TEACHERS' OPINIONS ON USING PHOTOGRAPHS TO STUDY NATURAL SCIENCES

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Abstract

This research aimed at investigating, within a focus group, the primary grades teachers' opinions concerning the use of photographs in Natural Sciences lessons. We asked teachers to answer nine questions on: the contents of the used photographs, their sources, the circumstances/reasons they took into account when selecting the photographs, the lesson stages when they used them, the used methods, the context in which they had got information about the manner in which photographs should have been used, the pupils' interest in using photographs during learning activities in Natural Sciences, which are the disadvantages/risks for pupils if photographs were not used, and on the challenges the teachers had to cope with when using photographs during Natural Sciences lessons. At the end of our study, we noticed the diversity of the topics and lesson stages when photographs had been used, teachers' preference for the Internet as a source of photographs although Internet connection in school was poor, and that teachers appreciated photographs as significant for pupils' motivation, to focus their attention, enabling perception and understanding of natural and human induced processes, to form their representations and enable knowledge retention in pupils' memory, to develop thinking, language, imagination, and creativity. They pointed out that in the absence of photographs for learning Natural Sciences, pupils would run the risk of not understanding or less understand the topics, and of making misleading representations.

Keywords: *visual learning, perception, observation, environmental education, primary education*

INTRODUCTION

Photographs are frequently used in the pre-university education system in Romania for studying Geography (Lazăr, 2006; Dulamă, 2011a, 2011c, 2013) and Natural Sciences (Dulamă, 2012). Teachers consider that photographs and other visual materials are important in studying *Mathematics and Environmental Exploration* (Dulamă, Osaci-Costache & Ciobanu, 2014; Dulamă & Magdaș, 2014; Magdaș et al., 2017b, 2018) and argue that, by using them, teachers enable their students to perceive nature better (Dulamă, 2010; Deac et al., 2019). Photography is considered a pedagogical and visual, methodological tool through which people fathom their experiences in nature (Socha et al., 2016). Digital photography is used as a tool through which the following are stimulated: interest, curiosity and involvement in environmental education activities (Ardoin et al., 2014).

Using photographs is useful in environmental education (Ilovan et al., 2018b, 2019), forestry education (Dulamă et al., 2016; Dulamă, Ilovan & Magdaş, 2017), in identifying and analysing natural risks (Ciascai, Dulamă & Marchiş, 2007), and in studying Cultural Geography (Ilovan, 2019a, 2019b). Teaching where audio-visual tools are used contributes to students' motivation and stimulation of their interests, to consolidating concepts and enabling them to learn better (Adeyanju, 1997). Goldberg asserts that "photographs have a swifter and more succinct impact than words" (1991, p. 7). By means of photographs one may also contribute to improving students' answers (Ewald & Lightfoot, 2001, p. 119), and the realised experiences with the visual media may determine their cognitive abilities (Messaris, 1994, p. 3). Visual alphabetisation is the basis during the processes of understanding (Sinatra, 1986, p. 4). When pupils work with an image, they try to correlate it with the information taught before and by acting accordingly they develop their critical thinking (Hindal, 2014; Ilovan, 2019a, 2019b).

Photographs have a large share in illustrating digital textbooks for *Mathematics and Environmental Exploration* and these are used in nowadays Romania (Buzilă et al., 2017; Dulamă et al., 2017; Dulamă, Ilovan & Maroşi, 2015; Magdaş et al., 2017a; Ilovan et al., 2018a). The development of the ICT offers teachers and digital native pupils in Romania a fast and easy access to the photographs available on the Internet (Dulamă, Magdaş & Osaci-Costache, 2015) and to other digital products that include photographs (Dulamă et al., 2015; Dulamă, Ilovan & Buş, 2016; Magdaş, Vereş & Dulamă, 2019; Osaci-Costache et al., 2015). They also benefit from electronic devices (smartphone, photo cameras) that enable them to take good quality digital photographs to illustrate geographical studies (Magdaş, Ilovan & Ursu, 2018; Rus et al., 2019). Many pupils are provided with available smartphones in classrooms that they may use to record static and dynamic images (Cappello, 2011). The efficiency of using these photographs in e-learning to *Mathematics and Environmental Exploration* is strengthened by being provided with smartboards (Zoltan, Magdaş & Dulamă, 2019; Magdaş, Zoltan & Dulamă, 2019).

In this context, where there is a diversity of photographs that can be used for learning Natural Sciences and where teachers and pupils can access and study them easily, still, when assisting primary school teachers' lessons, we noticed that there were various ways of using photographs during the didactic process and both teachers and pupils coped with challenges in deciphering the contents of those photographs.

Alenizi (2015) points out that teachers have difficulties in using photographs efficiently. Starting from this issue specific to the Romanian primary education system, the aim of this research is to investigate teachers' opinions concerning the use of photographs during Natural Sciences lessons. To achieve this aim, we organised a focus group with ten primary school teachers and we asked them to answer nine questions. Our previous experience with this method was helpful in organising the activity (Ilovan & Mihalca, 2013, 2014). Questions targeted to identify valuable information on: the contents of the used photographs, their sources, the circumstances/reasons they took into account when selecting the photographs, the lesson stages when they used them, the used methods, the context in which they had got information about the manner in which photographs should have been used, the pupils' interest in using photographs during learning activities in Natural Sciences, which were the disadvantages/risks for pupils if photographs were not used, and on the challenges the teachers had to cope with when using photographs during Natural Sciences lessons.

THEORETICAL BACKGROUND

In dealing with the didactics of geography studies in Romania and the Republic of Moldova, researchers describe the formation of geography-specific competences (Dulamă, 2011a; Osaci-Costache, Dulamă & Ilovan, 2013) and, within these, of the competence to analyse and interpret a photograph (Dulamă & Roşcovan, 2007, pp. 261-266). In order to form pupils' competence to analyse a photograph, during activities, they learn to identify the photograph type, to describe elements according to their location, to identify the environmental components and the relationships among them, so they learn to analyse the contents of a photograph. Concerning the contents of the photograph, pupils should learn to grasp the significance of the photographed objects and phenomena, of their qualitative and quantitative features, to explain relationships (cause-effect, spatial, dynamic and others) among elements, to explain the distribution of objects and phenomena on the Earth, contrasts, thresholds and limits.

To explain all this, pupils must make suppositions, phrase hypotheses, search for proof through which those hypotheses are confirmed or infirmed, make judgements, and draw conclusions. In order to form the competence to analyse and interpret a photograph, several methods are proposed: scientific description (Dulamă, 1996, 2001, 2008a, 2008b), heuristic conversation, and the case study (Dulamă, 2011). Other researchers give details on a series of learning activities where a

photograph is used and explain the employment of various teaching methods (the observation, the literary description, the scientific description, the exercise, the quadrants, learning through cooperation, the cube, and the individual study) to enable the analysis and interpretation process of the respective photograph contents (Mateiu (Cotoi), Ciurean & Ciurean, 2014; Costantea & Dulamă, 2015).

Triacca (2017), who explored the use of photographs for primary school, considered that they are relevant in the teaching and learning process. This researcher identified two scenarios of employing photoghraphs in the education system: one starting from the photograph to the lesson or the activity and another one where the start is represented by the lesson plan and images are inserted with the aim to clarify and stimulate the learners' interest. She identifies four educational stages in teaching with images: identifying objectives, choosing or more images according to their legibility and relevance, unfolding the activity, and debriefing. She mentions that pupils should have the best possible conditions to access images, to look at them from a close or long distance, to zoom in, to manipulate them enough time to decipher them.

METHOD

Procedure. Data collection was achieved within a focus group organised in December 2019, where we invited ten primary school teachers. The activity was led by a primary school teacher. After asking each question, participants were offered time to answer. Teachers were asked to answer sincerely and completely to these questions in order to grasp as correct as possible a representation of the investigated topic. All teachers answered all questions. To ensure the correctness in collecting data, participants wrote their answers on sheets of paper. If during listening to the others' answers some of them remembered other aspects not mentioned yet on the answer sheet, they were asked to fill in their answers. Confidentiality of answers was ensured during data processing.

Teachers' perceptions, convictions and cognitions, how they thought about using photographs in Natural Sciences lessons underwent a phenomenological analysis in order to identify the in-depth meanings of their experience. Answers were processed through thematic and contents analysis and thus we grouped them in different categories, and we employed certain statistical processing.

Participants. Ten teachers from the urban area (four) and rural area (six) took part within the focus group. All teachers were women and were distributed in a balanced manner into three age categories, between 25 and 65 years old (three were between 25 and 40 years old, four were between 40 and 54 years old, and three were in the category of 55 years old or over). Five teachers had less than 30 years experience within the educational system (one teacher – between 6 and 10 years, one between 11 and 15 years, two between 16 and 20 years, and one between 26 and

30 years old), and the other five had over 30 years experience. These teachers worked with various classes: preparatory class (two teachers), 1st grade (two teachers), 2nd grade (one teacher), 3rd grade (two teachers), and 4th grade (three teachers). The fact that participants fell into different age categories and of experience within the education system, that they came from both urban and rural areas, and worked with pupils from all primary levels of study enabled us to grasp rich and relevant information about using photographs in learning Sciences.

The research material is represented by focus group participants' answers.

RESULTS AND DISCUSSIONS

In this part, we present and discuss teachers' answers grouped in the following sections: contents of the photographs; sources of photographs; criteria for selecting photographs; lesson stages when photographs are used; teaching methods associated to photographs; importance for pupils of using photographs during learning activities in Sciences lessons; disadvantages and risks for pupils when not using photographs during learning activities in Natural Sciences; teachers' challenges when using photographs during Natural Sciences lessons.

Contents of the photographs

Participants were asked to specify what kind of photographs they used in Natural Sciences lessons, including *Mathematics and Environmental Exploration* (MEE). All participants asserted that during Sciences activities they used photographs with animals and plants. Referring to the animals, some of them mentioned two categories (domestic and wild), and they associated plants with landforms (field, hill, mountain) or with their use (medicinal plants). Five participants used photographs to illustrate natural phenomena and processes (aggregation states of water, in two cases; and the water cycle in nature in three cases). Teachers used photographs to enable their pupils' learning about the solar system (four cases), about the outer space (three), and about the planets (two).

They were concerned with offering their pupils visual representations of several clippings where natural components prevailed, such as landforms (two cases), living environments (forests, parks, swamps) (four cases), natural resources, soil (two cases), but also photographs with man's activities and interventions in nature (three cases), with activities of the people concerning pollution or environmental protection, photographs that reflect the economy of an area or of a place, or human community from different continents or belonging to certain ethnicities.

Teachers were concerned about analysing landscapes with their pupils (two cases), diverse seasons, life cycles (two cases), representative places for home settlement, and anthropic phenomena and processes. Finally, we

underlined the diversity of topics for which the participants used photographs in order to enable their pupils' understanding and grasping adequate representations about the reality.

Sources of photographs

For the question enquiring about the sources of the used photographs during Natural Sciences activities and lessons, teachers presented several sources. All teachers downloaded photographs from the Internet, using especially Google search engine and the option *Images*. They used also photographs from printed sources: magazines (seven), atlases (seven) (botanical, zoological, geographical, miniatlases), school textbooks (six), albums (six), books and posters (three), curricular auxiliaries (three), encyclopaedias (three), and almanacs. Three participants emphasized that they used personal photographs taken by themselves, and three used copyright photographs, probably taken by colleagues and friends.

We underline that the Internet is teachers' main source of photographs nowadays, using less the printed sources that are less accessible, more expensive, where much time is needed to find the appropriate photographs for a certain lesson and they are less visible for all pupils in a classroom because of their small size in the printed source.

Criteria for selecting photographs

Participants were asked about the reasons they took into account when choosing photographs for a lesson of Natural Sciences. In Table 1, we present the categories of criteria and the criteria we established after a thematic analysis of the teachers' answers. When selecting photographs we focused on the features of the photographs themselves (contents, form, colour, organization/structure of the elements - i.e. existence of one dominant element or of a composition –, quality, clarity, details, message, accuracy, dimension, plans of the photograph, conformity with reality), the features of the pupil (learning style, needs, learning rhythm, interests, and age specificities), features of the lesson (objective, subject /topic, available time for using/ analysing the photograph, lesson contents and type) and the (resulted) visual effects after their use (understanding of the introduced subject, identifying the object/process/phenomenon of nature, making generalisations, deducting the relationships among the photograph elements, identifying the structure of the photograph elements, information systematisation, identifying groups of elements, identifying details). The researcher Triacca (2017) noticed that photographs are selected according to their legibility and relevance.

We were surprised that teachers selected photographs also considering the progress to be obtained by their pupils as a result of using photographs in Sciences lessons.

Table 1. Criteria for photographs selection

Categories of criteria	Criteria	No. of options
Features of the photographs	Contents (objects/processes of nature)	7
	Form	6
	Colour	5
	Organization/structure of the elements (i.e. existence of one dominant element or of a composition)	4
	Quality	3
	Clarity	3
	Details	3
	Message	2
	Accuracy	1
	Dimension	1
	Plans of the photograph	1
	Conformity with reality	1
Features of the pupil	Learning style	6
	Needs	3
	Learning rhythm	2
	Interests	1
	Age specificities	1
Features of the lesson	Objectives	10
	Subject/topic	8
	Available time to use/analyse the photograph	7
	Lesson contents	5
	Lesson type	2
(Resulted) Visual effects	Understanding of the presented subject	3
	Identifying the object/process/phenomena of nature	3
	Making generalisations	2
	Deducting the relationships among the photograph elements	2
	Identifying the structure of the photograph elements	2
	Information systematisation	1
	Identifying groups of elements	1
	Identifying details	1

Lesson stages when photographs are used

In Table 2, one may notice that teachers used photographs in all Sciences lesson stages. All teachers argued that they used photographs during assessment; half of them used them in teaching and conveying knowledge and only one mentioned to have used them during pupils' knowledge achievement process. Four teachers used photographs in order to systematise knowledge. Teachers associated the use of knowledge with the events of instruction established by Gagné (1968), mentioned in Table 2.

We notice that teachers used photographs mostly to get pupils' attention and when introducing the lesson topic to their pupils, as well as during warm-up. Few teachers used photographs as an educational means aiming to increase the efficiency of cognitive processes while guiding learning, in gaining performance and feedback.

In specialty literature, photographs are recommended to ensure the perception of certain processes and phenomena that take place in reality, of objects and assemblies extant in reality and that are not visible directly (Dulamă, 2001, 2008). Therefore, photographs are very relevant when used during the moment of knowledge achievement and they are an essential resource when guiding learning.

Table 2. Using photographs according to the stages of a Sciences lesson and instruction events

Lesson stages	No. of options	Instruction events	No. of options
Assessing/verifying knowledge/tests	10	Getting pupils' attention	7
Teaching contents/ conveying knowledge	5	Lead-in/Contextualization	1
Consolidating/Retention	4	Introducing pupils in the lesson topic/ warm-up	5
Systematization	2	Directing learning	2
In any lesson stage	2	Gaining performance	2
Achieving knowledge	1	Feedback	2

Teaching methods associated to photographs

Teachers listed eight methods that they categorised as traditional (conversation, problematization, observation, experiment, explanation, description, modelling, and brainstorming) and other eight that they considered usually modern (the Venn chart, I know/I want to know/I've learnt, the quadrants, the cube, the stars explosion, the cluster, the gallery tour, the coat of arms, and the conceptual matrix) (Table 3) or activating (Dulamă, 2008b).

We notice the variety of methods that teachers used and the balanced use of traditional and 'modern' methods. The fact that all teachers mentioned that they used analysis when working with photographs showed their concern for developing their pupils' observation spirit and analytical thinking. We noticed the large proportion of using heuristic conversation, problematisation and explanation because through these methods teachers enabled pupils' understanding of the contents represented in photographs, their understanding of the represented phenomena and processes. Two teachers mentioned that they used photographs in realising syntheses, and one used them as support for argumentation.

Table 3. Methods for using photographs in Sciences lessons

Traditional methods	No. of options	Modern methods	No. of options
Conversation	10	Venn chart	8
Problematization	9	I know/I want to know/I've learnt	8
Observation	9	The quadrants	6
Experiment	7	The cube	6
Explanation	6	The stars explosion	5
Description	4	The cluster	5
Modelling	2	The gallery tour	5
Brainstorming	1	The coat of arms	4
		The conceptual matrix	1
Total	**48**		**48**
Mean value	**6**		**6**

Pupils' acknowledgement of using photographs during learning activities in Sciences lessons

Three teachers underlined that photographs were attractive for their pupils, while other three emphasised their role in practising visual learning. In Table 4, we notice that teachers considered that using photographs during learning activities in Sciences is important for pupils due to the following reasons: it motivated them to boost their knowledge; it focused their attention; it enabled their perception and grasping representations of objects, of natural phenomena and of certain aspects of reality; it enabled pupils' understanding of natural processes, of human activities, of the impact of man's activities on nature; it raised awareness about natural disasters or those caused by human intervention; it developed critical and reflexive thinking; it trained pupils' cognitive structures; it exercised thinking operations (making comparisons, categorizing); it developed scientific thinking, language, imagination and creativity; it enabled

memorising information (easiness in retaining information and higher amount of knowledge).

Table 4. Importance for pupils to use photographs during learning activities in Sciences lessons

Categories of influenced cognitive processes	Influenced cognitive processes	No. of options
Motivation for knowledge	Stimulating curiosity	3
	Stimulating/increasing interest	7
Focusing attention	Increasing attention	2
Enabling perception and forming representations	Observing natural elements	3
	Observing natural processes/phenomena	3
	Observing landscapes	2
	Forming representations	4
Enabling understanding	Correctness of understanding	2
	Depth of understanding	3
Connecting theory & practice	Turning theoretical knowledge into practice	7
Developing thinking	Critical thinking	5
	Reflexive thinking	1
	Logical thinking	3
	Training pupils' cognitive structures	1
	Exercising thinking operations (comparison, categorization)	3
Developing language	Using language	4
	Correctness of language	2
Developing scientific thinking	Phrasing hypotheses	4
	Identifying the relationships between the natural and human-made environment	4
	Identifying spatial, visual, and temporal relationships	6
	Drawing conclusions	5
	Identifying transdisciplinary connexions	1
Developing imagination and creativity	Developing imagination	4
	Developing creativity	1
Memorising knowledge	Easiness of learning information	4
	High level of knowledge	3
	Retaining certain objects into the "visual" memory	2

Disadvantages and risks for pupils when not using photographs during learning activities in Natural Sciences

One first aspect noticed by two teachers was the fact that the lesson would be less attractive. In the absence of illustrating certain natural objects, processes and phenomena, teachers asserted that pupils would not notice, understand or they would understand with some difficulty the cause-effect relationship visible within the natural environment or in an anthropic environment; the same would be true for the impact of natural phenomena.

All teachers argue and were convinced that in the absence of appropriate photographs pupils would hardly grasp their representations of the environment and reality (two teachers) and that they ran the risk of delivering wrong representations and concepts. In the absence of at least several photographs, pupils would run the risk of losing contact with reality (two teachers). Five teachers also argued that visual memory is trained less in the absence of photographs, and three considered that there was a danger of stimulating mechanical memorisation.

Ways of forming teachers' competence to use photographs in Natural Sciences activities and lessons

All teachers argued that they had learnt to use photographs through individual study of some books and only three said that they have studied certain papers in specific journals. In the top of the studied books, there were the didactics books (for their Didactics of Sciences and Didactics of Geography), including teaching books. Seven teachers pointed out as sources specialty literature; one referred to pedagogy literature and another one to the textbooks. Four teachers pointed out the Internet as source of their information about using photographs in their teaching activity. One teacher mentioned the models available on the website *Didactic.ro*, and another one the available lesson plans online.

Six teachers underlined that they had got the necessary information during activities organised by the teaching committees, monthly meeting where all teachers of the primary school were supposed to participate at. Nine participants mentioned semestrial teachers' meetings as a source being attended by primary school teachers from several neighbouring settlements hosting two activities annually.

Concerning the typology of the practical activities that represented working models based on photographs, three teachers mentioned teaching activities in general, one mentioned the demonstrative lessons hosted by the teaching committees and two teachers pointed out the diverse demonstrative activities within the primary school teachers' methodical committees. Two participants of the focus group received information directly from their colleagues.

We highlight the position of the teaching literature, mentioned as the main source for information about the efficient use of photographs with a teaching aim.

Teachers' challenges when using photographs during Natural Sciences lessons

For all participants, the greatest challenge is the lack of Internet access in their schools. Even through in one of the school buildings there is Internet access, the pupils from the classes managed by the focus group guests would have to move to other classrooms which may lead to other challenges. One teacher also points out the low speed of the Internet access in the places where such access is available. Half of the teachers pointed out the lack of audio-video resources (PCs, printers), while two of them only the lack of a printer.

Teachers presented a series of challenges concerning the photographs directly (Table 5): lack of photographs, inappropriate photographs for pupils' age, and inappropriate photographs for subject/topic/lesson contents. Time resources are a challenge for half of the teachers. One teacher underlined the lack of training courses where one could learn how to use photographs in Sciences lessons, and another one challenges in making the steps for analysing and interpreting photographs.

Table 5. Teachers' challenges when using photographs during lessons

Enablers	Challenges	No. of options
Apparatuses	Lack of audio-video materials (PCs, printers)	5
	Lack of printers	2
Internet access	Lack of Internet connection in school	10
	Low speed of the Internet connection	1
Time	Not enough time	5
Photographs	Lack of photographs	8
	Inappropriate photographs for pupils' age	9
	Inappropriate photographs for subject/topic/lesson contents	7
Training programmes	Lack of training courses	1
Own competence level	Difficulty in making the steps for analysing and interpreting photographs	1

CONCLUSIONS

At the end of this study, we noticed the diversity of Natural Sciences topics where teachers used photographs in order to ensure/enable pupils' understanding and grasping appropriate representations. Although the greatest difficulty for all participants, concerning access to photographs, is the lack of Internet access in schools, the Internet was the main source of photographs for these teachers. This was in the disadvantage of printed sources, which were more difficult to access (physically and financially).

These teachers formed their competence to use photographs in Natural Sciences by individual study of reference books (in Didactics), while assisting to and analysing activities organized during the teaching committees and semestrial teachers' meetings. Almost all professors acknowledged the following problems: lack of photographs and the inappropriateness of the existing ones to pupils' age and to the lesson topic.

Teachers select the photographs they use according to a series of features belonging to the respective images (contents, organization of elements, colour, clarity, etc.), to the pupils (needs and interests, style and learning rhythm, age specificities), to the lesson (objectives, subject, contents, available time, lesson type), and according to the targeted effects (understanding, identification, deduction, generalization).

They use photographs in all moments of a lesson and appreciate them as significant for pupils' motivation, focusing their attention, enabling perception and understanding the natural and human induced processes, in grasping their representations and enabling knowledge retention in pupils' memory, for thinking development, language, imagination, and creativity.

Not using photographs during Natural Sciences lessons has the disadvantage that the latter ones are less attractive to pupils and run the risk of not understanding or difficult understanding of certain processes, as well as underlying wrong representations and concepts.

Acknowledgement

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