a) Walking paths;
b) Cycling paths;
c) Other.

The first nature trails were created in the early 20th century in Canada and the USA. In Europe, the first nature trail was opened in Germany, followed by trails in Great Britain, the Netherlands, Austria, Sweden, Hungary and the former Czechoslovak Republic. The first unofficial educational trail focused on forestry was opened in Slovakia in 1926 in the current Štiavnické vrchy (Štiavnické Mountains) PLA (Protected Landscape Area) (Burkovský and Kollár, 1989). The opening of the first official nature trail in former Czechoslovakia (the

area of the today's Slovakia and the Czech Republic) dates back to 1956 (Čeřovský, 1976), according to Bizubová (Bizubová 1998) to 1960. The path was located in the Pieniny National Park, in the area between Červený kláštor and the Lesnický Brook.

As regards the mining trails in Slovakia, they are experiencing a great comeback. In the last decade, there were, for example, the following mining trails opened:

In 2019

- Educational mining trail Nová Baňa (Nová Baňa and surroundings, Žarnovica District) focused on the history of precious metal mining in Nová Baňa; the 15 information boards placed on the trail can be divided into two historical and thematic areas. The 4.3 km-long route A of 210 m difference in elevation leads along with the places showing the evidence of the Middle Ages surface and underground mining activities, passes through more physically demanding forest terrain in the area of Mýtny Vrch (Mýtny Hill) and the Gupňa Hill in the southern part of the deposit. Route B is less difficult to walk and leads mostly through the urban area of the town Nová Baňa called Vŕšky. It is 5.6 km long, and its altitude difference is 130 m. It mainly shows the 16th to 19th-century mining works, including the local ore processing facilities and mining water system.

In 2018

- The educational trail in Kvetnica (Poprad District) and its 5 information boards are focused on the presentation of mining history and old mining works in the surroundings of Kvetnica and Spiš.

In 2017

- Educational mining trail Rákoš (Rákoš and surroundings, Rožňava District) focused on the history of mining in Gemer; there are 5 information boards on the trail.
- Mining educational trail in Gelnica focused on the local mining history in Turzov; 6 information boards installed.
- Pezinok mining trail (Pezinok and its surroundings, Pezinok District); the 6,750 m-long educational trail with 156 m difference in elevation has 11 stops and takes about 2.5 hours to walk. It passes through the areas of pyrite and antimony ore mining and marginally touches upon the gold mining

In 2016

- The Poráč mining educational trail (Poráč and surroundings, Spišská Nová Ves District) consists of three separate interconnected loop trails. One may learn from the information boards along the route and from the trail guide book.

In 2015

- Educational Trail Staré mesto – Glanzenberg (Banská Štiavnica Glanzenberg hill, Staré mesto/ Old Town); a less physically demanding route passing through a part of Banská Štiavnica with typical mining settlements and areas of opencast ore mining and archaeological excavations. It takes about 2 hours to walk this nature trail of 200 m difference in elevation, along which 23 information boards are placed.

In 2014

- Mining nature trail in Vyhne (Handel, Vyhne and surroundings, Žiar nad Hronom District), about 3.7 km long, medium difficulty and smaller elevation difference. On the route, you can see the remains of mining activities and their impact on the landscape, reconstructed mining mouths, water galleries and the upper part of Vyhne. The footpath named "Tracing the history of the mining activities in Vyhne" has 10 information boards in total.
- Educational mining trail in Ľubietová (Ľubietová and its surroundings, B. Bystrica District) leads to a significant historical copper ore deposit in Ľubietová, Podlipa. It is installed along forest roads and footpaths, heap fields near the mouth of old mining galleries and pingen. It starts on the square in Ľubietová, passes through the old mining cuttings to the small retention pond in Podlipa and continues along the mining fields. Each of the 13 stops, along with a total of 4 routes, are thematically differentiated and follow the geological and mining activity of the copper-ore deposit in Podlipa.
- The Mining Trail of Staré Hory (the village of Staré Hory and its surroundings, Banská Bystrica District) with 10 information boards on the route has a length of 3.5 km. It leads through difficult terrain with an elevation difference of 130 m.

In 2013

- Internet educational trail „We travel in time"- Banská Hodruša (Banská Hodruša and its surroundings, Žarnovica District), has length 3.1 km and 16 stops. Each stop is numbered and marked with a brown oak column with a QR code table. A trail guide book is also available.
- Educational mining trail Spišská Nová Ves - Novoveská Huta (Novoveská Huta, Spišská Nová Ves District). The educational mining trail has a total length of 18 km with 8 notice boards.

- Modra mining nature trail (Modra, Harmónia recreation zone of town Modra, Pezinok District). The footpath has a length of about 3 km, the elevation difference of the route is 170 meters.

In 2012

- Educational Iron trail in Čučma (Čučma and its surroundings, Rožňava District) - on the route of the trail there are 9 information boards.
- Nature trail Hnilčík (Gelnica District) is built around the village. It presents the rich mining history of the region through seven information boards.

In 2010

- Educational mining trail in Nováky (town of Nováky and its surroundings, Prievidza District). The educational trail has 15 stops with information boards.

In 2009

- Turecká educational trail (around the village of Rudná, Rožňava District) with mining and forestry themes. It has a length of 8.2 km. The trail consists of 26 educational boards and two relaxation zones.
- The tourist-educational mining trail in Handlová (Prievidza District) is about 9.5 km long with 13 information boards and two rest zones
- and another example is an educational trail called "Through the history of mining" in Hnilčík (Hnilčík, Spišská Nová Ves District).

Basic rules for the design of externally mounted panels - boards resulting from the practice

How the (educational) information element - the board will be perceived by visitors of mining tourism will be significantly influenced by their attractiveness, colour, graphic design. A mining tourist differs from a tourist in a wide landscape focused on natural beauty or diverse social phenomena in the landscape by his specificity and interest in the narrow specialized historical activity and its relics in the landscape. These are often educated groups of tourists, not only laymen but also experts in mining research. Therefore, the rules for the design of externally mounted notice boards cannot strictly be based on generally used methodical procedures applied in tourism, but are adapted to the requirements of mining tourism clients. That is why their content interpretation is more professional, often technical terms are used, and the texts on the panels are longer. Form of design - graphic design is more complicated, often using professional schemes and maps.

However, the design of notice boards for mining tourism must be based on a number of important rules for their content and graphic design and their production and placement in the landscape.

Before we start building these installations, we have to realize that with their text and graphics (as well as used material and in situ localization) they have to fulfil several functions (Schneider et al., 2008):

The first and basic function is to give directions to a visitor in the terrain. Each board should contain the name of the visualized site (point) and must have a serial number (with the name of the specific stop) in the case of nature trails and routes. It should include a tourist map (for educational trails it is necessary to place such a map on the first or welcome board of the trail). Notice boards should also include information on how many kilometres or how much time remains until the end of the route; that means to the destination from where the tourist started the route, or to the place from which the visitor can hike further.

Another important function is to provide quality and interesting text and image information not only about a special visualized mining element, object or phenomenon and its specifics, but it should also provide basic information about the surroundings and possibly wider territorial and landscape relations.

The notice board should arouse interest or enthusiasm in the presented issue among mining tourists (mainly from the general public).

As intended for clients, especially pupils and students, as well as the general public, it should encourage appropriate behaviour in nature, but also encourage them to visit other (similar) places in the area.

Even before the actual design of information boards and after realizing their basic functions based on practice, the creator must also sort and adopt the generally applicable rules for their design (Jelínek et al., 2009), which are:

- Easy to read text - suitable style, font size at least 8 mm, sufficient colour contrast of font and background, when placing the board in a place exposed to the light, it is advisable to use light text colours on a dark background.

-Brief and well-structured text - clear title of the board, summarize long text into short words and sentences, used up to 50 words per paragraph, if the board contains more text, it is advisable to divide it into more parts with highlighted headings. Stylize the text so that each board topic provides information separately.

- Always maintain the appropriate ratio of text and graphics, with the image part prevailing. The text should be 20 to 35% of the board area.

-Maintaining clarity, which in the case of information boards with mining focus often requires appropriate avoidance of technical terms (possibly explaining them by text or scheme). If the boards are also in a foreign language, it should not have a longer version than the language of the country in which it is installed.

- An important feature is a timeliness. As far as historical topics are concerned, the text must be designed in such a way that it remains up to date (credibility) even after several years (during the lifetime of a board).

Only after acquiring all the above functions of notice boards in the mining tourism and observing the main best-practice rules, it is possible to proceed with the methodological part of board preparation. This does include not only their content and graphics but also their actual production as installations designed for mining tourism. Obviously, the rules of external information boards design for mining tourism have their specifics.

Methodological rules for designing mining tourism information boards

Several types of information boards are commonly used to mark mining educational installations in the landscape, which we generally call signs. *The sign* is a tool - an area or a spatial mark which communicates with a participant of mining tourism.

The sign is a form of impersonal communication with a visitor that must meet three requirements which can be expressed by a communication triangle (Ludwig, 2003). When one of the three inextricably interconnected vertices of the triangle represents the method used to prepare the installation, then the other represents the visitor (reader) themselves, and the third vertex represents the topic of individual introduced phenomena (*Fig. 1*).
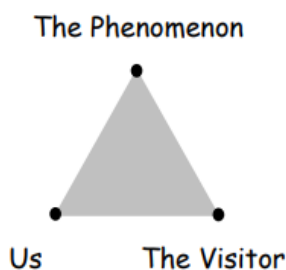

Fig. 1: Communication triangle schematically depicting impersonal communication between a visitor and a board (sign, panel), referring to a topic displayed on a board

It is undisputed that the use of information signs in the landscape in mining tourism has both advantages and disadvantages (Gross et al., 2006). In order to be of benefit to the visitor, the signs must be user-friendly as visitors themselves ultimately choose what they will or will not read and will select the range of sing information they will take in. Signs should be used for educational purposes; that means they must provide visitors with information and indirect content interpretation. However, they must be economical not only in terms of content but also in terms of technology and material. In case of improper processing, production or use in situ, they also have negatives that need to be eliminated. Signs cannot be invisible, and they cannot blend with the landscape (*Fig. 2*). Despite the quality of the sign, it cannot answer all the questions (such as a guide). They cannot be text-based because visitors ignore such signs. However, in mining tourism, these signs are often used because many tourists visiting mining sites have a specific - positive relationship to mining, and they accept the boards processed in this way.

The purpose of trail signing determines the total content and form of the sign itself (Ludwig, 2003). There are four basic groups of signs based on their purpose:

• directional signs which provide to give direction to the tourist and facilitate his movement in the area, on the site or along the mining educational trail,

• regulatory signs regulate behaviour in the area, on the site or on the mine sidewalk, introduces various rules of behaviour, but also possible sanctions;

•   informational signs bring information about other points of interest in the surroundings about danger etc.

 and the last type are

• interpretative signs, which are most important for the presence of a mining tourist because they make available information about mining phenomena on the site.

Fig. 2: Organized group of mining tourists on Mining trail Ľubietová (photo by P. Hronček)

Notice, educational or interpretative signs - boards, panels

The task of the information panel is to give the visitor interesting facts, uniqueness or various specifics about the place where they are installed. They provide information on the natural and socio-economic elements of the landscape, including man, his culture, technology and history, settlements and cultural monuments.

Their main goal is not only to educate or explain, but also to lead visitors to discover new connections, relationships or ties and meanings. They cannot, or should not, contain heterogeneous information. They should be simple and clear, therefore, first of all, the title of the topic should be included, if they are part of a nature trail they should include its name, stop number, accompanied by the trail logo and small picture and graphic material. This should create a kind of "header" of the board. The textual information (i.e., the interpretation itself) should be brief, interesting and understandable. The form is often used through an engaging story. The textual part of the presentation must be accompanied by photographs, maps, diagrams and drawings. The golden rule for the graphical part of information boards is that they should not only form the visual part of the topic described in the text but also complement, disseminate and provide new information. Therefore, they must be self-supporting and self-reading, meaning they must have a concise, interesting and self-supporting description.

The graphic design of the information board should be not only engaging but also simple and logical. For educational installations where there are several boards on the route, they must have a single design, which the visitor will understand at the beginning of the route at the introductory board. Also, their form and material should fit into the environment and show the presented topic.

In general, we can state that the information board is effective if its "communication" with the visitor is not only quick but also interesting or even dramatic. That way, it can provide the visitor with the information about what they can see, experience or learn on the route.

According to research conducted on visitors of indoor expositions (Ham, 2013), the majority of them concentrates on one panel for less than 6 seconds (Medek et al., 2016). However, according to our field measurements, this is not relevant neither applicable for mining tourism. Attendance of mining facilities in the landscape is significantly limited by seasonal and weather conditions. During the summer season and on sunny days, the visitors usually spend more time reading individual panels. Our findings show that, on average, a visitor can spend as much as 5 minutes studying a single mining tourism information board. However, the specificity in the case of mining installations in the landscape is that tourists coming to these sites have a particular interest in the mining heritage.

When reading information boards, we have to realize one thing - the visitor reads the boards not as linear as a book, but non-linearly, like a newspaper (Medek et al., 2016). Text-based compilation of explanatory boards often uses 3-30-3 rule of visitor-board interaction, which in 2005 introduces the Rocky Mountain Region Centre for Design & Interpretation (US Forest Service, 2005). M. Gross, R. Zimmerman and J. Buchholz (2006) dealt with this rule in detail. To the rule dedicated attention also Czech authors J. Woitsch and K. Pauknerová (2014) or M. Medek et al. (2016). The rule, which is the result of research in other geopolitical conditions, is often transmitted without critical reassessment to our central European environment, where nature trails have a different form, boards have more detailed content and also tourist motivations to visit are different.

3-30-3 time rule - board reading rule, or rule of visitor-board interaction, is interpreted as follows:

3 seconds - most visitors only look at the board for 3 seconds. This is where the visual familiarisation with the board takes place, and this piece of information usually includes an eye-catching title, a large image, or both.

30 seconds - as long as the board caught their attention in the first three-second phase, its viewing last about 30 seconds. The main information is usually longer described in 1-2 paragraphs.

3 minutes – the board which will grab the attention of visitors thematically and graphically will be viewed up to 3 minutes (in detail).

Based on our field research, we came to the conclusion that this rule is more likely to be applied to generally focused boards (nature trails) with various topics, where the boards are more graphically compiled with lay descriptions. These kinds of nature trails are mainly intended for children or a wide spectrum of tourists. The thematic notice boards, that means mining installations in a landscape, are high-level expert-content or medium-level expert-content notice boards placed on trails visited by a small group of tourists (mining tourists) who, unlike other tourists, spend more time reading and studying the text and content of individual boards. We can observe this situation especially during student field trips (secondary schools and universities), also during professional events and seminars, events aimed at popularization of mining heritage, etc. We have also seen a higher interest in explanatory boards by many individual visits to these facilities. As mentioned above, it is on average more than 3 minutes, often up to 5 minutes, when reading the content of the board with an understanding and perception of its graphic schemes and links to the surrounding landscape.

Czech authors (Medek et al., 2016) divide the visitor's interaction with the board; in other words the visitor's interest in the board content and reading it in phases, based on 3-30-3 rule. The phases of a visitor's time interaction with the board can be characterized as follows:

- Engagement - arousing the visitor's interest in board content for about 3 seconds,
- Detection - getting to know the contents of the board within about 30 seconds,
- Start – reading the information board in about 3 minutes,
- Interest - the visitor gains interest (does not have to), creates his own conclusions and decides how to continue along the route (*Fig. 3*).

It is important to emphasize that in each of the phases, the visitor decides whether to continue reading the board. The tourist decides individually depending on the textual and graphic composition of boards. Our research on the mining trails in Slovakia confirmed that abovementioned factors influencing the visitor effort to read the board until the end or to finish the visitor interaction with the board prematurely.
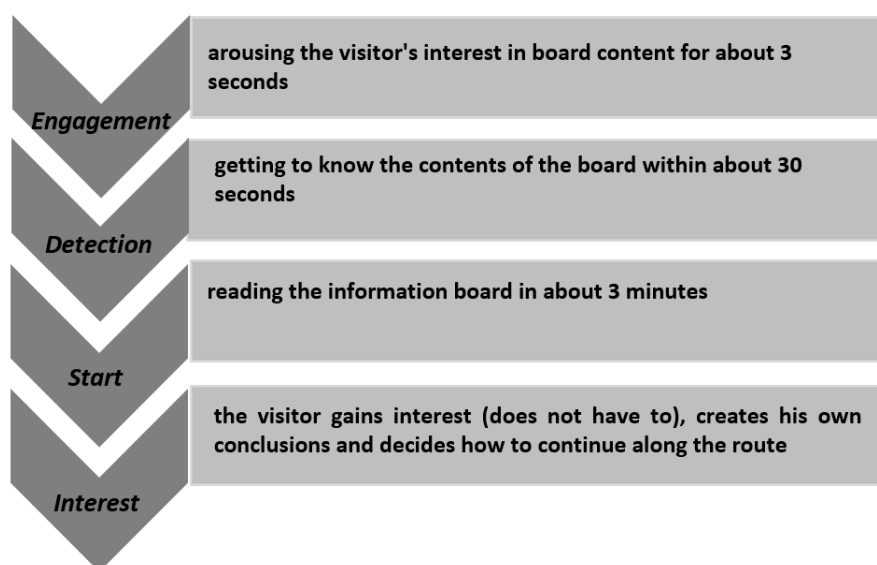

Fig. 3: The phases and time range of the visitor's interaction with the notice board (edited by Medek et al., 2016, s. 51)

Based on various guidelines (Ludwig et all., 2003; US Forest Service, 2005; Anonymous, 2008; Jelínek, Kozubková, Kostečka, 2009; Anonymous, 2008) or methodological works by M. Gross, R. Zimmerman and J. Buchholz (Gross et al., 2006), J. Woitsch and K. Pauknerová (Woitsch & Pauknerová, 2014) or M. Medek with a team (Medek et al., 2016) we can present basic methodological characteristics regarding content and form (font or colour), which is necessary to follow when creating notice boards.

The methodology of the used questionnaire survey

Questionnaire survey is a method aimed at mass and quick identification of facts, opinions, attitudes, preferences, values, motives, needs, interests, etc. For the purposes of the present study, a public opinion survey was carried out based on the general methodology of questionnaire creation, according to E. Taylor-Powell

(Taylor-Powell 1998), Š. Švec (Švec 1998), N. Bradburn, S. Sudman and B. Wansink (Bradburn at al. 2004), P. Gavora and coauthors (Gavora et al. 2010) and M. Bačíková (Bačíková 2018).

We conducted our research through a unique form with questions answered by respondents. In order to achieve the stated goals of the research and easy statistical processing of responses, it was necessary to follow basic methodical procedures during its creation. When preparing, it is necessary to pay attention to whom the questionnaire is intended and what we need to find out with it. The validity of the questionnaire survey depends on the quality of the questionnaire, the accuracy and clarity/transparency of the questions with respect to the target group of respondents.

For our survey connected to mining nature trail boards, we have selected a questionnaire with closed-ended questions (pre-offered answers from which respondents could choose). This method is much more advanced, more convincing and more accurate in achieving research objectives (Weis et al., 2016). This means that by the use of open-ended questions we can easier identify what individual respondents think, but we are unable to evaluate and validate its conclusions through results in relation to specific objectives set in advance as in the case of closed-ended questions.

We prepared the questionnaire using a closed-ended form of questions. Selective questions, with multiple choices designed to meet the research objective on the basis of the answers, were used. Subsequently, the questionnaire was assigned to the respondents, and finally, we did a statistical evaluation. A specific example was question no. 15, which is an open-ended question without any answer option offered. The aim of the question was to obtain an independent evaluation of the educational trail attractiveness by the respondent with the respondent's suggestions for any changes or additions to the educational trail as an experience-oriented type of information medium. The results of statistical analyses were used in the formulation of the research conclusions.

Fig. 4: Example of notice board, central board on the main square in Smolník (on the left), information board no. 8 as a part of Educational mining trail in Nováky (on the right) (photo K.Weis)

Fig. 5: Information board on the mining site Korňa oil spring in Korňa (on the left) and the information board of Nature trail in Ľubietová (on the right) (photo P. Hronček)

Results

Modern notice boards on the example of the Vyhne nature trail

The Vyhne nature trail

Educational mining trail „Tracing the history of the mining activities in Vyhne" (Žiar nad Hronom District), was opened on October 11, 2014, in the Handel locality. Its length along the less demanding route is 3.7 km and has a total of 9 stops with explanatory boards. The tenth board is introductory. The trail is self-service, out-and-back and its route takes about 1.5 to 2 hours. It is freely available all year round according to suitable tourist equipment *(Figs. 4, 5, 6)*.

- Welcome board
  Welcome boards can also be called starting-point boards as they are usually placed at nature trail starting points. They must contain the name of the nature trail with the logo, the name of the founder, administrator, author(s), the implementation company, eventual project partners. The introductory board must necessarily correspond with the graphics of the other boards.

  The welcome board of the trail in question (like all others), a co-author of the scientific text and graphic design of which is K. Weis, who is, at the same time, the author of this scientific study, follows the basic rules of mining nature trail design listed in the introductory part of the study.

  It is based on the 3-30-3 rule, which is apparent from its content and graphics. The other methodological rules are also well traceable.

  The introductory board shows the name of the nature trail, the authors of the texts, a brief introductory description in Slovak and English. For easy reading, the text is arranged in columns. In the central part of the board, there is a brief description of each stop to which the photo is attached. In addition to the precise identification of stops in the map at the bottom of the board, there is also a trail profile. In the right corner is a map showing the wider geographical space of the nature trail and its accessibility. In the middle top of the introductory board, there are rules of behaviour and movement on the educational path.

  Tourist's rules of the Vyhne educational trail:
  1. Stay on the signed path at all times;
  2. Keep quiet and remain disciplined;
  3. Do not destroy the forest and do not frighten animals away;
  4. Do not damage educational trail notice boards,
  5. Do not damage or pollute the environment and do not set fire;
  6. Pay attention to your personal safety;
  7. Do not enter open mining works.

There is also a brief description of the individual boards, their photos and the exact location on the map included:
- Board no. 1: St. Anthony of Padua Adit – At the entrance to the trail is parking available. The route leads from the adit of St. Anthony of Padua almost along the contour, towards the village Vyhne. Along the route, you can see the remains of mining activities - heaps, spoil banks and surface mining pit.
- Board no. 2: Old St. Anthony of Padua Adit - Originally the second mouth of the St. Anthony of Padua, called the Old Adit of St. Anthony of Padua. It is located on the site of the first mining administration house - the Lower Handelhaus.
- Board no. 3: Stamp-mill no. 5 and water adit Gabriel - Here are the remains of Stamp-mill no. 5, where the ore exported from the mine was treated. The water used to drive the processing plants was the water supplied by a water gallery, which runs above the remains of the building. The route continues to the observatory rock with a cross, from where the ascent is more physically demanding and then continues along the ridge to the Šprochova Valley.
- Board no. 4: Joseph Adit and Šprochová Valley - The Joseph Adit is located on the floor of the Šprochová Valley. By descending the valley, there are visible remains from the beginning of mining activity in Vyhnianska Valley. At the level of the state road, the trail turns right and continues to the opposite hill, where it continues along with the level of Upper láf railway track.
- Board no. 5: The Luke Adit and Upper láf - This adit is located at the level of the Upper láf - railway track, on which the ore was transported to stamp-mill and processing facilities.
- Board no. 6: Holy Trinity Shaft- A place where the mining tower of the Holy Trinity Shaft and the Central Ore Processing Plant stood.

- Board no. 7: Central processing plant and Anna Antónia Adit - from the Anna Antónia Adit we cross the stone ditch and continue along the route of the collecting water ditch.
- Board no. 8: The Katharine Adit and collecting ditches - At the level of the original collecting ditches, it continues to the state road and then back to Vyhne.
- Board no. 9: John's Cross-Cut to Holy Trinity Shaft - This cross-cut served as an access adit under the Holy Trinity Shaft. Above it is a knocker, as it used to be in the past.

Fig. 6: Organised field trip for university students along the signed nature trail (photo B. Gregorová)
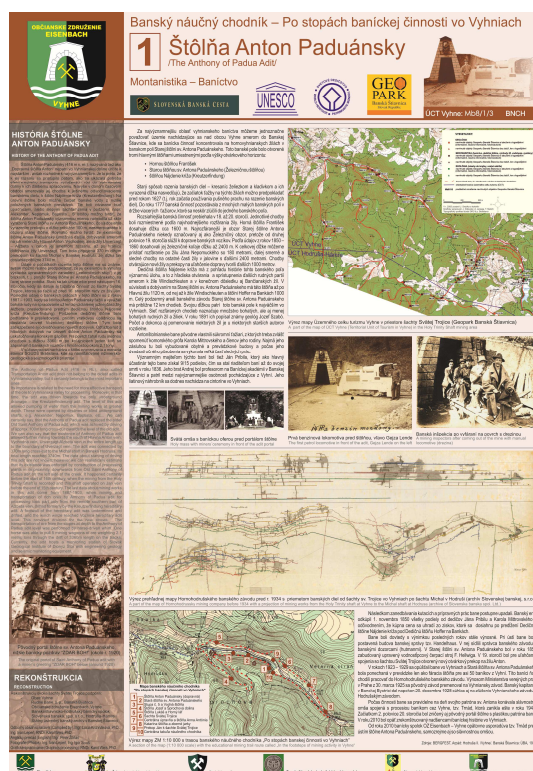
Fig. 7: The example of the board in Vyhne village. Autor of the board is K. Weis (photo K. Weis)

All information boards of the nature trail in Vyhne meet the basic methodological rules for the design of boards for mining nature trails. We started from the methodological bases as we described them in the part of the Study Material and methods.

Results of the questionnaire survey

The questionnaire consisted of 15 questions (*Fig. 8*), answered by respondents in writing. A total of 1,400 respondents participated in the survey during years 2018 and 2019, and the questionnaire survey was conducted on the following educational and mining Trails:

- Mining nature trail in Vyhne (*Fig. 7*),
- Educational mining hiking trail in Nováky,
- Educational trail on the iron road in Čučma,
- Educational mining trail in Ľubietová,
- Mining educational trail Nová Baňa.

Students who attended the survey were from different years of study from the Department of Geography and Geology (Faculty of Natural Sciences, Matej Bel University in Banská Bystrica) and from the Institute of Geo and Mining Tourism, Faculty of BERG, Technical University of Košice.

Fig. 8: Questionnaire used in the survey with a detailed view of selected questions

The basic evaluation of the survey responses is summarized in Fig 9. When compiling a database file, several correlations, more or less significant, were observed, but mostly only for certain pairs of questions.

Given that nearly half of the participants were students of study programmes with related or marginally related fields, the most surprising fact is that 43% of respondents (aged 18 to 23) have never taken a route of any mining nature trail and 26.7% report that they have experienced such an educational trail just once. Perhaps this is also the reason for relatively high correlation between such answers and, what seems surprising, the square of A's answers and the cube of C's answers (question No. 2: Does, in your opinion, the content of the boards provide sufficient information on the site?... A) Yes, absolutely or question no. 3: What did you like most about the board? … C) Its content and visual). This probably implies that although respondents do not know the topic, they are able to get enthusiastic about it, but they are particularly interested in the content-visual aspect of the information boards.

Considering time needed to first visual familiarisation with the issue (question no. 5), it can be stated that the information boards, due to their diversity and territorial differences, have a suitable composition and visually mastered graphics, as almost 59% of respondents claim 5 seconds was enough, and of course, they were mostly interested in graphics, i.e. picture attachments (45.8%) and maps (30.6%). It took only 30 seconds for most respondents (47.4%) to get acquainted with the whole board and read the whole board with an understanding of either 3 minutes (50.4%) or up to 5 minutes (39.8%). The above demonstrates that, in general, there was too much textual information used to design boards. The information was, however, often drawn from archival collections and other documents without any objectively acceptable degree of its compression and generalization. Such an interpretation corresponds to the relatively high level of criticism of technical approach and the extent of the information sought, which are most often oral comments of respondents. The reason for this may be the fact that there is still a tendency in Slovakia to produce relatively specialized or narrowly specialized (technical) texts on educational trails corresponding to relatively specialized topics, but without trying to reach other interest groups, not to mention other age categories. We strongly recommend paying more attention to this fact. The degree of acceptance of the scope and expertise of textual information was also reflected in the willingness, or reluctance to pay attention to the text and boards. Therefore, it is not surprising that up to 37% of respondents started reading the text but did not finish it. 38.8% of respondents either viewed more or less just picture attachments, or 14.6% respondents just took a picture of a board to see it at home (?), see question no. 7. question no. 9 brought very similar results, where up to 29.4% of respondents said they had read the entire board

(this does not correspond to the answer to question no. 7), but 25.8% only looked at the map attachments, and 25.7% started reading the text, without finishing it. Only 6.6% say they took a picture of the board to look at it at home ... The trend of taking pictures of information boards by mobile phones is understandable since there is a gradual degradation of common forms of communication between young people in general, and they are replacing them with "social networks" or other forms of digital communication. However, it is highly unlikely that this form of "education" will take on a wider meaning now and in our conditions. Rather, we assume that this type of response was more of an excuse for the respondents, as reflected in the low revealed interest in textual information (17.7%, question 3 (A) and partial correlation with the answers to question 7). (A) and 9 (A), expressed as a percentage of 9.57% and 12.6%.

The answers to questions no. 11 and 12 provided a positive finding, i.e. whether the respondents consider the information presented in the boards useful for their study, or their study programme (question 11) and whether the teacher's interpretation was/was not sufficient and widened the range of information obtained (question 12). Up to 83.1% of respondents answered the question no. 11 with 'Yes' and up to 84.4% responded with the same answer to question no. 12. In addition to the positive outcome in terms of boards content and teacher quality, it is also possible to state the ability of respondents to assess the content of the board and the complementary interpretation of the subject matter of their own study (which should be obvious). However, they are not willing to spend the necessary energy and time to read. This trend is consistent with the decreasing ability of our young generation to understand written text, and they rely on 'complementary' ideal experiential forms of education. As teachers, we will have to adapt to this trend as it is now commonplace in several developed countries. Nevertheless, the inconsistency of educational standards at different stages of the education process in Slovakia and the declared efforts to optimize or make more attractive forms of education remain.
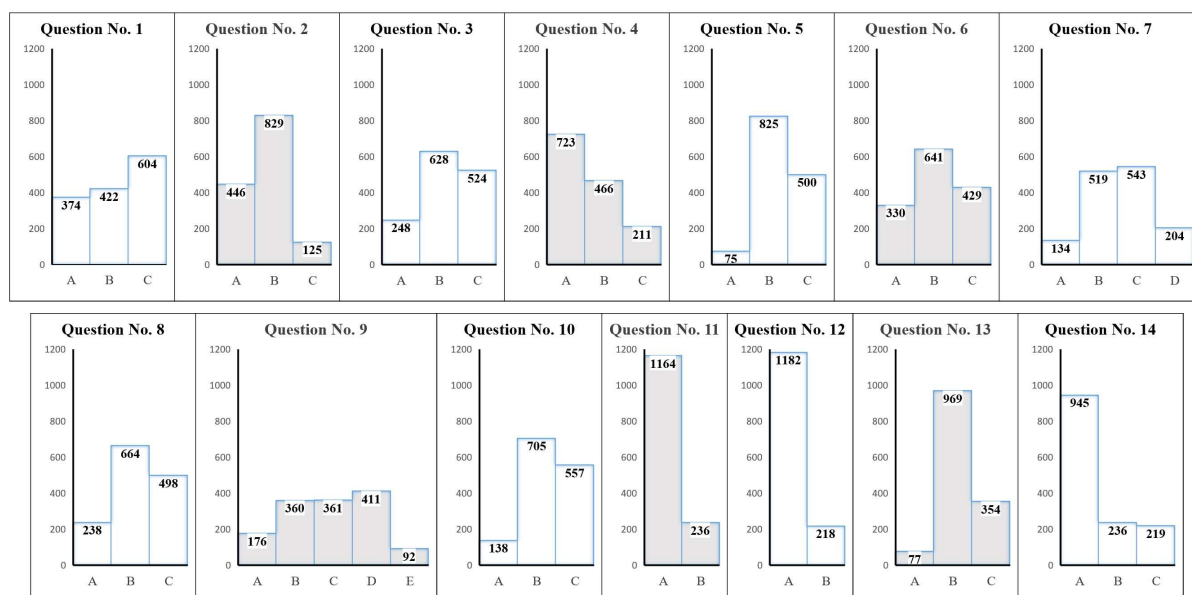

Fig. 9: Basic processing of questionnaire survey results

Evaluation of respondents' answers to open-ended question no. 15 brought interesting results. Of the total of 1,400 respondents, only 267 respondents used the opportunity to answer this question, which is surprising, but the unwillingness to respond was partly correlated with the occurrence of answer C to question no. 1 and significantly with answer C to question no. 2. A significant correlation has also been shown with answers A to questions no. 7 and 9, suggesting that this group of non-responders is not professionally close to the mining theme, has no experience with this specific kind of objects and technical monuments, and has not shown any significant familiarisation with the presented issue.

Most frequent were proposals for any type of nature trail upgrade with live attractions, or the possibility to experience something real, to be involved in some activities (this type of answers occurred up to 195 times). The second most common suggestion was to add multilingual texts for the main content, or at least for descriptions of images and other graphics add-ons (maps, archival sources, tables, etc.). Given that only 23 foreigners participated in the research, even though they were foreign language-speaking respondents with varying degrees of understanding of the Slovak text, this result was very surprising. One of the possibilities of interpretation is a general effort to standardize the content of information boards with expectations and experience from abroad (?), Or it is more likely to try to understand the issue also from a foreign language text and to test it at the same time.

Most answers in the questionnaire (up to 96%) suggested adding texts either only in the world languages or in the languages of neighbouring countries of the Slovak Republic with the exception of the Czech language (there is a high degree of similarity and understanding of the spoken word as well as written text).

The second-largest group of proposals were requests to make the nature trail more attractive by adding either originals or replicas (best functional) of the former technological facilities used in mining and metallurgy. The third-largest group were only different types of comments with a predominantly positive perception of a particular nature trail (the ratio of positive responses to negative was 71/29 out of a total of 74 such responses).

Given that all nature trails on which the survey has been carried out operate as self-guided trails without any hired guide and mostly in rural areas, it is not possible to assume any change in the way of operation in the near future. The existence and use of functional models is tied to closed areas with paid entry. Only in this way can the protection and maintenance of such objects be ensured. This fact is valid not only for Slovakia, but it is universal.

Discussion

For the information boards preparation and design, with emphasis on mining themes, we recommend following subsequent methodological principles.

Based on our analysis of the latest world and domestic (Czech and Slovak) literature and almost three years of our own research, we came to the conclusions that we recommend to observe following methodological principles when preparing and creating external (text-pictorial) information boards presenting mining themes (for mining tourism):

- The main text should not exceed 1 standard page (i.e. 1800 characters, including space character - approx. 350 words), as it takes the average person to read the page with understanding within one minute. For narrowly specialized topics in specific cases, it could be up to 1.5 pages.
- Ideally, the main text should be readable from a distance of 1, max. 2 meters, which in practice, however, cannot usually be observed. Only headings and subheadings are readable from this distance. Typically 60-72 points are used for the title, 44-48 points for the subheading. Typically, 24-30 point fonts are commonly used for the main interpretative text, 20 points in exceptional cases, but the font is less readable. The 18-point size is used for callouts.
- It is better to design additional text as extended captions for images (up to 500 characters). Despite their small size, they are usually read-only by specialists in the field, and they do not bother ordinary tourists.
- The used font size must correspond to the size of the board, and legibility must be guaranteed even in poor weather conditions.
- The font used must be easy to read. Use a serif font that is not only easy to read, but also makes you feel calm. It is inappropriate to use, for example, graphical forms of writing or imitations of handwriting.
- The text needs to be clearly divided into several parts with sub-headings. To emphasize a certain part of the text, it is advisable to use a soft background colour.
- The line length is optimal between 8 and 15 words. Paragraph alignment and text justification are necessary for information boards. Narrow text blocks are easier to read; they are clear and more dynamic.
- Pictographic material should be used to represent phenomena or objects (themes) that are not visible in the landscape, or that look different (images from the past), or have already disappeared.
- It is advisable to avoid too complicated visual (graphical) information (arrows, lines, ornaments, diagrams, etc.).
- Images and maps must be self-reading (descriptions below the images and maps, maps should have a basic legend, scale indicator, and north arrow or compass rose). These pictorial elements should complement the main text appropriately, transparently and extensively.
- The introductory board shall include the location of the mining trail in the wider landscape, taking into account well-known and accessible tourist points. There must be a clear map of the route and description of trail stops on the board. Included must be not only a description of the route length but also its difficulty (it is suitable to depict the route length and profile graphically). It is also advisable to remind visitors of rules or restrictions (prohibitions) or to specify the visitors' regulations.
- The board at each stop should include a schematic map of the entire site or the nature trail to know which way the route leads, for giving more accurate directions to visitors. This schematic map must be graphically identical to the initial map but must indicate the current location of the visitor.
- The colours of the images, fonts and overall graphics used must be tested directly in the terrain in order to be legible during cloudy days or strong sunlight.

- The use of different types of materials for the production of boards (such as wood, metal, foil or other modern materials) must be tested in practice. So their quality can withstand unfavourable weather conditions (colour fading caused by sunlight, damages caused by frost and freezing or rotting caused by moisture, etc.). An important factor in material selection is their appropriate integration with the natural landscape and their appropriate placement.

- Boards should not be placed in areas where they are distracting, often extremely unesthetic. We should care that they will sensitively blend in with the environment (especially their material, colour design, location).

We also need to consider the way of their implementation - installation, since the information boards can be vertical or inclined (lectern) or horizontal. Sometimes they are mounted on the surface level of the nature trail. These factors are important for their readability.

- The placement of the boards (of nature trail route) must reflect the specific needs of local communities and must comply with the legal requirements of the company (land ownership, etc.).

- Routes of nature trails should start in places where there is good transport accessibility not only for individual tourists but also for organized groups.

- When preparing board content, producing and installing boards "in-situ" one must always take into account the subsequent maintenance, sustainability and update of the content at reasonable costs. Protection against vandalism is significant as well.

- When creating boards for mining tourism, it is important to follow the phases step by step considering the time range of the visitor's interaction with the notice board. We modified the results of this interaction, according to Medek and co-workers (Medek et al. 2016, p. 51) based on the results of the questionnaire survey.

Conclusion

The final methodological recommendations for the design of a modern notice (interpretative, educational) board in mining tourism are:

- Create a simple profile (graphics) of a board;
- Keep the text well-arranged, not only in the middle part of the board but also in its corners;
- Create a strong focus of interest, particularly in the form of images;
- Choose graphics so that the visitor's attention is not lost;
- The text must not be as wide as to cover the entire board space;
- Individual boards on the trail must be linked (not thematically, but they must be consistent one to another);
- The task of the board must be to produce a short but visually interesting interpretation;
- If photos from the board's location are used, it is advisable that the visitor could see the object in situ;
- Use self-reading maps, graphs, sketches, historical drawings and sources;
- For modern trails, it is necessary to use QR codes.

The information boards created in this way placed along with an increasing number of modern mining nature trails, which will be equipped with traditional stationary panels, will have great potential to attract more and more mining tourists not only individuals but also organized groups of cognitive mining tourism.

References

Anonymous. (2008). Outdoor Interpretive Signage. *Tourism Development*, How-to Guide. Province of Nova Scotia.

Anonymous. (2008). Trails Management Manual. Standards and Guidelines for Planning, Design, Construction, and Maintenance of the Trails and Track Systems. *Maricopa County Parks and Recreation Department*.

Bačíková, M. (2018) Dotazník. In Bačíková, M., Janovská, A.: Základy metodológie pedagogicko-psychologického výskumu. *Sprievodca pre študentov učiteľstva*. Košice : Univerzita Pavla Jozefa Šafárika v Košiciach, pp. 65 – 84.

Bizubová, M. (1984). Náučné chodníky na Slovensku. PVVŠ, roč. XXXV, č. 10, s. 391-393.

Bizubová, M. (1994). Náučné chodníky, cesty a lokality na Slovensku. *Geografia*, roč. 2. č. 1. s. 15-18.

Bizubová, M. (1995). Úloha náučných chodníkov v prírodovednom vzdelávaní na základných školách. „*Zborník z národnej konferencie „Stratégia environmentálnej výchovy a vzdelávania na školách*", Bratislava,

Bizubová, M. (1998). Formovanie ekologického vedomia prostredníctvom náučných chodníkov. *Zborník z 1. jubilejnej konferencie „Trvalo udržateľný rozvoj krajiny a ochrana životného prostredia"*, Zvolen, s. 55-61.

Bizubová, M. (2001). Geografické informácie v systéme náučných chodníkov a ich didaktické využitie. Geografické štúdie Nr. 8 – *Premeny Slovenska v regionálnom a didaktickom kontexte*. Fakulta prírodných vied Banská Bystrica, s. 269-272.

Bizubová, M., Ružek, I., Makýš, O. (1998). Náučné chodníky Slovenska. I. časť. Bratislava: Strom života. 104 s.

Bizubová, M., Ružek, I., Makýš, O. (1999). Náučné chodníky Slovenska. II. časť. Bratislava: Strom života, 140 s.

Bizubová & Minka (2001). Aktívny cestovný ruch cez prizmu náučných poznávacích trás v regiónoch SR. Sborník přednášek. I. medzinárodní konference „Aktívni cestovní ruch - strategický faktor rozvoje regionu". Newport Univerzity Ostrava 24.-26.5.1999. Ostrava, s.15 - 22.

Bradburn, N., Sudman, S., Wansink, B. (2004) Asking questions: The definitive guide to questionnaire design. For market research, political polls, and social and health questionnaires. San Francisco, CA, US : Jossey-Bass, 426 p.

Burkovský, J. & Kollár, Š., (1989). Príležitostný náučný chodník z roku 1926. In *Chránené územia Slovenska*, z. 13, pp. 80 – 81.

Čeřovský, J. (1976). Poznávame prírodné bohatstvo socialistickej vlasti – Sprievodca výstavou o náučných chodníkoch. Správa CHKO Malá Fatra, s. 40.

Čeřovský, J. (1978a). Vyhlídky, zákruty a cíle našich náučných stezek. Památky a příroda, roč. III, č. 7, s. 425-433.

Čeřovský, J. (1978b). Chráněné krajinné oblasti a kultúrně výchovná činnosť. Památky a příroda, roč. III, č. 8, s. 449-455.

Gavora, P., Koldeová, L., Dvorská, D., Pekárová, J. & Moravčík, M. (2010). Elektronická učebnica pedagogického výskumu. Bratislava : Univerzita Komenského. Online: http://www.e-metodologia.fedu.uniba.sk

Gross, M., Zimmerman, R., Buchholz, J. (2006). Signs, trails, and wayside exhibits: connecting people and places (3). UW-SP Foundation press, Inc.

Ham, S. H. (2013). Interpretation – Making a Difference on Purpose. Golden: Fulcrum
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5167249.pdf

Jelínek, M., Kozubková, J. and Kostečka, P. (2009). Realizace návštěvnické infrastruktury. Praha: AOPK ČR. Králiková, K. and Burkovský, J. (2008). Náučné zariadenia v prírode. In *Enviromagazín*, 2008, Nr. 3.

Ludwig, T. (2003). Basic Interpretive Skills. The Course Manual. Werleshausen: Bildungswerk Interpretation.

Mazúrek, J. (1988). Didaktické využitie náučných chodníkov a lokalít pre geologicko – geografické exkurzie na príklade CHKO Štiavnické vrchy. In *Acta facultatis pedagogacae Banská Bystrica* – Prírodné vedy IX., SPN, Bratislava, s. 161-194.

Medek, M., Činčera, J., Gregorová, J., Pořízová, K. Lisková, M. (2016). Naučné stezky: zpracování a hodnocení nepřímých interpretačních programů. Brno: Masarykova univerzita.

Schneider, J., Fialová, J. and Vyskot, I. (2008). Krajinná rekreologie I. Brno, MZLU v Brně.

US Forest Service (2005). Interpretive Media Design Guidelines [online].

Suchá, B. (1990). Sprievodca – náučné chodníky Slovenska. Ústredie štátnej ochrany prírody L. Mikuláš, s. 134.

Švec, Š. (1998) Metodológia vied o výchove: Kvantitatívno-scientické a kvalitatívno-humanitné prístupy v edukačnom výskume. Bratislava : Iris, 303 p.
http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5167249.pdf

Taylor-Powell, E. (1998) Questionnaire Design: Asking questions with a purpose. The Texas University, 46 p.

Weis, K., Bednárik, P., Masný, M. (2016). Geographically-montanistic research of mining site Smolník and its mining works virtual reconstruction. In *Geographical information* : Nitra, University of Konštantín Filozof. - Vol. 20, No. 2 (2016).

Woitsch, J. and Pauknerová, K. (2014). Metodika pro prezentaci sídelního a krajinného prostoru a kulturního dědictví prostřednictvím tvorby náučných stezek. Plzeň: Západočeská univerzita v Plzni.