Non-Formal Children and Youth Education Focused on Geoscience Content in the Czech Republic

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Abstract: The aim of this paper is to review Czech domestic and international English written literature outputs on the theme of nonformal geoscience education published in the last two decades, with to respect to the local situation in the Czech Republic. The literature findings cover education of children and youth (age group of six to nineteen years old pupils and students). Information about non-formal education with specific geoscience content put into the context of natural sciences education literature sources. The overview study reflects contemporary Czech educational reality and includes the relations to the formal educational system. It encompasses literature resources about nonformal and at the same time out-of-school, leisure based and interest education. Previous conclusions and future visions in the field of geoscience educational research are described. Terminological limits in the field have been researched in the literature. The study outlines two scientific approaches dealing with the theme. It presents the possibility of classification of the geoscience non-formal activities, based on literature findings. Finally, it shows an overview of particular geoscience activities, which are realized for children and youth on university campuses in the Czech Republic. These activities are put into practice with the purpose to motivate and stimulate children's interest in the geoscience, to transmit the general knowledge of sciences and improve their skills and abilities.

Keywords: non-formal education, geoscience, leisure based education, out-of-school education, interest education, Earth science education

The importance of comprehensive education is once again emphasized in our contemporary educational system of the 21st century. The notion of *lifelong education/learning* should be the starting point of every human being in our society. *Non-formal education* that is the subject matter of this paper is also one of the possible ways of lifelong education.

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The primary aim of this study (indicated above) is to present an overview of the literature in the area of non-formal geoscience education with respect to the Czech educational reality in geoscience education. For this purpose, two partial aims have been determined. The first partial aim is to review the awareness in the area of non-formal geoscience education which is the missing complement to several already existing overviews of formal geoscience education written by well-known experts such as C. R. Ault (1993) and C. King (2008). The second partial aim is to show the situation in the Czech geoscience non-formal education, based on the literature.

This paper is divided into several sections. The first one attempts to define non-formal children and youth's education (on a primary, lower secondary and upper secondary level) and describes its integration into the official Czech educational system. It also presents the main principles of non-formal education and highlights its connections with other types of education. It addresses the contemporary significance of this particular educational area as well as the current trends associated with it. The next part briefly describes the development of non-formal education and its historical context in the Czech Republic but also worldwide. The third part describes geoscience education and its influence on our society, research approaches to nonformal geoscience education and the needs for establishing geoscience didactics. The fourth section presents geoscience educational concepts and approaches. A significant part of this section is dedicated to an overview of geoscience disciplines that are part of formal geoscience education in the Czech Republic and that are nowadays more and more emerging in the content of non-formal education. According to various indicators gained during formal education[1], to support the geoscience awareness among children, youth and even the general public and to make it a natural part of a general education, non-formal education seems to be an important complement to formal education. The fifth section shows the variability of different courses and the possibilities of classification of non-formal geoscience activities for children and youth according to selected general parameters. The last part deals with the role of Czech universities in non-formal education and popularization of geoscience.

[1] The real life problems appearing in formal geoscience education in the Czech Republic are dealt with in papers *Proč učitelé přírodopisu (ne)mají rádi geologii (Why do science teachers (dis)like geology?)* (Kopecká, 2014) or *Rámcový vzdělávací program a výuka geologie na základní škole a čtyřletém gymnáziu (The framework educational program and geology teaching at elementary and four-year secondary schools)* (Pluskalová, 2004) and others.

1 The framework of non-formal education

Initially, the term non-formal education was understood as a complement to formal education.[2] However, with time, some authors have added new interpretations to this term and the limits of its meaning are becoming quite ambiguous, as a result of which many problems connected to the terminology have appeared (Eshach, 2007; Falk & Dierking, 2000; Prokop, 2007 and others). For instance, it is often replaced by a variety of different terms (most often these terms are: informal or out-of-school education), e.g. Riedinger (2015, p. 454). Moreover, it can be contrasted with the concept of formal education (Spronk, 1999). There are also several tendencies to use the term informal education as a superordinate of non-formal education (see Gerber, Marek, & Cavallo, 2001). The situation is also complicated because of several terminological contradictions such as non-formal schools, which are appearing in the developing countries (Hasan & Chowdhury, 2013). The reason for these terminological differences is frequently the influence of the traditional educational system on non-formal education in a given country.

As a result, we can use a rich variety of different definitions to specify non-formal education. These can be classified according to various points of view (see Rogers, 2005). Nevertheless, it seems to be more important to understand the context of non-formal education rather than to define precisely the term itself. Every educational situation involves elements of in/formality that are related and cannot be separated. They appear in different ways and under the different circumstances (Colley, Hodkinson, & Malcolm, 2002; Golding, Brown, & Foley, 2009). Usually, the authors of various papers state the perspective from which they view the education in their research.

In this paper, non-formal education is understood as an education that takes place outside the school facilities (i.e., not in a formal setting), that is organized but based on the voluntary participation of individuals (Braund, 2008). *The International Standard Classification of Education* (ISCED) just as the official national Czech curriculum[3] uses the above-stated principles to describe non-formal education (UIS, 2011). Definition and characterization of non-formal education specified in ISCED at General Conference in Paris, on November 2011 (according to UIS, 2011) is following:

[2] The first definition of this term was published by P. Coombs (1968, p. 138).

[3] Accessible from the Ministry of Education, Youth and Sports websites; online: www.msmt.cz.

> (…) Non-formal education is defined as education that is institutionalized, intentional and planned by an education provider. The defining characteristic of non-formal education is that it is an addition, alternative and/or a complement to formal education within the process of the lifelong learning of individuals. It is often provided in order to guarantee the right of access to education for all. It caters to people of all ages but does not necessarily apply a continuous pathway-structure; it may be short in duration and/or low in intensity; and it is typically provided in the form of short courses, workshops or seminars (…).

Other authors understand non-formal education as an education universally accessible for all to whom it is aimed (Yasunaga, 2014) and a flexible education (Hornáčová & Prokop, 2005). In general, non-formal education is pupil-oriented and takes into consideration pupils' specific needs and inner motivation. Částková, Kropáč and Plischke (2016) claim that non-formal education is based on the pupil orientation and at the same time takes into account the social and cultural aspects individual pupils experience in their life.

Non-formal education is also related to other forms of education, such as children and youth interest education, out-of-school education and leisure based education (chosen aspects of which are shown in table 1). Taking into consideration contemporary situation in the Czech Republic, *interest education* seems to be one of the possible ways to accomplish non-formal education. It is defined in the § 111 *Education Act No. 561/2004 Coll. on Pre-school, Basic, Secondary, Tertiary Professional and Other Education* as an education developing personal interests provided to learners in their leisure time and focusing on various areas (interpreted from *Act No. 561/2004 Coll.*, as amended, Ministry of Education, Youth and Sports, 2004). *Out-of-school education* take place after school or during the classes (Braund & Reiss, 2006; DeWitt & Storksdieck, 2008). Leisure-based education is every type of an activity carried out during the time is not used to satisfy basic physiological needs or to fulfil school or work duties (Hofbauer, 2005). According to Falk (2005), it is an education carried out in person's free time, nonsequential, self-placed and voluntary. The inner motivation and pupil's interest in their own education must also be taken into consideration. Pupils are able to choose what they want to learn, the same as where and with whom (socially constructed nature of learning). He also prefers the term leisure (free-choice) learning to other terms (non-formal, informal, formal) as those three take into consideration mainly physical setting.

Table 1
Chosen characteristics of non-formal education according to three examined aspects

	Non-formal	Out-of-school	Interest	Leisure-based
Aspect of location				
In a school facility	no	no	yes	usually no
Out of a school facility	yes	yes	yes	yes
Aspect of time				
During the classes	yes	yes	no	usually no
Out of classes	yes	yes	yes	yes
Organizational aspect				
School as an operator	yes	yes	yes	usually no
Other operator	yes	yes	no	yes
No operator	no	yes	no	yes

Note: Personal interpretation naturally enables the existence of activities which are difficult to classify. For instance, voluntary summer training camp organized by teachers outside the school can be approached as a non-formal, out-of-school, interest and leisure-based education at the same time.

Non-formal education is also important from the economical point of view (Štěch, 2007; Younés, 2000). Moreover, its importance is growing in connection to the natural and other sciences (Salmi, 2012). It is grounded in the orientation of the individuals/participants (education, health) during the educational courses/activities. Findings in the field of psychology and pedagogy confirm the importance of non-formal education. Individual subject matter methodologies profit from it too. Several studies (e.g. Bockschneiderová, Břízová & Mazehóová, 2009) prove the positive effect of non-formal education on the health of the individuals, be it mental, physical or social health (e.g. prevention, rehabilitation).

A growing effort to achieve the recognition in individual countries has become the main trend in non-formal education during the last twenty years (Werquin, 2009). Another trend is appearing together with new scientific discoveries (Younés, 2000). They bring new needs to educators and science promoters (Hebáková, Marek, & Kučera, 2011). Newly, we can distinguish other non-formal educators focused on geoscience education. These are, for instance, national parks (Bogner & Wiseman, 2004), museums (Prokop, 2007), research institutes (Aichler & Bokr, 2007), geoparks (Nevřelová & Ružek, 2017) and university campuses (see section 6).

2 Historical context of non-formal education

The beginnings of non-formal education stretch back to the late 1960s and the beginning of the 1970s[4] and according to Salmi (2012) follow the approach in the 1920s for *everyday science learning* (E. Krieck). At the same time, access is being developed due to the influence of *experience pedagogy* and the thoughts of Kurt Hahn (Veevers & Allison, 2011). Formal education accepted experiences from non-formal educational settings (i.e. science centres, outdoor). Rising interest in non-formal education could be observed also during the 1990s[5] when the establishing documents were created under the auspices of the international organizations UNESCO and OECD.[6] These documents added profound new value to non-formal education and initiated the revision of educational policy in many countries. Lifelong learning, as a new notion, also appeared in the educational policy of European Union in 1995.[7] Afterwards, European Commission created the documents leading to the formation of action plans of non-formal and informal education (EC, 2000).

The development of non-formal education was supported by the Ministry of Education, Youth and Sports in the Czech Republic ten years ago. Crucial is the document *Strategie celoživotního učení* (*Strategies of Lifelong Education*; Ministry of Education, Youth and Sports, 2007). It presents "all forms of learning within and outside of the traditional educational system as part of a single interconnected unit that facilitates transitions between education and employment." (UNESCO, 2016, p. 10). In 2009, a national project *Podpora technických a přírodovědných oborů* (*Support of Technical and Natural Science*) was initiated. The Operational Program *Vzdělávání pro konkurenceschopnost* (*Education for Competitiveness*) between years 2007-2013 enabled the implementation of two successive projects here in the Czech Republic[8] which led to the production of many publications dedicated

4 Further examined by P. Coombs (1968), M. Ahmed (1972) and others.

5 See for instance Etling (1993), Hofstein & Rosenfeld (1996).

6 This notion appears in two simultaneously published papers: *Learning: the treasure within* (Delors et al., 1996) and *Lifelong learning for all* (OECD, 1996).

7 See EC (1995).

8 Firstly (up to the year 2012) Ministry of Education and National Institute for Further Education prepared project *K1 – Klíče pro život (Keys for life)*. Secondly (up to the year 2015) project *K2 – Kvalita a konkurenceschopnost v neformálním vzdělávání (Quality and competitiveness in non-formal education)*.

to non-formal education.[9] These are mostly aimed at the children and youth educators. In comparison with other countries (OECD), the process of implementing non-formal education into the Czech educational system is in a "very initial phase" (cited in Werquin, 2010, p. 20).

3 Geoscience non-formal education in a research of educational specialists

The educational research in the field used to be exclusively a part of geology. Nowadays, the situation is changing. The contemporary trend is to understand the interdisciplinary connections and to achieve a broader understanding of the subjects in general. According to Loon (2008), the nature of this trend should be synthetic. That is the reason why the term Earth science has been recently introduced and why it is nowadays being replaced with the new term geoscience education (see King, 2008).

The aims of geoscience education are similar in all forms (formal, non-formal, informal) to the aims of other natural science of dual character (Wood, 2009). On the one hand, it should motivate participants to study natural sciences and to create a new generation of scientists. Geoscientists need to be able to effectively assess and rationally use natural and water resources, understand the effect of waste disposal sites, including radioactive ones, on the environment, perceive various areas from the point of view of engineering geology factors, including urbanization and building engineering (Turanová & Ružek, 2015). On the other hand, geoscience education should lead to responsible and conscious life in our society. Even children and youth who do not become scientists should understand the natural principles and should be able to make effective and purposeful decisions in different areas of their lives (Brossard, Lewenstein, & Bonney, 2005; Wood, 2009). These decisions concern health, critical thinking, assessing media information, climate change, nature conservation and natural resources (Vohra, 2000). A very convenient approach is so-called "science for all", which says that the subject matter should be as comprehensible as possible (e.g. Orion, 2007). In accordance with the holistic model, geoscience faces several challenges that have to be incorporated in their contemporary and future direction. These challenges are: to provide the public with general knowledge of natural processes that form our environment, to understand the influence people's

[9] The list of all the publications with the references is accessible online: www.znv.nidv.cz.

actions have on the Earth at local, regional and even global level (Locke, Libarkin, & Chang, 2012).

Research into non-formal education in the natural science aims mostly at the participants of non-formal education and on the possible influence on their motivation and interest in this particular field of study (i.e. Gibson & Chase, 2002; Janštová, Jáč, & Dvořáková, 2015; Hemmer et al., 2007), their attitudes towards this field of study and the interest in their possible future occupation, which might be connected to this field of study. The other researchers aim at the new educational approaches, methods (i.e. Mao & Chang, 1998; Hosťovecký, Štubňa, & Stankovský, 2012; Esteves, Fernandez, & Vasconcelos, 2014; Musacchio, Lanza, & D'Addezio, 2015). A third small group of findings are evaluations of activities (for instance Pražáková & Pavlasová, 2017). Two main scientific approaches dealing with geoscience nonformal education can be observed in the professional literature. The first approach is represented by the specialists on leisure based education who deal with the theory of non-formal and informal education (Bauman, 2012). In 2004, the term non-formal education itself was introduced into the Czech educational context by B. Hofbauer (Kaplánek & Macků, 2012). The second approach is formed by a community of subject-matter methodologists of different fields of study (e.g. natural science didactics), who are also considerably engaged in the sphere of non-formal education (Papáček et al., 2015). These two approaches have been so far developing individually. However, the cooperation between them would make an important contribution to the research of non-formal education.

Czech educational specialists (methodologists) have to deal with the large number of questions connected to the establishment of subject (matter) didactics (see Trna, 2005). In the case of geoscience didactic, according to Turanová et al. (2008) there is a noticeable lack of background in the field. For instance, the number of geoscience educational specialists is very low. They are usually natural scientists who particularly work with the educational problematics. Geoscience specialists in education do not have an opportunity for scientific growth – in Czech, the same as in the Slovak Republic there is no accreditation of postgraduate studies in the field. Consequently, geoscience didactics seems to be a minor part of the research of other didactics (e.g. biology) with the interdisciplinary character (Papáček et al., 2015).

As partial support to the Czech nonformal geoscience education, we must consider the potential of networking at the different dimensions – teachers (Turanová & Ružek, 2015) or activities (e. g. SciCamp, 2015). This initial step could contribute to the sharing of internal and international experience in the field (Hofbauer, 2005). It could help to connect real-life nonformal (geoscience) educational activities with the responsible national or international institutions (as in the Czech Republic National Institute for further education or European association of institutions of non-formal education of children and youth).

4 From formal to non-formal content in geoscience education

The content of non-formal education is largely based on the content of formal education. Contemporary formal geoscience education is changing its concepts and that is the reason why some of the experts talk about a transforming paradigm in natural science in general (Vohra, 2000; Škoda & Doulík, 2009). The key document that provokes changes in geoscience education is *Earth system science overview: A program for global change* (NASA, 1986). The Earth system science approach has been accepted by the specialists and it is therefore used in natural science education (Loon, 2008). This approach emphasizes multidisciplinary learning. The pupil/student is in the very centre of the education, and the learning/teaching process integrates other pupils' skills and competences. The teacher is in the role of a mediator. Inquiry based science education is preferred. Learning takes place in various types of environment and alternative evaluation and assessment is used to inform the pupils about their progress (Orion, 2007). Especially in this point, non-formal education can appropriately supplement formal education.

Together with the progress of science and technology (Younés, 2000), existing branches of geoscience are experiencing their boom as well. We can distinguish individual branches, e.g. geotechnology, geoinformatics and applied geophysics. New ecological approaches and techniques form other new subdisciplines (such as environmental geology, geoecology). This diversity makes it quite challenging to define the amount and depth of the subject matter which should be transmitted to the educational content. On the other hand, it creates a big space for non-formal education. To certain

extent, the subject matter for schools is defined by curricular documents of individual states (*Framework Educational Programme*, RVP, in the Czech Republic). The curricular documents suggest topics, curriculum and desired outcomes concerning the non-living nature. Although national standards have been introduced, the topics are often not evenly covered in individual curricula (King, 2015).

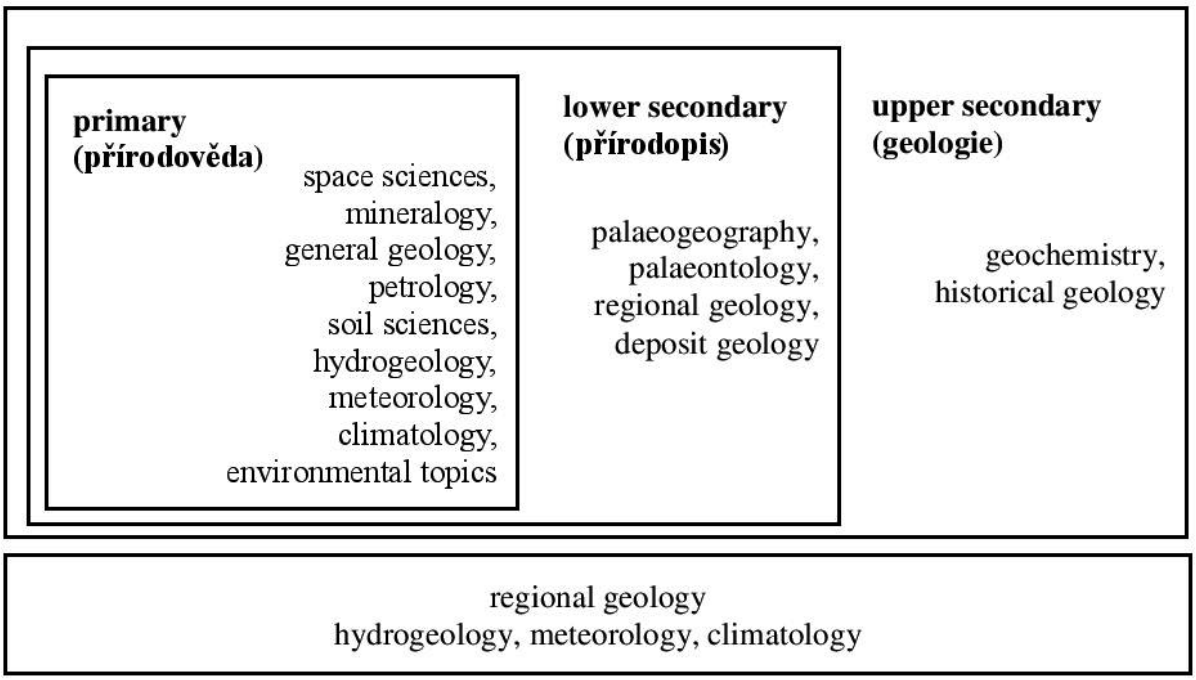

Figure 1. Top box of the schema shows geoscience content (inspired from formal education) in highlighted levels of education. The bottom frame concentrates on disappearing themes from geoscience content (regional geology) or themes moving to other educational areas/subjects. Used and modified from Czech curricular documents (Ministry of Education, Youth and Sports, 2016; VÚP, 2007). Czech names of school subjects are in the brackets.

Although geoscience is viewed comprehensively, newly published studies differ in their content and usually deal with selected Earth science. For instance King (2008), in his overview leaves out the following topics: atmosphere, oceans, geomorphology and land. On the other hand, Mao & Chang (1998), although they perceive geology and oceanography as Earth sciences, focused specifically on astronomy and meteorology in their research. According to Hemmer et al. (2007), geoscience includes geography

(social, regional and physical), geology, geophysics and soil sciences. All these terminological distinctions complicate the data generalization. On the other hand, they enable the scientists to work interdisciplinary and look for the relations among the individual disciplines. There is also no need to emphasize the names and types of subjects schools in individual countries use to teach geoscience.

Geoscience is not a school subject in Czech schools. The content of geoscience is usually distributed through following subjects: *přírodověda* (natural science) for the primary level, *přírodopis* (natural science) and *zeměpis* (geography) for the lower secondary level, *geologie* (geology) and *geografie* (geography) for the upper secondary level of education. This paper deals with several topics of geoscience that have been used to enrich Czech education lately (from primary to upper secondary level). It follows the line of *přírodověda – přírodopis – geologie* subjects (it is shown in picture 1). Czech curricular documents also cover practical parts of education which can be used in geoscience too. For example:

1) performing simple experiments (*přírodověda*);
2) observation, classification according to identification key and creating collections (*přírodopis*);
3) fieldwork and geological excursions (*geologie*).

Finally, to answer the question 'What is supposed to be the content of geoscience in non-formal education?' We can conclude that individual authors could introduce in this area of education some of the content of all previously mentioned geoscience disciplines, which were recognized from all Czech levels of formal education. This approach is legitimate as the contents that emerge into non-formal education usually (since the historical beginnings) arise from current needs and trends of formal education.

5 Classification of non-formal geoscience education

In non-formal education, geoscience activities are variable. Nowadays, there is no generally valid method of their classification.[10] A great amount of ambiguities appear in this field of study (e.g. a short-term activity might

[10] Suggestions for classification of individual sub-activities are available (see e.g. Fields, 2009; Lindner & Kubat, 2014).

be considered as a long-term in a different study, non-formal activity is sometimes understood as an activity out of classes, out-of-school activity does not necessarily mean outdoor activity, etc.). Therefore, the authors of this paper perceive the presentation of one of the possible classifications of non-formal geoscience activities as crucial. This classification uses primarily general (duration, periodicity, time context, setting, selectivity) criteria (see table 2) and is inspired by several articles belonging to other natural science branches published during last twenty years.[11] Hereinafter stated enumeration of categories is not exhaustive. Other categories (e.g. age, gender) can be related to the participants (Fields, 2009[12]; Lindner & Kubat, 2014; Pražáková & Pavlasová, 2017).

Table 2
Classification of non-formal geoscience education according to selected criteria

Criterion	Classification	Examples of possible activities
Time context	during classes	excursions to science centres, museums, fieldwork
	out of school classes	hobby groups, evening lectures
Physical setting	outdoor	excursions or expeditions, fieldwork
	indoor	laboratory experiments, excursion to museum
	combined	hobby groups, (geoscience) camp
Duration	short-term	lectures, fieldtrips, a competition, (geoscience) camp
	multi-day	summer school, specialized training camp
Periodicity	periodical	the (geoscience) olympiads, a correspondence seminar
	occasional	attending expositions, lectures, educational programmes
Selectivity	selective	the (geoscience) olympiads, students' professional activities (SPA), a correspondence seminar
	not selective	attending an interactive exposition, (geoscience) camp

Note: Authors' adaptation used the data from previous research.

[11] The reason is a missing record of research of geoscience activities and other non-formal education. In comparison with other topics, natural science non-formal education is perceived as one of the least described in three international magazines (IJSE, JRST a SE) in the years 2003–2007 (Kekule, 2014). Following studies are several of those that cover the discussed topic: Almquist et al. (2010), partially Hadjachilleos et al. (2004), Pražáková & Pavlasová (2017).

[12] The research works with data collected among undergraduates.

Taking into consideration its context, we can distinguish non-formal education/learning that is realized during the school classes (de Barros et al., 2012; Bitgood, 2002; DeWitt & Storksdieck, 2008; Hadjachilleos, Valanides, & Leou, 2004; Kvasničák, 2005). Every pupil can actively participate in planning out-of-school, non-formal education. School-based learning takes up an average a quarter of pupil's time in their life (Younés, 2000), it is therefore crucial for children and parents to be able to thoroughly and conscientiously choose other educational activities and activities for personal development.

According to the setting where activities take place, we can distinguish outdoor (Bogner & Wiseman, 2004, Dillon et al., 2006) and indoor (Benson, 2010[13]) non-formal educational activities. *Outdoor* educational activities for children and youth are essential in geoscience education. Without extensive outdoor activities, the Earth sciences have no future (Loon, 2008). Certain authors understand outdoor education as fieldwork/field trip (Elkins, Elkins, & Hemmings, 2008), others add to this category trips to museums, science centres, outdoor sites and other places (Falk & Dierking, 1997). Combination of both, outdoor and indoor in a certain activity/programme can be also often seen. From the point of view of duration, nonformal education can be divided into *short-term* activities (usually up to one week) and *multi-day events* (usually more than one week). *Multi-day events* are often organized during summer but it is possible to realize them even during other seasons too (e.g. during spring or autumn break). Multi-day events and short-term events both ongoing for at least two days can be further divided according to their continuity. We can distinguish *overnight* (Almquist et al., 2010; Janštová, Jáč, & Dvořáková, 2015) and *day-time only* activities (Pražáková & Pavlasová, 2017*)*. Another viewpoint is the regularity of repetition which divides non-formal activities into *periodical* and *occasional* (Farkač & Božková, 2006). And last but not least criterion that can be used to classify programmes of non-formal education is the *selectivity*. This criterion allows to choose successful participants and support them in their further activities in the field of geoscience. As was pointed out above, educational and general criteria mingle in different types of activities and programmes of non-formal nature sciences education.

[13] The author describes possible indoor preparation of a mapping course for university students. The course itself is not the subject of the research.

Table 3
Non-formal geoscience educational activities for children and youth organized by universities

University	Faculty	Geoscience activities for children and youth
University of South Bohemia in České Budějovice (České Budějovice)	F. of Education	Young researchers' club, competition, the (geoscience) olympiads
	F. of Science	–
Masaryk University (Brno)	F. of Education	The (geoscience) olympiad
	F. of Science	The (geoscience) olympiad, competition, (geoscience) seminar, summer school, exhibition
Jan Evangelista Purkyně University (Ústí nad Labem)	F. of Education	–
	F. of Science	Particular (geoscience) activities during the week of science
Charles University (Praha)	F. of Education	–
	F. of Science	Correspondence seminar, cycle of lectures, daytime only camp, geolab, students' professional activities (SPA), days of (geosciences), excursions, educational programmes in museums
Palacký University Olomouc (Olomouc)	F. of Education	–
	F. of Science	Lectures, excursions
Technical University of Ostrava (Ostrava)	F. of Mining and Geology	Excursions to faculty's depositories, competitions, fieldtrips, lectures, workshops

Note. This table does not include complete list of identified activities with natural science topics (natural science camps, children's natural science conference, junior academy in natural sciences, etc.). Authors' own findings from on-line documents, April 2017.

6 Institutions providing non-formal geoscience education

As was stated in the first section, the number and diversity of youth and child educators is growing. As evidence of the development in the area of non-formal geoscience education in the Czech Republic we provide the overview of activities realized at the campus in the state universities (Table 3). Nowadays, the universities start to take part in the field of nonformal

geoscience education (Lindner & Kubat, 2014) be it on a level of a university as a whole institution, individual faculties or departments.

The reasons why we have focused only on non-formal geoscience education established by universities are the primarily limits caused by the missing resources (e.g. the team of scientist, database of activities provided by the control authority) in education. In the Czech Republic there is no instrument for retaining and passing on the up-to-date information about non-formal (geoscience) activities. The most comprehensive information could be available in a certain time before and shortly after the realization of an individual activity by institutions. The other limits are reliability and the differences in the presentation (usually websites and posters) of data. Since the universities and other natural research institutions started using non-formal education as an instrument for subject popularization (Aichler & Bokr, 2007), they have become a control authority which guarantees the quality of activities and at the same time reliability and accessible presentation of information about it.

7 Conclusion

This theoretical study summarizes the key findings of research in the area of non-formal and geoscience education published between 1997 and 2017. The literary sources were obtained from two dimensions (international and national) of research. International literature sources included in this summary were searched using verified scientific databases (*Web of Knowledge,* EBSCO, ERA, SCOPUS etc.). Czech studies incorporated knowledge from reviewed articles, proceedings of scientific conferences and online documents provided by significant institutions.

This study is the first overview of non-formal education in geoscience. Moreover, it reflects the Czech contemporary situation. We perceive the benefit of this paper in the description of educational aspects of various activities. It could be useful to teachers of didactics of biology and geology and preservice biology and geology teachers. Besides, it might be interesting for in-service teachers who are looking for the options how to help their students with the right choice from of a nonformal course. As Hofbauer (2005) states, in our contemporary educational system, formal education is enriched by non-formal educational programmes. Non-formal activities enable flexibility in gaining new information and supporting pupils' interests (see e.g. Hornáčová & Prokop, 2005; Petr, 2014).

Our preliminary findings show that Czech non-formal education in geoscience is experiencing its growth. It is also more supported by Czech scientific institutions. They guarantee the quality of non-formal geoscience activities and programmes. It seems that nonformal geoscience education is enhancing formal educational system. The results of this theoretical paper permit further comparisons and evaluations of the non-formal educational activities in international perspective. Moreover, it provides effective feedback to the educators.

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