DOI: 10.2478/frp-2020-0009
Wersja PDF: www.lesne-prace-badawcze.pl

Leśne Prace Badawcze / *Forest Research Papers*
Czerwiec / June 2020, Vol. 81 (2): 81–90

REVIEW ARTICLE

e-ISSN 2082-8926

Geocaching in education – a review of international experiences Part 2. Recipient, location and subject matter of education

Ewa Referowska-Chodak

Warsaw University of Life Sciences – SGGW, Institute of Forest Sciences, Department of Forest Protection, ul. Nowoursynowska 159, 02–776 Warsaw, Poland

Tel.: +48 22 5938169, e-mail: ewa_referowska_chodak@sggw.pl

Abstract: This article discusses the recipient, locations and subject matter of education using geocaching, based on a literature review. The aim is to aid the implementation of similar methods of education in Poland, including forest education, by providing practical information and guidelines.

In the literature, the most frequently mentioned recipients of geocaching education are pupils, especially between 10–18 years of age, and university students. This is due to the fact that the authors of the publications were mostly school and academic teachers, as well as students and doctoral students of teaching and social faculties. For the same reason, the preferred locations of educational geocaching were also school/university areas and their immediate vicinity, as well as urban areas, including parks. Locations modified to a lesser degree by anthropogenic influences such as protected areas, waterfronts and forests were also mentioned. The subject range of geocaching classes is very wide, although geography, mathematics, biology, ecology, history, culture, modern technology/equipment, linguistics and physical education were particularly frequently mentioned. Subjects related to geology, local society, economy and art were also reported. Regarding recipients of educational geocaching, the literature clearly indicates limitations in its application to the youngest age groups, while at the same time its great usefulness in the education of all other age groups is highlighted. In addition to the currently dominating anthropogenic geocaching locations, Poland offers a large variety of natural places, such as forest areas, which are already used for informal field education. These locations furthermore enable multidisciplinary education, which is in line with the extremely wide range of subject content proposed for educational geocaching.

Keywords: Adventure education, educaching, field education, forest education

1. Introduction

Educational potential of geocaching, which is a game of hiding caches/boxes by some contestants ('geocachers'), and finding them – on the base of geographical coordinates – by other contestants (Sherman 2004; Samołyk 2013; Majdak, Świder 2016), was noticed in the world very fast, only after a year since it started functioning (Webb 2001 after: Ihamäki 2015a).

Educational geocaching can be based on caches set up earlier by 'regular' geocachers or prepared by educators only for classes of specific topics. It may be realized within formal and non-formal education, in both natural and fully anthropogenic landscapes. For its wider implementation into educational practice in Poland – especially forest education – it speaks of a number of advantages of this form of education, realized successfully outside the country, and in the initial phase in Poland (www.pcen.pl; http://sodmidn.kielce.eu). To the most important advantages included can be: positive evaluation of field classes by the students (Christie 2007; Freiermuth 2017); creating responsibility for the environment (Adanali, Alim 2017; Grau Martínez 2017); running classes in dynamic, activating, creative way (Vitale et al. 2012; Zecha 2012); increasing recipients' involvement in education process (Größ 2010; Mayben 2010); increasing motivation of students (Donadelli, Rocca 2014; Ring 2014); transferring multidisciplinary knowledge and skills (Zemko et al. 2016; Pombo et al. 2017);

Received: 16.11.2019 r., accepted after revision: 12.02.2020 r.

developing thinking and problem-solving skills (Ihamäki 2007a; Zecha 2012); increasing effectiveness of education in comparison to the indoor education (Ihamäki 2015a; Blažek et al. 2016); teaching cooperation within team (Ring 2014; Schaal, Lude 2015); including physical activity into teaching process (Adanali, Alim 2017; Pombo et al. 2017). Those issues were described in detail in the first part of the cycle (Referowska-Chodak 2020).

The aim of this publication – second one in cycle – is the definition of recipients, locations and scope/subject matter of education using geocaching. Presented information, described on the basis of foreign experience, may have practical meaning while implementing educational geocaching in Poland, also within forest education.

2. Methodology

Detailed description of methodology, which is common for the entire cycle of articles, was presented in the first part entitled 'Geocaching in education – a review of international experiences. Part 1 Introduction: advantages and problems' (Referowska-Chodak 2020). Presented there was an attempt to answer a question – why? Why is it worth to pay attention to this method of education and try to implement it into Polish realities?

Results of this article were elaborated on the basis of 42 publications sought for in March 2019 in Scopus base of scientific publications (www.scopus.com) and in Google Scholar base (http://scholar.google.pl). It was reviewed for answers for the following important questions in education:

- For whom? What age groups are mentioned in the cited publications? Which one of them is mentioned most frequently, what may indicate on special utility of this method for running classes? Should any of the groups be omitted?
- Where? What locations/environments were so far practically used in educational geocaching? Are these objects anthropogenic, natural, or maybe places of connection of both in form of cultural landscapes?
- What about? What is the possible thematic scope of education using geocaching? What subjects/issues were formulated for discussion during classes? Are any fields of study more popular than other ones?

In subsection dedicated to recipients of education used was age division for school stages most frequently listed in the cited publications. It is a division dominant in the USA (where majority of publications originated), but also for instance in Canada, India or Australia (http://en.wikipedia.org/wiki/K-12). Due to different systems of education in particular countries, it was not always possible to precisely allocate defined in publication recipients into mentioned age groups. Therefore, if age group from the publication balanced between groups given in the results, publication was cited in both age groups. In Table 1, the adopted age division was related to the Polish education system functioning in the 20th century; therefore, in the period of described experience in educational geocaching.

Adopted in results, the age division (Table 1) is more similar to division in present, recently implemented, Polish education system; however, due to data accessibility, in discussion presented were the chosen statistical references to the previous system in which gymnasium functioned.

In the subsection dedicated to the locations of education, compared were anthropogenic, cultural and natural places/environments in which authors of cited publications proposed the use of already existing or creating new caches and trails of educational geocaching. In the cited publications, the most frequently included were descriptions of specific situations, classes, not general assumptions for this method of education. That is why, the list may seem quite short, and some categories of locations may potentially overlap in space like a hill with forest area. They were however listed separately in order to present the widest possible spectre of locations/environments, which in the cited sources were described as locations of practical experiences.

In reference to the content of educational geocaching, it should be noticed that the information given in the publica-

Table 1. Main age groups of education recipients abroad and in Poland

Education stage	Foreign (e.g. USA)	Poland (before the reform)	Poland (after the reform)
Pre-school stage	5–6 years*	3–6 years	3–6 years
First stage	6–9 years	7–9 years (cl. 1–3)	7–9 years (cl. 1–3)
Second stage	10–13 years	10–12 years (cl. 4–6)	10–14 years (cl. 4–8)
Third stage	14–17 years	13–15 years (gymnasium)	15–18/19 years (high school)
		16–18/19 years (high school)	
Adults (including students)	18 years and more	19 years and more	19 years and more

*for such age (the earliest) examples of geocaching classes were given

tions had a radically different level of detail (specific topic or very wide range of content), but it was also extremely different in terms of fields. The following assumptions were adopted for their ordering: 1) information was presented from general to specific (firstly given was information of collective nature, then this which could be assigned to specific fields, then to subject/section, and in the end, the one which within the given field/subject/section was reported as a specific topic), 2) fields of science were divided according to the current Regulation of Minister of Science and Higher Education (Regulation/Rozporządzenie 2018a).

3. Results

3.1. The recipient of education

Recipients of education with the use of geocaching are:

- Younger kids (age: around 5–6 years) (Bragg et al. 2010 after: Ihamäki 2015a; Ring 2014),
- Pupils of the first stage of education (age: around 6–9 years) (Christie 2007; Ihamäki 2007a, 2014; White–Taylor, Donellon 2008; Hamm 2010; Huang et al. 2010 after: Albach 2014; Burri Gram-Hansen et al. 2013; Hall, Bush 2013; Donadelli, Rocca 2014; Ring 2014; Schaal, Lude 2015; Blažek et al. 2016; Adanali, Alim 2017; Donadelli 2017; Grau Martínez 2017; Pombo et al. 2017, 2018),
- Pupils of the second stage of education (age: around 10–13 years) (Lary 2004 after: Hamm 2010; Christie 2007; White-Taylor, Donellon 2008; Bragg et al. 2010 after: Ihamäki 2015a; Hamm 2010; Huang et al. 2010 after: Albach 2014; Mayben 2010; March 2012; Vitale et al. 2012; Zecha 2012; Burri Gram-Hansen et al. 2013; Hall, Bush 2013; Alabau Subich 2014; Donadelli, Rocca 2014; Ring 2014; Heikkinen, Maliniemi 2015; Schaal, Lude 2015; Blažek et al. 2016; Zemko et al. 2016; Adanali, Alim 2017; Grau Martínez 2017; Pombo et al. 2017, 2018),
- Pupils of the third stage of education (age: around 14–17 years) (Christie 2007; Ihamäki 2007a; Inman et al. 2008 after: Hamm 2010; White-Taylor, Donellon 2008; Größ 2010; Hamm 2010; March 2012; Vitale et al. 2012; Zecha 2012; Cardwell 2013; Hall, Bush 2013; Alabau Subich 2014; Donadelli,Rocca 2014; Heikkinen, Maliniemi 2015; Ramirez Davies 2015; Schaal, Lude 2015; Blažek et al. 2016; Zemko et al. 2016; Adanali, Alim 2017; Pombo et al. 2017, 2018),
- adults:
  - students (age: around 18–22 years) (Webb 2001 after: Ihamäki 2014; Christie 2007; Ihamäki 2007a, 2007b, 2015b; Lawrence, Schleicher 2008 after: Ihamäki 2015a; Matherson et al. 2008 after: Ihamäki 2014; White-Taylor, Donellon 2008; Hamm 2010; Dwyer, Mccourt 2012; Albach 2014; Donadelli, Rocca 2014; Heikkinen, Maliniemi 2015; Maman, Blumberg 2015; Schaal, Lude 2015; Blažek et al. 2016; Fenech et al. 2017; Freiermuth 2017; Lazar et al. 2018), including candidates for teachers (Vitale et al. 2012; Adanali, Alim 2017),
  - other adults (for instance members of communities, clubs, unions) (Christie 2007; Blanco, Adam 2013; Albach 2014; Schaal, Lude 2015), especially up to 70 years old (Schaal, Lude 2015), retirees (Ihamäki 2007a), teachers – in case of caches set up by students for practice (Ihamäki 2007a, 2007b),
- cross-sectional groups of society (Albach 2014; Larsen et al. 2014; Ihamäki 2015a), including families with children (Schaal, Lude 2015).

3.2. Location of education

On the basis of literature review, listed below locations were used for education with the use of geocaching:

- Museum complex (Blanco, Adam 2013; Burri Gram -Hansen et al. 2013),
- School/university complex, including garden, school court (Christie 2007; Ihamäki 2007b; White-Taylor, Donellon 2008; Größ 2010; Lo 2010; Mayben 2010; Cardwell 2013; Alabau Subich 2014; Albach 2014; Donadelli, Rocca 2014; Ramirez Davies 2015; Zemko et al. 2016; Adanali, Alim 2017; Donadelli 2017; Freiermuth 2017; Grau Martínez 2017), closest surrounding of school (Größ 2010; Alabau Subich 2014),
- Historical locations (Dixon 2007 after: Mayben 2010; Dobyns et al. 2008 after: Ihamäki 2014),
- Urban area (White-Taylor, Donellon 2008; Größ 2010; Vitale et al. 2012; Zecha 2012, 2016; Blanco, Adam 2013; Burri Gram-Hansen et al. 2013; Albach 2014; Ihamäki 2014, 2015a; Heikkinen, Maliniemi 2015; Blažek et al. 2016; Freiermuth 2017),
- Airport area (Hubackova 2018),
- Camping area (Heikkinen, Maliniemi 2015),
- Urban park (Shaunessy, Page 2006 after: Mayben 2010; White-Taylor, Donellon 2008; Mayben 2010; Zecha 2016; Donadelli 2017; Pombo et al. 2017, 2018),
- Botanical garden (Albach 2014), arboretum (Larsen et al. 2014),
- Zoo (Dixon 2007 after: Mayben 2010),
- Cultural landscape (Dwyer, Mccourt 2012),
- Protected area: national park (White-Taylor, Donellon 2008; Albach 2014), an object covered with nature park protection area (Blažek et al. 2016), biosphere reserve (Zecha 2012), nature reserve (Albach 2014),
- Forest area (Größ 2010; Alabau Subich 2014; Ring 2014; Heikkinen, Maliniemi 2015; Grau Martínez 2017),

• Valley of a river/canal (Zecha 2012, 2016; Grau Martínez 2017), surroundings of a lake (Größ 2010; Heikkinen, Maliniemi 2015),
• A hill (Größ 2010),
• Archeological site/park (Etxeberria et al. 2012; Albach 2014), ruins (Größ, 2010),
• Closed mine (Cardwell 2013), geological objects (Lazar et al. 2018).

Besides the above listed physical locations, virtual places of geocaching education can be also mentioned. They can be an internet site of a cache – it includes information passed by cache's creator, but also allow finders to describe their experience, which may also be of a great meaning for increasing the level of knowledge of following finders (Ihamäki 2007a).

3.3. Scope and subject of education

The authors of publication are paying attention on usefulness of geocaching in education in the field of:

• All program contents (Christie 2007), school curriculum (Hamm 2010; Mayben 2010; Lo 2010; Vitale et al. 2012; Alabau Subich 2014; Donadelli, Rocca 2014; Ring 2014; Ihamäki 2015a; Pombo et al. 2017, 2018); however, with the inclusion of recipients' relations with every-day life, especially the young ones (Zecha 2012),
• Getting to know the world in which recipients live (Christie 2007; Cardwell 2013; Zecha 2016),
• Science and natural science:
  ◦ science (Brown et al. 2003 after: Mayben 2010; Christie 2007; Dixon 2007 after: Mayben 2010; Vitale et al. 2012; Donadelli, Rocca 2014; Larsen et al. 2014; Ihamäki 2015b; Zemko et al. 2016; Adanali, Alim 2017),
  ◦ natural science (Pérez, Pérez 2012 after: Alabau Subich 2014; Alabau Subich 2014; Zemko et al. 2016; Grau Martínez 2017),
  ◦ mathematics (Lary 2004 after: Hamm 2010; Sherman 2004; Elwood 2005 after: Alabau Subich 2014; Schlatter, Hurd 2005 after: Mayben 2010; Christie 2007; Buck 2009 after: Mayben 2010; Stephens 2009 after: Hamm 2010; Bragg et al. 2010 after: Ihamäki 2015a; Lo 2010; Pérez, Pérez 2012 after: Alabau Subich 2014; Vitale et al. 2012; Cardona 2013 after: Alabau Subich 2014; Alabau Subich 2014; Donadelli, Rocca 2014; Larsen et al. 2014; Ihamäki 2015a, 2015b; Blažek et al. 2016; Zemko et al. 2016; Adanali, Alim 2017; Grau Martínez 2017): distance, angles, coordinates, conversion, measures, problem-solving and so on.
  ◦ physics (Lo 2010; Alabau Subich 2014; Blažek et al. 2016),
  ◦ chemistry (Lo 2010),
  ◦ biology (natural history) (Vitale et al. 2012; Alabau Subich 2014; Ring 2014; Ihamäki 2015a; Blažek et al. 2016), including observing/recognizing animals (Christie 2007; Anderson 2008 after: Mayben 2010; Zecha 2012), soils (Christie 2007), trees/plants (Sherman 2004; Christie 2007; Anderson 2008 after: Mayben 2010; Huang et al. 2010 after: Albach 2014; Schäfer 2010 after: Zecha 2012; March 2012; Zecha 2012; Cardona 2013 after: Alabau Subich 2014; Albach 2014; Larsen et al. 2014; Zemko et al. 2016; Pombo et al. 2017, 2018), water habitats (Zecha 2012), ecology (Sherman 2004; Lo 2010), nature protection (Zecha 2012; Pombo et al. 2017, 2018), ecosystem, habitats, population, food chain (Grau Martínez 2017),
  ◦ geology (Sherman 2004; Anderson 2008 after: Mayben 2010; White-Taylor, Donellon 2008; Lo 2010; Cardona 2013 after: Alabau Subich 2014; Cardwell 2013; Lazar et al. 2018),
  ◦ geography (Sherman 2004; Shaunessy, Page 2006 after: Ihamäki 2015a; Christie 2007; Ihamäki 2007a, 2007b, 2014, 2015b; Lawrence, Schleicher 2008 after: Ihamäki 2015a; White-Taylor, Donellon 2008; Lo 2010; Mayben 2010; Alabau Subich 2014; Donadelli, Rocca 2014; Ring 2014; Blažek et al. 2016; Adanali, Alim 2017; Donadelli 2017): coordinates and geographical directions, spatial orientation (Schlatter, Hurd 2005 after: Mayben 2010; Kerski 2006 after: Ihamäki 2015a; Christie 2007; Ihamäki 2007b; Swingle 2007 after: Ihamäki 2015a; Matherson et al. 2008 after: Vitale et al. 2012; White-Taylor, Donellon 2008; Mayben 2010; Vitale et al. 2012; Zecha 2012; Alabau Subich 2014; Donadelli, Rocca 2014; Ring 2014; Ramirez Davies 2015; Schaal, Lude 2015; Blažek et al. 2016; Zemko et al. 2016; Adanali, Alim 2017; Grau Martínez 2017), local region (Sherman 2004; Vitale et al. 2012; Ring 2014; Heikkinen, Maliniemi 2015; Ihamäki 2015a; Blažek et al. 2016), sudden atmospheric phenomena (Adanali, Alim 2017), erosion (Zecha 2012, 2016), rivers (Zecha 2012, 2016), meteorological observations (Stephens 2009 after: Hamm 2010; Cardona 2013 after: Alabau Subich 2014), the universe (Stephens 2009 after: Hamm 2010), continents (Ring 2014), landscape (Anderson 2008 after: Mayben 2010; Vitale et al. 2012; Ihamäki 2015a; Zecha 2016) and its interpretation (Zecha 2016), maps (Sherman 2004; Alabau Subich 2014; Donadelli, Rocca 2014; Ring 2014; Grau Martínez 2017), digital cartography (Cardona 2013 after: Alabau Subich 2014; Donadelli, Rocca 2014; Ring 2014), different coordinates (Alabau Subich 2014, Ramirez Davies 2015), scale (Grau Martínez 2017), orography (Grau Martínez 2017),
• Social science (Shaunessy, Page 2006 after: Ihamäki 2015a; Christie 2007; Matherson et al. 2008 after: Mayben 2010; White-Taylor, Donellon 2008; Mayben 2010; Vitale et al. 2012; Cardona 2013 after: Alabau Subich 2014; Alabau Subich 2014; Donadelli, Rocca 2014; Ring 2014; Adanali, Alim 2017; Fenech et al. 2017; Grau Martínez 2017):

◦ journalism (Ihamäki 2007b) – for instance by creating one's own reportage on geocaching (Ihamäki 2007a; Freiermuth 2017),

◦ policy (Mayben 2010), forming, changes and cooperation of individuals and society (Ring 2014), territorial/administrative division (Grau Martínez 2017),

◦ economy (Mayben 2010), local economy (Cardwell 2013), local natural resources (Cardona 2013 after: Alabau Subich 2014), socio-economy, local living conditions (Blažek et al. 2016), local community (Vitale et al. 2012; Ring 2014), realized professions/occupation (Ring 2014),

◦ changes in local landscape (Ihamäki 2014),

◦ ecological and environmental education (Ihamäki 2007a; Zecha 2012; Cardona 2013 after: Alabau Subich 2014; Ihamäki 2014; Adanali, Alim 2017), among others things, threats for the environment (Adanali, Alim 2017), rules, perspective and own participation in sustainable development, environment protection (Ring 2014; Schaal, Lude 2015), interaction between man/environment and nature (Ring 2014),

◦ physical education (sports education) (Schlatter, Hurd 2005 after: Mayben 2010; Ihamäki 2007b, 2015a; Dobyns et al. 2008 after: Hamm 2010; White-Taylor, Donellon 2008; Größ 2010; Lo 2010; Moss 2010 after: Vitale et al. 2012; Vitale et al. 2012; Cardona 2013 after: Alabau Subich 2014; Alabau Subich 2014; Ring 2014; Grau Martínez 2017), tourism, including ecotourism (Zecha 2012), healthy lifestyle (Grau Martínez 2017),

• Humanities:

◦ cultural landscape (Schäfer 2010 after: Zecha 2012; Dwyer, Mccourt 2012; Ring 2014; Ihamäki 2015a; Zecha 2016),

◦ ethnography (Blažek et al. 2016), local customs/culture (Vitale et al. 2012; Zecha 2012; Blanco, Adam 2013; Ring 2014; Heikkinen, Maliniemi 2015; Pombo et al. 2017, 2018), cultures of other societies (Lo 2010; Mayben 2010), beliefs/religions (Pérez, Pérez 2012 after: Alabau Subich 2014; Ring 2014; Heikkinen, Maliniemi 2015),

◦ history (Elwood 2005 after: Alabau Subich 2014; Schlatter, Hurd 2005 after: Mayben 2010; Dobyns et al. 2008 and Matherson et al. 2008 after: Ihamäki 2014; Inman et al. 2008 after: Hamm 2010; Lo 2010; Zecha 2012; Alabau Subich 2014; Ring 2014; Blažek et al. 2016; Zemko et al. 2016): local history, including historical objects (Ihamäki 2007a, 2014, 2015a, 2015b; Kerski 2007 and Swingle 2007 after: Ihamäki 2015a; Schäfer 2010 after: Zecha 2012; Vitale et al. 2012; Cardona 2013 after: Alabau Subich 2014; Cardwell 2013; Donadelli, Rocca 2014; Ring 2014; Heikkinen, Maliniemi 2015; Blažek et al. 2016; Pombo et al. 2017, 2018), historical figures (Burri Gram-Hansen et al. 2013; Cardona 2013 after: Alabau Subich 2014; Blažek et al. 2016),

◦ archeology (Etxeberria et al. 2012),

◦ knowledge of foreign languages (Ihamäki 2007a, 2007b; Ramirez Davies 2015; Zemko et al. 2016; Freiermuth 2017; Hubackova 2018), knowledge of one's own language, speaking and writing skills (Dixon 2007 after: Mayben 2010; Pérez, Pérez 2012 after: Alabau Subich 2014; Donadelli, Rocca 2014; Ihamäki 2015a; Grau Martínez 2017), for instance description of one's own experience in searching a cache (Dobyns et al. 2008 after: Ihamäki 2014; White-Taylor, Donellon 2008; Lo 2010; Vitale et al. 2012; Cardona 2013 after: Alabau Subich 2014; Ihamäki 2015a) or description/history connected with setting up a cache (Ihamäki 2015b), toponomy (Cardona 2013 after: Alabau Subich 2014),

◦ knowledge of the literature (Pérez, Pérez 2012 after: Alabau Subich 2014; Burri Gram-Hansen et al. 2013),

• Art:

◦ artistic issues (Ihamäki 2007a), for instance photography (Ihamäki 2007a, 2007b), plasticity (Alabau Subich 2014),

• Engineering and technical science (Alabau Subich 2014; Larsen et al. 2014):

◦ modern technologies, including system and use of GPS (Webb 2001 after: Ihamäki 2014; Sherman 2004; Elwood 2005 after: Alabau Subich 2014; Christie 2007; Ihamäki 2007a, 2007b; Mayben 2010; Vitale et al. 2012; Maman, Blumberg 2015; Ramirez Davies 2015; Blažek et al. 2016),

◦ magnetic fields, radio waves (Sherman 2004),

◦ technical objects in the surroundings (Schäfer 2010 after: Zecha 2012),

◦ navigational information and internet communication, information and communication technology (Webb 2001 after: Ihamäki 2014; Alabau Subich 2014),

◦ operation of device like compass, GPS receiver (Sherman 2004; Lawrence, Schleicher 2008 after: Ihamäki 2015a; Mayben 2010; Alabau Subich 2014; Donadelli, Rocca 2014; Ring 2014; Zemko et al. 2016).

4. Discussion and summary

As was emphasized in the introduction, education using geocaching has a lot of advantages, and especially valuable is – in majority of cases – the one increasing the effectiveness of education (Mayben 2010; Tozo 2011 and Ulukök 2012 after: Adanali, Alim 2017; Ring 2014; Ihamäki 2015a; Blažek et al. 2016; Kisser 2016). That is why, it is worth taking a look at foreign experience in this matter, by analysing in the beginning such practical aspects as: recipient, location and scope/subject matter of education, referring at the same time to the Polish realities.

As recipients of education using geocaching the authors of the analysed foreign publications indicated practically all age groups. However, most frequently mentioned were students and pupils, especially from 10–18 years age group (corresponding to our present classes from 4th grade in primary school to 4th grade in high-school). It results from the fact that authors of those publications were in majority teachers from primary and high-schools and also academic teachers describing their experience with learned by them (respectively) pupils or students. Other configurations occurred rarely, for instance, academic teacher organizing classes for pupils of primary school (for instance Ihamäki 2014; Zecha 2012). Authors of the cited publications were also students and PhD students of teaching and social majors (Mayben 2010). Few were publications also referred to non-formal education organized by employees of botanical gardens, urban parks or youth centres (March 2012; Albach 2014; Heikkinen, Maliniemi 2015; Pombo et al. 2017, 2018). It does not mean, however, that education using geocaching is less suitable for non-formal education. It probably means that non-formal educators are less willing to publish their experience than formal educators. Basically, in order to run such education, one needs to have willingness and conviction to go outdoor with students/recipients of education. In Polish realities – as was mentioned in the first part of the cycle of articles – it quite often meets reluctance from school teachers (Referowska-Chodak 2013), and very often, is realized by non-formal educators, among others, from the State Forests, national and landscape parks, centres for ecological education and non-governmental organizations. In case of education run by centres for ecological education and non-governmental organizations, there is no collective information on the number and age structure of participants. In case of landscape parks, such collective information is not published. In 2003, researches were conducted in 21 parks, from which resulted that 80,000 persons benefited from the education run by employees of parks (while field classes covered around 20,000 persons). Mainly they were pupils of primary schools, gymnasia, technical high-school and high-schools (Sikora-Stachurska 2007). If these data were to be interpolated to all current landscape parks (123), it would have been around 469,000 participants of education. It should be remembered, however, that changes in law and organization that occurred in 2008, caused reduction in the number of park employees (Kistowski 2012), therefore, also the possibilities of running educational classes. In case of education run in national parks, the available data are not unified. On one hand, information is published on the number of visitors of museums and educational centres – slightly over 1 million people in 2018 (Environment Protection/Ochrona Środowiska 2019); on the other hand – information on the number of didactic events – 5,277 in 2018 (Environment Protection/Ochrona Środowiska 2019), without providing the number of their participants. The age structure of education recipients is also unknown. Among non-formal educators, the State Forests offer the most complete data. In 2017, on 2,337,597 participants of education run by foresters, 18.52% were pre-schoolchildren aged 3–6 years, 31.40% – kids from primary schools (7–12 years old), 11.97% – gymnasium youth (13–15 years old), 6.82% – over-gymnasium youth (16–19 years old) and 31.28% – students and adults (over 19 years old) (Mrowińska 2018). However, in the cited year, on field classes and trips with a guide, the most numerous group was students and adults (42.37%), then children from primary schools (28.06%) and kindergartens (16.47%), and the least numerous – over-gymnasium youth (4.02%) and gymnasium youth (9.07%) (Mrowińska 2018). Due to the fact that the oldest age group is not divided into students and other adult persons, it creates a sort of a problem in reference to the presented results, in which students are important recipients of educational geocaching. Presented statistics of education in the State Forests allow to make two observations. First one is quite a large share of kindergarten groups, which – in case of education using geocaching – were quite rarely mentioned and it referred mainly to 6-year old children, so the oldest ones. It results from the ability to understand the course of classes or to operate the equipment needed for tracking caches. Mentioned were however (in the results) families with children, but in this case, equipment managing can be realized by the adults. It seems, therefore, that in terms of this age group (especially youngest children) current educational model should be realized. Second observation concerns gymnasium and over-gymnasium groups, which relatively rarely use education run by foresters from the State Forests, while in case of educational geocaching (outside Poland) are most frequently indicated as its participants. Situation in Poland (in the State Forests) may result from overload of the curriculum on higher levels of education and difficulties with finding time for going out with students and reaching foresters. On the other hand, it is also quite 'difficult' group (in comparison to pre-schoolers) usually living in its own virtual world, group that is hard to get connection with (Referowska-Chodak 2013). That is why especially for those age groups, geocaching seems to be a great solution, for instance during residential school trips. It finds confirmation also in the observations from other countries: way of people's learning evolved in the last decades very intensively (Hamm 2010). This entails a need for searching new ways of forming level of knowledge, awareness and skills, especially among younger recipients of education. It should be noticed, that modern students are no longer so engaged and motivated by traditional model of learning as previous generations (Prensky 2006 after: Mayben 2010). In their case on motivation for

learning and its results influences positively the use of modern technologies (Hsieh et al. 2008 after: Mayben 2010). Lessons are considered to be less boring then (Deaney et al. 2003 and Downes, Bishop 2009 after: Mayben 2010). It is also thought that 'technological gadgets' like smartphones, used in educational geocaching, become modern connector between young people and the nature (Hartl 2006 after: Zecha 2012).

Second practical aspect of education using geocaching, discussed in this article is a location. Presented in the results, foreign experience focus foremost on anthropogenic places. These are school/university grounds and urban areas, including parks (that could also be widely used in formal education in Poland). It results from the aforementioned fact that the authors of majority of publications are school or academic teachers, who usually tried to run classes 'nearby', and not wasting time for distant trips (Shaunessy, Page 2006 after: Mayben 2010). It is particularly frequent with so called instructional geocaching, where the transferred content does not have to be connected with the place of hiding the cache (for instance Christie 2007; Mayben 2010). It can be an idea for similar classes in Poland, for instance, in the surrounding of headquarter of forest inspectorates or national park objects, when time of classes is limited and does not allow for travelling a longer route. However in standard geocaching, caches are localized in special places, which are attractive in terms of history, culture or nature (Schneider, Jadczaková 2016). Among the last ones, the authors list areas of protected nature, places by watercourse/reservoirs, geological objects, but also forest areas, although in case of the last ones they are often considered as a place of touristic geocaching rather than educational (Ihamäki 2015a). It seems, however, that in Poland, educational geocaching in forests has much bigger chances and possibilities of coming into being. This is due to the fact that the Polish forests are in great measure under management of the State Forests National Forest Holding, whereas some of them are within boundaries of landscape parks. Part of the remaining forests are within boundaries of national parks. Noticed should be, however, that within duties of both employees of the State Forests (Ordinance/Zarządzenie 2003), national parks and landscape parks (Act/Ustawa 2004 – art. 103.2.2 and 107.2.6) is realization of education of society. Written in the directions of development of forest education in the State Forests assignment of 'evaluation of educational experiments and their implementation into practice' (Ordinance/Zarządzenie 2003 – attachment 1) may be a basis for implementing educational geocaching by foresters.

Already now the Polish forests are recognized (and used) for their educational value – this purpose serve, among others, developed and realized programs of ecological or forest education in national and landscape parks, in the State Forests, but also in urban forests. For inclusion of the earlier mentioned values, being expanded is field educational infrastructure, for instance didactic trails (Mrowińska 2018; Environment Protection/Ochrona Środowiska 2019). Collected experience and prepared trails may be adapted and used for running education with the use of geocaching. Closeness of big, busy road is considered to be a not very attractive place of hiding the caches (Schneider, Jadczaková 2016). That is why, in the Polish forests, it is worth using for this purpose numerous, and at the same time much more intimate, didactic trails, tourist routes or other elements of infrastructure mentioned before. Such a solution may limit the problem of loss in animate and inanimate nature, connected with visiting distant caches, which in first article was considered as a problem of education using geocaching (Patubo 2010 after: Zecha 2012; Zecha 2012).

Additional educational advantage of the Polish forests is the number and variety of forms of nature protection. Object (and subject) of education run by foresters in the State Forests are 700 nature reserves (Mrowińska 2018), but also numerous ecological sites, natural monuments or areas of Natura 2000 protection. Employees of national and landscape parks also run education according to form and regime of nature protection being a subject matter and their place of work. Placing caches within boundaries of protected areas or generally in forests requires, however, obeying applicable restrictions (Act/Ustawa 1991, Act/Ustawa 2004). In national parks and nature reserves, it is forbidden to step off the trail (Act/Ustawa 2004 – art. 15.1.15). It is recommended to clearly mark, that to geocachers apply terms of use protected areas as it does to other tourists (Schneider, Jadczaková 2016).

Third practical educational aspect of geocaching is the thematic scope of classes. As can be noticed on the basis of review of foreign experience, it is very wide. It provides even an opportunity to realize every content of the curriculum, although especially often mentioned are: geography, mathematics, biology/natural history, history, culture, ecological education, modern technologies/equipment (especially GPS), linguistics and physical education. Presented in the results, the scope of education realized abroad is consistent with the scope of formal education in Poland (among others, Regulation/Rozporządzenie 2017, 2018b). It is an argument for implementing educational geocaching also in our country, within formal education (school education), but also non-formal education, including forest education. Theoretically, the content of forest education run in the State Forests include structure and functioning of forest ecosystems, meaning of forest (ecological, economic and social), threats and protection of forests, nature protection and challenges for foresters and forestry (Ordinance/Zarządzenie 2003 – att. 2), that is a narrower range than the potential one. However, it should be emphasized that in the directions of forest education development written was the sentence 'per-

fecting educational program in cooperation with educational institution for providing consistency of school and educational programs' (Ordinance/Zarządzenie 2003 – att. 1). It allows for including in the classes run by foresters also those subjects that are not directly mentioned in the basic scope of forest education. Additionally, in the same document, a statement was included of a need to 'create programs developing interdisciplinary approach to forest environment and economy in forests, combining knowledge and skills from many fields of science and practice'. This is a part of the concept of integrated education, described already in 2003 by forester-educator Andrzej Antczak in the context of building educational trails. According to him, classes on the trail, beside raising environmental and forest-economy related issues, may introduce topics from 'geography, literature, history, chemistry, mathematics or art, e.g., plastics (…) and music' (Antczak 2003). It should be emphasized that forests in Poland are especially complex and valuable environment for teaching, rich not only in terms of nature but also in terms of history and culture. They allow, therefore, for running interdisciplinary classes, including – prospectively – also classes using geocaching. This situation refers to not only the forests under management of the State Forests (including landscape parks), but also the forests within the borders of national parks and urban forests where society's education is being run. In case of education run by employees of landscape parks, the need for promoting not only nature content, but also historic and culture value of the park is pointed out (Act/Ustawa 2004 – art. 107.2.6). In case of national parks, only education in terms of nature protection is mentioned (Act/Ustawa 2004 – art. 103.1.2); however, due to the fact that park is being created due to cultural values of given area (Act/Ustawa 2004 – art. 8.1), in practice, those values (also historical) are also promoted (Andrzejewska et al. 2013).

To sum up, international experience concerning recipients of educational geocaching indicate on one hand on certain limits in its use in the youngest age groups, but on the other hand – on its high usefulness in education of remaining age groups, especially school and students. Among the listed locations of education, dominant were anthropogenic ones. However, in Poland, at widely developed non-formal education, added to them can be numerous natural objects (for instance, forest areas), which are already used as places of field education. They allow for running multidisciplinary education that falls within the wide scope of content proposed by the authors of foreign publications for realizing when using geocaching.

Conflict of interest

The author declares lack of potential conflicts.

Acknowledgements and source of funding

Own research within statutory activity.

Bibliography

Adanali R., Alim M. 2017. The views of preservice teachers for problem based learning model supported by geocaching in environmental education. *Review of International Geographical Education Online* 7(3): 264–292.

Alabau Subich A. 2014. El Geocaching, una eina per al treball competencial en Educació Física i el seu coneixement entre el professorat d'Educació Física al Baix Empordà (Treball Final de Màster). Facultat d'Educació, Traducció i Ciències Humanes Universitat de Vic, Portugalia.

Albach D. 2014. Geocaching as a means to teach botany to the public. *Plant Science Bulletin* 60(2): 1–3.

Andrzejewska A., Bąk B., Lubański A., Kębłowska A., Kamińska M., Markowski M., Morkowski M., Pepłowska-Marczak D., Olszewski A., Okołów G., Otręba A. 2013. Ścieżka dydaktyczna – Skrajem Puszczy. Wyd. Epograf i Kampinoski Park Narodowy, Blizne Łaszczyńskiego, Izabelin, 43. ISBN 978-83-62910-60-1.

Antczak A. 2003. Tworzymy ścieżkę edukacyjną w nadleśnictwie. Poradnik Edukacji Leśnej 4, Centrum Informacyjne Lasów Państwowych, Warszawa, 30 s.

Blanco V.P., Adam F. 2013. Integración de GIS (sistemas de georreferenciación de la información) y localizatión espacial en prácticas pedagógicas y lüdicas vinculadas a museos (Integration of GIS (Geographic information system) and locative tools in pedagogical and ludic practices for museums). *Arte, Individuo y Sociedad* 25(1): 121–134.

Blažek M., Lána M., Blažek V., Dvořák J. 2016. Information technologies in teaching geography from the teacher's point of view, w: P. Karvánková, D. Popjaková, M. Vančura, J. Mládek (red.) Current topics in Czech and Central European geography education. Wyd. Springer, Cham, Szwajcaria, 169–186. ISBN 9783319436135, DOI 10.1007/978-3-319-43614-2_10.

Burri Gram-Hansen L., Burri Gram-Hansen S., Øhrstrøm P. 2013. From geocaching to mobile persuasive learning - Motivating the interest in the life and work of Danish author Kaj Munk. *Lecture Notes in Computer Science* LNCS 8095: 595–596. DOI 10.1007/978-3-642-40814-4_68.

Cardwell M. 2013. Hide and go geocaching: Technology and history intersect for students at CIM's Harricana Branch event. *CIM Magazine* 8(6): 70–71.

Christie A. 2007. Using GPS and geocaching engages, empowers and enlightens middle school teachers and students. *Meridian* 10(1).

Donadelli G. 2017. Outdoor learning and geocaching. *Interaction* 45(2): 45.

Donadelli G., Rocca L. 2014. Teaching and learning with geocaching, w: T. Jekel, E. Sanchez, I. Gryl, C. Juneau-Sion, J. Lyon (red.) Learning and teaching with geomedia. Wyd. Cambridge Scholars Publishing, United Kingdom, 44–58. ISBN 978-1-4438-6213-4.

Dwyer O.J., Mccourt M. 2012. Making memory, making landscapes: Classroom applications of parallel trends in the study of landscape, memory, and learning. *Southeastern Geographer* 52(4): 429–439. DOI 10.1353/sgo.2012.0032.

Etxeberria A.I., Asensio M., Vicent N., Cuenca J.M. 2012. Mobile devices: A tool for tourism and learning at archaeological sites. *International Journal of Web Based Communities* 8(1): 57–62. DOI 10.1504/IJWBC.2012.044682.

Fenech A., Harvey R., Watson E., Sheard N., Stinchcombe E., Short E., Pagett M. 2017. Using technology to play hide and seek. *Occupational Therapy News* 25(11): 24–26.

Freiermuth M.R 2017. 'I Found It!' A smartphone GPS treasure-hunting game in a flipped English class. *Innovation in Language Learning and Teaching* 11(2): 101–108. DOI 10.1080/17501229.2015.1066793.

Grau Martínez S. 2017. La idea del Geocaching como herramienta interdisciplinary (trabajo final de grado en magisterio de primaria). Área de Ciencias Sociales, Universitat Jaume I, Hiszpania.

Größ E.M. 2010. Geocaching in der Schule: Eine Trendsportart im jahrgangsübergreifenden Projekt (Examensarbeit). Wyd. Bachelor + Master Publishing (diplom.de), Hamburg, Niemcy.

Hall J., Bush L. 2013. Incorporating the Game of Geocaching in K-12 Classrooms and Teacher Education Programs, w: J. Keengwe (red.) Pedagogical Applications and Social Effects of Mobile Technology Integration. Wyd. IGI Global, Hershey, USA, 79–97. ISBN 9781466629868.

Hamm B. 2010. Geocaching in education: A literature review (VCT 6010). Bowling Green State University, Bowling Green, Ohio, USA.

Heikkinen J. Maliniemi P. 2015. Geokätköilyn kehittäminen seikkailu-ja pelikasvatukselliseksi menetelmäksi nuorisokeskus ympäristöön. Degree programme in civic activities and youth work, Humak University Of Applied Sciences, Finlandia.

Hubackova S. 2018. Geocaching as unconventional method for foreign language teaching. *Lecture Notes in Computer Science* 11284 LNCS: 87–94. DOI 10.1007/978-3-030-03580-8_10.

Ihamäki P. 2007a. Geocaching at the Institute of Paasikivi – New ways of teaching GPS technology & basics of orientation in local geography. New trends in ICT and accessibility - Proceedings of the 1st International Conference in Information and Communication Technology and Accessibility, ICTA, 155–158.

Ihamäki P. 2007b. Geocaching in primary schools – New ways of teaching GPS technology & basics of orientation in local geography. Interactive Mobile and Computer aided Learning Conference, IMCL, Amman, Jordan.

Ihamäki P. 2014. The potential of treasure hunt games to generate positive emotions in learners: Experiencing local geography and history using GPS devices. *International Journal of Technology Enhanced Learning* 6(1): 5–20.

Ihamäki P. 2015a. User experience of geocaching and its application to tourism and education (doctoral dissertation). *Annales Universitatis Turkuensis ser. B* 404, 249. DOI 10.13140/RG.2.1.3202.3205.

Ihamäki P. 2015b. Design 'the Pori hidden beauties geocaching series': Computer-supported collaborative web-based learning and sharing experiences. *International Journal of Web Based Communities* 11(2): 131–151. DOI 10.1504/IJWBC.2015.068538.

Kisser T. 2016. Mit geocaching auf dem Weg zu einem verbesserten topologischen Raumverständnis. *Kartographische Nachrichten* 1: 14–20.

Kistowski M. 2012. Problemy zarządzania parkami krajobrazowymi w Polsce jako skutek zmian przepisów prawnych w latach 2008–2010. *Problemy Ekologii Krajobrazu* 33: 215–227.

Larsen J., Minner D., Rowe E., Edwards T., Asbell-Clarke J., Bardar E., MacEachern B. 2014. STEMLandia – The Nature's Apprentice Geocaching Adventure Opening the Door for STEM Learning Through Outside Games, w: J. Viteli i M. Leikomaa (red.) Proceedings of EdMedia 2014 - World Conference on Educational Media and Technology. Wyd. Association for the Advancement of Computing in Education (AACE), Tampere, Finlandia, 2198–2202. ISBN 978-1-939797-08-7.

Lazar K.B., Moysey S.M., Brame S., Coulson A.B., Leea C.M., Wagner J.R. 2018. Breaking out of the traditional lecture hall: Geocaching as a tool for experiential learning in large geology service courses. *Journal of Geoscience Education* 66(3): 170–185. DOI 10.1080/10899995.2018.1453191.

Lo B. 2010. GPS and geocaching in education. Wyd. International Society for Technology in Education (ISTE), Washington D.C., USA, 100 s. ISBN 9781564842756.

Majdak P, Świder B. 2016. Geocaching jako nowoczesna forma aktywności krajoznawczej, w: A. Stasiak, J. Śledzińska, B. Włodarczyk (red.) Współczesne oblicza krajoznawstwa. Wydawnictwo PTTK „Kraj", Warszawa, 115–124. ISBN 978-83-7005-595-0.

Maman S., Blumberg D.G. 2015. Remote sensing, space and geo-physics as a scientific education and outreach trigger at Ben-Gurion University. Proceedings of the International Astronautical Congress, IAC 13, 10320–10323.

March K.A. 2012. Backyard botany: Using GPS technology in the science classroom. *American Biology Teacher* 74(3): 172–177. DOI 10.1525/abt.2012.74.3.8.

Mayben R.E. 2010. Instructional geocaching: an analysis of GPS receivers as tools for technology integration into a middle school classroom (doctoral dissertation). Department of Educational Leadership, Policy and Technology Studies in the Graduate School of The University of Alabama, USA.

Mrowińska I. 2018. Raport z działalności edukacyjnej Lasów Państwowych 2017. Centrum Informacyjne Lasów Państwowych, Warszawa, 72 s.

Ochrona Środowiska 2019. Rocznik statystyczny. Wyd. GUS, Warszawa.

Pombo L., Marques M.M., Lucas M., Carlos V., Loureiro M.J., Guerra C. 2017. Moving learning into a smart urban park: Students' perceptions of the Augmented Reality EduPARK mobile game. *Interaction Design and Architecture(s)* 35: 117–134.

Pombo L., Marques M.M., Carlos V., Guerra C., Lucas M., Loureiro M.J. 2018. Augmented reality and mobile learning in a smart urban park: Pupils' perceptions of the EduPARK game. *Smart Innovation, Systems and Technologies* 80: 90–100. DOI 10.1007/978-3-319-61322-2_9.

Ramirez Davies E.A. 2015. GPS GeoCaching Y Gramática? (Condiconales en Inglés). Experiencia del uso del GPS para

fines educativos en el Colegio Montessori-Medellín. Colegio Montessori-Medellín, Antioquia, Kolumbia.

Referowska-Chodak E. 2013. Znaczenie edukacji leśnej w plenerze. *Studia i Materiały CEPL w Rogowie* 34: 11–21.

Referowska-Chodak E. 2020. Geocaching w edukacji – przegląd międzynarodowych doświadczeń. Część 1. Wprowadzenie: zalety i problemy. *Leśne Prace Badawcze* 81(1): 29–42. DOI 10.2478/frp-2020-0004.

Ring H. 2014. Geocaching för att nå lärandemålen inom So-ämnen (Examensarbete). Institutionen för sociologi och arbetsvetenskap, Göteborgs Universitet, Szwecja.

Rozporządzenie 2017. Rozporządzenie Ministra Edukacji Narodowej z dnia 14 lutego 2017 r. w sprawie podstawy programowej wychowania przedszkolnego oraz podstawy programowej kształcenia ogólnego dla szkoły podstawowej, w tym dla uczniów z niepełnosprawnością intelektualną w stopniu umiarkowanym lub znacznym, kształcenia ogólnego dla branżowej szkoły I stopnia, kształcenia ogólnego dla szkoły specjalnej przysposabiającej do pracy oraz kształcenia ogólnego dla szkoły policealnej. Dz.U. nr 2017.0.356 z późn. zm.

Rozporządzenie 2018a. Rozporządzenie Ministra Nauki i Szkolnictwa Wyższego z dnia 20 września 2018 r. w sprawie dziedzin nauki i dyscyplin naukowych oraz dyscyplin artystycznych. Dz.U. nr 2018.0. 1818.

Rozporządzenie 2018b. Rozporządzenie Ministra Edukacji Narodowej z dnia 30 stycznia 2018 r. w sprawie podstawy programowej kształcenia ogólnego dla liceum ogólnokształcącego, technikum oraz branżowej szkoły II stopnia. Dz.U. 2018.0.467.

Samołyk M. 2013. Geocaching – nowa forma turystyki kulturowej. *Turystyka Kulturowa* 11: 17–29.

Schaal S., Lude A. 2015. Using mobile devices in environmental education and education for sustainable development – comparing theory and practice in a nation wide survey. *Sustainability (Switzerland)* 7(8): 10153–10170. DOI 10.3390/su70810153.

Schneider J., Jadczaková V. 2016. Mutual Impacts of Geocaching and Natural Environment. *Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis* 64(5): 1739–1748. DOI 10.11118/actaun201664051739.

Sherman E. 2004. Geocaching – hike and seek with your GPS. Wyd. APress Media LLC, Berkeley, CA, USA, 224 s. ISBN 978-1-59059-122-2.

Sikora-Stachurska A. 2007. Uwarunkowania stopnia realizacji funkcji społecznych w parkach krajobrazowych (rozprawa doktorska). Katedra Ochrony Lasu i Ekologii SGGW, Warszawa.

Ustawa 1991. Ustawa z dnia 28 września 1991 r. o lasach. Dz.U. nr 1991.101.444 z późn. zm.

Ustawa 2004. Ustawa z dnia 16 kwietnia 2004 r. o ochronie przyrody. Dz.U. nr 2004.92.880 z późn. zm.

Vitale J.L., McCabe M., Tedesco S., Wideman-Johnston T. 2012. Cache me if you can: Reflections on geocaching from junior/intermediate teacher candidates. *International Journal of Technology and Inclusive Education (IJTIE)* 1(1): 2–8. DOI 10.20533/ijtie.2047.0533.2012.0001.

White-Taylor J., Donellon P. 2008. Geocaching in education, w: K. McFerrin, R. Weber, R. Carlsen i D. Willis (red.) Proceedings of SITE 2008 International Conference. Wyd. AACE, Chesapeake, USA, 5340–5342.

Zarządzenie 2003. Zarządzenie nr 57 Dyrektora Generalnego Lasów Państwowych z dnia 9 maja 2003 roku w sprawie wytycznych prowadzenia edukacji leśnej społeczeństwa w Lasach Państwowych. Znak: ZO-733-6/03. Załącznik 1: Kierunki rozwoju edukacji leśnej społeczeństwa w Lasach Państwowych; Załącznik 2: Wytyczne do tworzenia „Programu edukacji leśnej społeczeństwa w nadleśnictwie".

Zecha S. 2012. Geocaching, a tool to support environmental education!? – An explorative study. *Educational Research eJournal* 1(2): 177–188. DOI 10.5838/erej.2012.12.06.

Zecha S. 2016. ¿ Cómo crear una ruta educativa GPS?, w: R. Alcaraz, E.M. Tonda Monllor (red.) La investigación e innovación en la enseñanza de la geografía. Wyd. Universidad de Alicante, Hiszpania, 915–921. ISBN 978-84-16724-07-9, DOI 10.14198/GeoAlicante2015.67

Zemko M., Vitézová Z., Jakab I. 2016. Geocaching as a means for modernization of educational process. Proceedings of the European Conference on e-Learning, ECEL 2016-January: 709–717.

Strony internetowe

http://en.wikipedia.org/wiki/K-12 – strona internetowa angielskiej Wikipedii opisująca system edukacji w USA, do którego podobne są systemy m.in. w Kanadzie, Australii, Indiach i Turcji [06.03.2019].

http://scholar.google.pl – serwis przeglądarki internetowej Google, gromadzący publikacje naukowe [05.03.2019].

http://sodmidn.kielce.eu/node/1028 – strona internetowa Samorządowego Ośrodka Doradztwa Metodycznego i Doskonalenia Nauczycieli w Kielcach [05.04.2019].

www.pcen.pl/aktualnosci-pcen/aktualnosci-rzeszow/item/402-zapraszamy-na-bezplatne-szkolenie-geocaching-czyli-nauka-poprzez-zabawe.html – strona internetowa Podkarpackiego Centrum Edukacji Nauczycieli w Rzeszowie z ofertą szkolenia o geocachingu [04.04.2019].

www.scopus.com – internetowa baza danych publikacji naukowych, prowadzona przez wydawnictwo Elsevier [04.03.2019].

Translated by: Anna Wyszyńska