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# European Journal of Geography

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# CONTENTS

# Editorial

The publication of the *European Journal of Geography (EJG)* is based on the European Association of Geographers' goal to make European Geography a worldwide reference and standard. As a result, the papers published in the EJG, including those on this issue, are focused in promoting the significance of geography as a discipline, in resolving global issues or applying geography, complementing, of course, the fundamental goals of improving the quality of research, learning and teaching of Geography. In other words with the EJG the European Association of Geographers provides a forum for geographers worldwide to communicate on all aspects of research and applications of geography with a European dimension, but not exclusive.

As a result, every issue of the EJG provides a glimpse of the important role Geography can play in helping researchers, academics, professionals as well as decision makers and politicians in resolving a wide spectrum of problems. In other words, EJG following Geography which connects the physical, human and technological sciences is aiming at enhancing teaching, research, and of interest to decision makers, problem solving. That is, in every issue of the journal a reader can find answers of how aspects of these sciences are interconnected and are forming spatial patterns and processes that impact on global issues and thus effecting present and future generations.

The goal of the editorial team, which up to now has been achieved to a great extent, is that the papers of the EJG by dealing with places, people and cultures, will explore those issues ranging from physical, urban and rural environments and their evolution to climate, pollution, development and political-economy. Thus, your contributions to the EJG are not only desirable, but necessary for Geography and Science as a whole.

Kostis C. Koutsopoulos
Editor EJG

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# EARTH OBSERVATION USING THE ISS IN CLASSROOMS: FROM E-LEARNING TO M-LEARNING

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## Abstract

Since April 2014, four video cameras are observing the Earth from the International Space Station (ISS) as part of the High Definition Earth Viewing (HDEV) experiment. In cooperation with NASA, the project 'Columbus Eye – Live-Imagery from the ISS in Schools' has published a learning portal for ISS earth observation (EO) including a large educational portfolio (http://columbuseye.uni-bonn.de/). As there is an undoubtedly wide-spread use of remote sensing techniques and image processing analyses for scientific and societal purposes such as weather forecasting, ecological monitoring, or disaster management, the need to understand the underlying processes and techniques is clearly recognizable. Nevertheless, the application of EO-products in everyday school lessons is sparse and mostly relying on static satellite images. The project Columbus Eye, therefore, aims at the sustainable integration of earth observation in schools. One of its key success factors is the e-learning environment, as it is combining computer-based and traditional learning methodologies. This paper introduces

the interactive learning materials for different educational levels such as the Columbus Eye Observatory providing insights in natural and man-made phenomena. The Observatory provides an interactive tool that allows pupils to develop a land-use map on their own. Moving on to more complex learning modules, e.g. the teaching unit “Calculating the Mean from the ISS” shows how curricular maths topics and earth observation can be combined. Finally, it will be explained how the project’s paradigm takes the next step towards smartphone-supported m-learning. Augmented reality (AR) is used to address hurricane movements and pressure characteristics in a mobile app. In doing so, the astronaut’s perspective becomes a tangible experience in regular school lessons.

***Keywords****: ISS, Education, Earth Observation, Augmented Reality, HDEV Experiment.*

## 1. INTRODUCTION: EDUCATION AND THE ISS

How can we awaken the pupils’ interest in natural sciences? There is no simple answer to this question; we need a mixture of stimulating their spirit of research, evoke fascination for science and provide tools that enable to access new fields of knowledge. With regard to these aspects, space and manned spaceflight can create an inspiring atmosphere in being part of the pupil’s dreams and reality at the same time. Our Blue Planet, seen from above, reveals the interconnection between humans and the environment, action and reaction, leading to a deeper understanding of coupled human-environment systems (Voß et al. 2010, Ortwein et al. 2016): "Man must rise above the Earth – to the top of the atmosphere and beyond – for only thus will he fully understand the world in which he lives" (Socrates). Therefore, the mission of the scientific project ‘Columbus Eye – Live-Imagery from ISS in Schools’ is to integrate Earth observation in schools sustainably in order to provide pupils with decision-making competence and responsibility and, simultaneously, with scientific knowledge of remote sensing techniques. To achieve this, fascinating videos of the Earth are used, providing teachers and pupils with free, accessible, easy-to-use software and learning environments based on ISS imagery generated by the HDEV experiment (Rienow et al. 2015a).

## 2. HDEV EXPERIMENT OF NASA

The ISS Columbus External Facility holds four commercial off-the-shelf cameras as payload since April 2014. Two cameras placed in the aft, one in forward and one in nadir view are monitoring the Earth from the ISS continuously and in sequence. In nadir view, the spatial resolution is approx. 500 m with a spectral resolution of 390 to 750 nm delivered by the CMOS sensor (Runco 2015). Including loss of signal and nighttime, the temporal resolution varies from 180 minutes to 3 days. The first part of Table 1 shows the camera specifications.

The general (and changing) conditions of the ISS determine the resolution and angle; moving in about 400 km height with flexible altitude and yaw. Reaching similar exposure once every 90 days, the ISS holds unique features for Earth observation cameras (Rienow et al. 2014). Connected through integrated avionics for commanding and data handling, the cameras can be operated externally via a TReK workstation, one switched on at a time. Although the power cycle can be influenced, zoom, lens, and light sensitivity remain pre-set. The videos are streamed down to Earth using a tracking and data relay satellite (TDRS) system, neither processed nor filed on the devices themselves (Runco 2015).

**Table 1.** Specifications of the HDEV ISS cameras and application in school lessons.

| | **Hitachi©** | **Panasonic©** | **Sony©** | **Toshiba©** |
|---|---|---|---|---|
| **Specifications** |  |  |  |  |
| | HD, COTS, static zoom and lens, non-adaptive light sensitivity | | | |
| **View** | forward | aft | aft | nadir |
| **Exemplary Topic** | typhoon formation | image correction | | scattering light |
| **Learning Unit** | The Eye of the Cyclone | Beyond Average – Calculating the Mean | | Scattering and Colours in the Atmosphere |
| **Type** | augmented reality | learning module | | observatory |

*Source: NASA, Columbus Eye*

Originally mounted to determine the longevity, use and usefulness of each of the four different CMOS cameras in space, the High Definition Earth View (HDEV) Experiment on board the ISS produces highly valuable videos of the Earth's surface which can be valorized for didactical purposes. Columbus Eye as the exclusive European partner of NASA is in charge of archiving, filing and preparing the HDEV videos for school lessons and to meet the public interest. In order to do so, Columbus Eye is sponsored by the German Aerospace Center (DLR) Space Administration. Currently, the Bonn HDEV archive holds 24 terabytes of data, including all videos since the 23rd of September 2014.

## 3. COLUMBUS EYE – INTRODUCING LIVE IMAGERY FROM THE ISS TO SCHOOLS

How can the interested public participate in manned spaceflight? Let them take the astronauts' view of the Earth! Therefore, Columbus Eye provides a free-to-use live stream of the cameras online, embedded in a news section and background information on the ISS and Alexander Gerst's mission "Blue Dot – Shaping the future" (DLR 2014). The users can follow the path of the ISS in real time and compare the videos from above with topographic map information. Additionally, highlight videos are presented on the web portal, featuring the rising sun or spectacular weather events. In order to create maximum usability, the highlight videos are pre-processed, i.e. to minimize the effects caused by Rayleigh and Mie scattering, and to improve contrast and color intensity values (Rienow et al. 2015b). A map-based search tool allows users to find highlights according to the region, geographic phenomena, and actions on-board the ISS. Geotagging allows for location of the videos along the ISS path. The archive provides maximum flexibility for the use in school lessons; teachers can use these highlight videos to accentuate curricular topics like weather phenomena or forest fires.

Additionally, other user groups are targeted by advertising selected highlights on Facebook. Despite displaying the videos and mission background lucidly, the portal links both sections through multiple learning environments for educational purposes. This approach strengthens (1) natural science education and, subsequently, (2) future scientific workforce as well as (3) public support of (future) space missions (Rienow et al. 2014, 2015b, Ortwein et al. 2016). Accounting for media literacy as one of the major goals of

modern school education, interactive work with videos at hand is the key component of the Columbus Eye Portal. (DGfG 2014)

## 4. FROM E-LEARNING TO M-LEARNING

Computer-aided e-learning is consistently established in educational theory. It is well-examined, how interactive learning environments support the understanding of underlying processes, and improve self-organisation. The concept of e-learning includes virtual classrooms, learning modules using computational facilities, as well as online (search) tools (Voß et al. 2011, Gryl 2012). A new approach to virtual learning environments is the so-called augmented reality (AR), a technique predominantly based on smartphones, which enriches real environments with virtual content. The shift from "E-Learning to M-Learning", i.e. from online to mobile learning environments, takes advantage of the anytime-anywhere availability of mobile devices (Clarke 2008, Korocu & Alkan 2011).

Smartphone applications, so-called "Apps", register to markers like charts, maps or environmental settings and add virtual content to the real time camera image (Dunleavy et al. 2009, Vuforia 2016). Thus, the addition of knowledge to objects used every day does not require an isolated learning environment, the smartphone facilitates merging reality and additional knowledge. Ordinary paper maps can become interactive playgrounds, where ISS videos or ISS astronauts' imagery like cities at night can be discovered in a new dimension. This experience leads to a critical reflection of the object on the one hand and on (educational) smartphone use on the other hand (Clarke et al. 2008, Korucu & Alkan 2011, Vuforia 2016, Ortwein et al. 2016). Technologically speaking, these Apps are meeting the latest technological requirements but are still executable with older Android versions. The apps were developed using Android Developer© extended by Vuforia© and distributed via the Google Play Store© and therefore reach a potential audience of over 85 % of smartphone users worldwide (Statista 2016).

This key concept of intermediality includes the combination and application of different media in order to improve media literacy. Intermediality is combined with an interdisciplinary approach to address curricular topics (Figure 1).

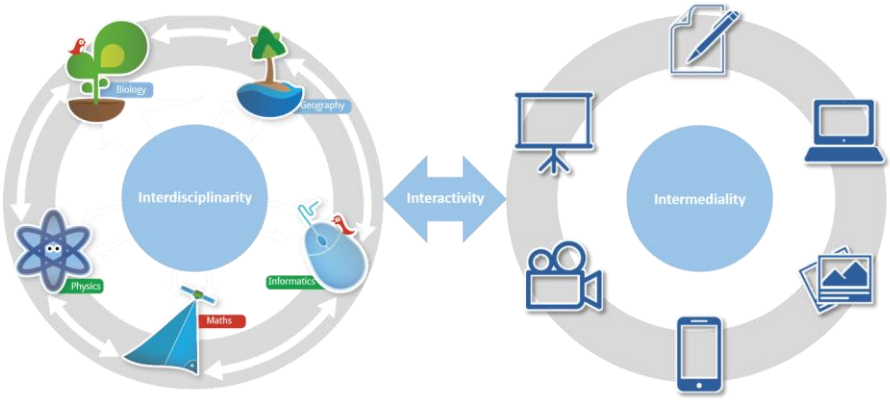


**Figure 1.** Linking interdisciplinarity and intermediality using interactive learning methods.

Questions addressed are: How are images generated? Why are they generated? And for what purpose? Using ISS data, these questions can be addressed in multiple subjects, combining their individual strengths to explain natural, social or even ethical phenomena. As the Earth can be observed from 3 different angles 24/7, the video material is predestined for the use in research-oriented subjects like Physics, as well as in the Social Sciences and

Geography. There are multiple perspectives to do so – not only regarding camera angles, but also regarding teaching and learning material (see Table 1). On the one hand, interdisciplinarity secures a sustainable integration of remote sensing techniques and applications throughout the school career and challenges the pupils' ability to transfer knowledge. Interactive learning environments, on the other hand, couple the methodological approach of intermediality with the content-based interdisciplinary approach. The following section briefly discusses the aforementioned computer-aided learning materials and online tools and presents the recently adopted 3D and m-learning techniques.

### 4.1 E-Learning: Using Computer-based Learning Modules

One key element of the content provided by Columbus Eye is comprehensive teaching units, each focusing on one topic regularly addressed in the curricula of German schools. The computer-based learning modules incorporate a ready-to-use software application suitable for pupils. The modules are designed to be carried out by the pupils themselves, ideally without active instruction by the teacher (Rienow et al. 2015a). Following a problem-centered introduction to the topic, the interactive part can be accessed, where remote sensing techniques are applied to the images in order to extract the information needed to solve the accompanying questions. Wrapping up, a small examination of the most important facts and techniques is conducted in a final quiz section. A teacher's guide is available for every learning module in order to minimize preparation and ease integration into the lessons.

One example is the mathematical learning module "Beyond Average – Calculating the Mean" (see Figure 2). Here, pupils apply mathematical operations in order to reduce noise in static ISS imagery. In the course of the module, the pupils familiarize with statistical methods and information science, and simultaneously see the benefit of this theoretical knowledge when they put it into practice (Rienow et al. 2016).

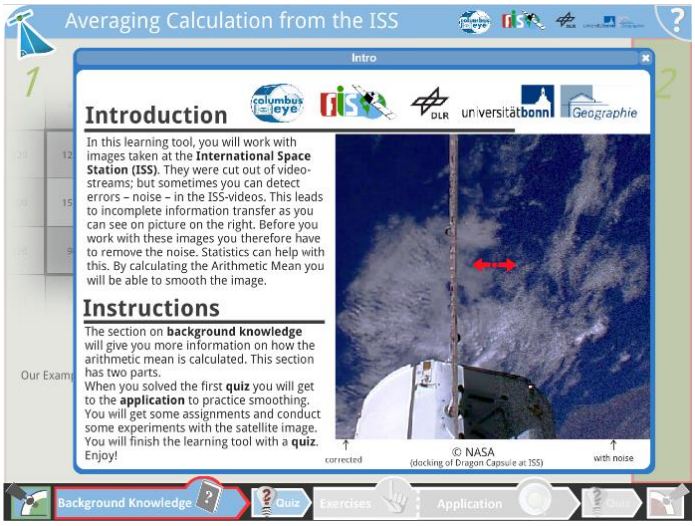


**Figure 2.** Pupils calculate the mean to correct image noise.

For the pupils, the module starts with a general introduction to the topic dealing with noise in ISS imagery. Once they have followed the instructions and internalized the mathematical concept of moving windows, averages and the calculation of the arithmetic mean, they can solve the quiz to finalize section one of the learning module. In order to guide the learning path, only after solving the quiz correctly the pupils can conduct the filtering on their own. For this, a filtering tool using a moving window can be applied to a selected number of images.

This tool is modelled on actual remote sensing software. Having analyzed their result, the final quiz can be solved and thus part two of the learning module is concluded. During the interactive application, the pupils will learn that methods can have drawbacks and earth observation is also a limited epistemological instrument. This learning material can be linked to the nowadays extensive use of filters when children make selfies and just polish them a bit. Using this tool they will learn that the modification of images often leads to loss of information. Using the arithmetic mean in this tool filter the image results in a smoothed image. But at the same time several details get lost that would still be recognizable in the original image even though some pixels are missing as seen in Figure 3 when comparing filtered and the original image.

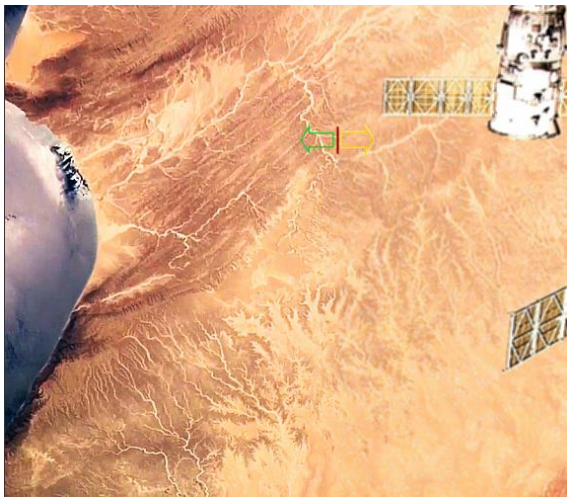

**Figure 3.** Mathematical thinking and remote sensing methods. The filtered image can be seen on the right, the original image on the left. The two arrows (green and yellow) mark the segments.

### 4.2 E-Learning: Online Classification Tools

Another way of working with the ISS video material is the examination of exclusive panorama shots derived from the videos. Transforming animated pictures into static pictures allows the application of various "traditional" remote sensing methods (Rienow et al. 2015b). Compiled in the so-called Observatory, the panoramas used here portray three geographical regions so far: West Africa, South America, Canada and the tropical rainforest. The world's largest desert, the Andes as well as ice–covered regions and the Amazonas rainforest and are prepared for analyses. Simple online classification tools enable pupils to filter land cover information from the panorama shots and thus become easily acquainted with remote sensing workflows (Rienow et al. 2015b, Voß et al. 2011). Selecting their own training samples, the pupils carry out instant classification using a minimum-distance-approach (see Figure 4). This supervised classification technique requires training of the classifier by several so-called training samples. With the help of those samples derived from training sites, the color characteristics of a pixel within a certain area as well as their object characteristics, i.e. their distribution, is inquired. The determining variable is the distance of the classified pixel to the midpoint of the color characteristics represented by the training samples. The allocation of one pixel to a certain class is determined by the least Euclidean distance. Thus, the smallest distance to the midpoint of one class defines to which class the pixel belongs in the final classification scheme (Wacker & Langrebe 1972). As seen in Figure 4, the pupils choose the respective training samples by creating a "New Surface". For each panorama, multiple classification schemes can be applied simultaneously; e.g. highlighting the cloud cover in the

southern regions in contrast to deserts in the northern, both found in the panorama of West Africa.

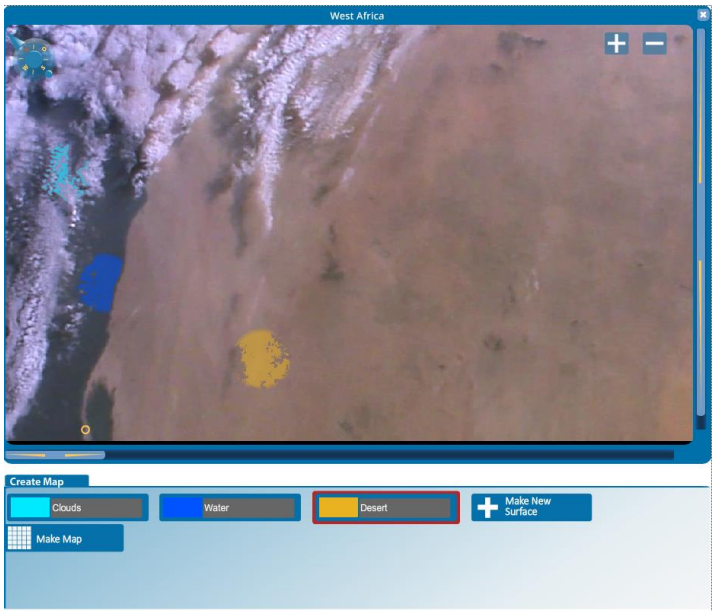


**Figure 4.** West Africa in focus: Performing a minimum-distance classification.

Additionally, the tool also provides new knowledge about a region. By clicking so-called information points that can be found in certain parts of the panorama, the pupils get further information about certain land cover characteristics or specific phenomena in the region. Figure 5 shows the example of West Africa and the Ship Graveyard of Nouadhibou.


**Figure 5.** Retrieving more information about the region and its phenomena by clicking on the information points.

Throughout the image, pupils can always spot between 8 to 12 information points classified in “Region” and “Phenomenon”.

Later on, the pupils create their own map based on the classes they chose and the colors they selected (see Figure 6). Moreover, they have the chance to quantify the area that is covered with the respective cover. Based on the first classification, the pupils are asked to create several maps within the same study area.

Comparing their results, they will recognize that (1) the more carefully they conduct the classification and (2) the more detailed classes they choose, the more representative the produced map will be.

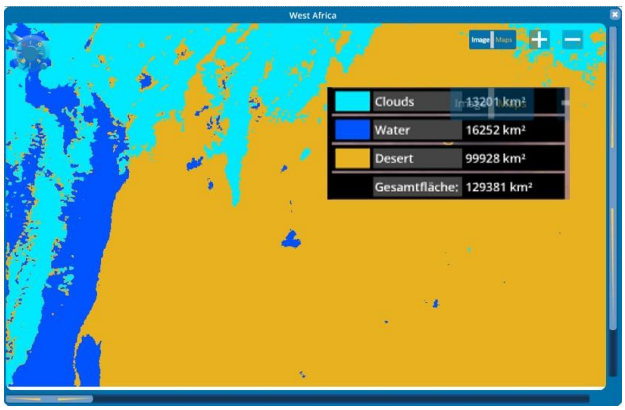


**Figure 6.** Map based on the chosen land cover classes.

The classification tool can be used either as a stand-alone application or embedded in a larger educational context by either addressing remote sensing techniques or using the thematic maps as an asset for curricular school topics in social sciences. Short texts incorporated in the design of the classification module give interpretation assistance. A sample lesson with corresponding questions and tasks can be downloaded as well.

### 4.3 Worksheets – the traditional way?

Traditional worksheets benefit from a structured approach to a narrow topic and manual, repetitive intake of knowledge. At the same time, encouraging tasks provide the framework for independent thinking. The Columbus Eye work sheets use these advantages, adding video material for understanding. The worksheets section features e.g. Atmospheric Scattering (Physics), Metropolises and their Natural Environment (Biology/Geography) or also Deserts (Geography). Adding a further twist to simple pen-and-paper applications, a new generation of interactive worksheets are presented, featuring e.g. stereoscopy and 3D. Based on multiple imagery, e.g. satellite images, ISS images, astronauts' images, and 3D videos, pupils discover the physical background of stereoscopy. The topics absorption, complementary colors, and polarizing filters are covered at once. Having acquired this knowledge, the pupils are able to produce their own 3D images and learn to understand the basics of new technologies such as 3D televisions or virtual reality (VR).

The worksheet "Stereoscopy and 3D" explains all relevant techniques and methods to produce and view stereoscopic pictures. It compares anaglyph images which are 3D visualizations consisting of two differently filtered color images, one for each eye to be viewed through "color-coded" (red and cyan) glasses as seen in Figure 7, to methods based on polarization. Our ISS HDEV anaglyph images, e.g. Mojave Desert (Figure 7) illustrated in this worksheet, were calculated using MATLAB© (Michel 2013).

**Figure 7.** Plunge into Mojave Desert – 3D experience with red cyan glasses. (Processed ISS048-E-68432, 30.08.2016, 20:21:00 GMT).

The worksheet consists of two sections: (i) the material section, where all necessary background information is given, and (ii) examples for 3D images comparing satellite and ISS imagery. The pupils are guided through the sections by several questions; in order to answer them correctly, the information provided by the material of section 1 has to be combined with the understanding of physical principles and the comparison of the imagery at hand.

### 4.4 M-Learning: Android Apps to get the view from space

In 2016, Columbus Eye launched its first educational Android App. The smartphone-based learning environment thereby introduces m-learning to the classrooms using ISS imagery. The first learning unit is called “The Eye of the Cyclone” and addresses the formation and path of typhoon Maysak using a multi-media approach. Based on a traditional worksheet, the static diagrams bring Philippine typhoon Maysak alive when viewed through the smartphone’s camera. A diagram of the typhoon’s secret interior mechanics morphs into a video of Maysak as seen from the ISS on 31st of March 2015, holding additional information on its unique characteristics. The second diagram of air masses shows the path of typhoon Maysak over time (see Figure 8).

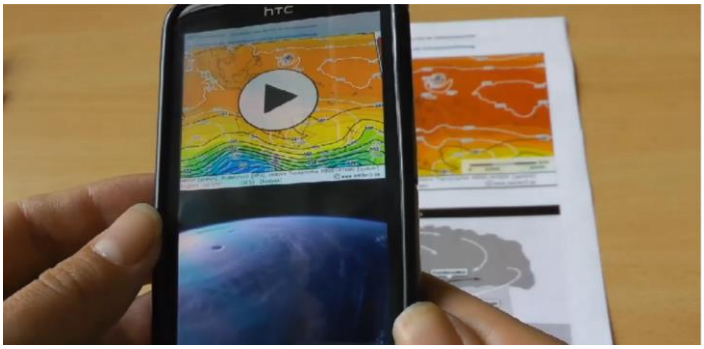


**Figure 8.** Demonstration of the Android App “The Eye of the Cyclone”.

But before those interactive parts can be explored by the pupils, the background information is presented in the worksheet by means of written scientific learning materials. These include information on the occurrence, formation and inner structure of typhoons, thus, fostering the comprehension competence. The pupils’ comprehension of the topic is assessed by several tasks on the work sheet’s final page. Those tasks can only be solved after the pupils have combined the information provided on the worksheet and extracted the interactive information with the smartphone. Whereas the materials hold general information,

specific information on Maysak can only be extracted by working with the App itself, such as measuring the diameter of the typhoon. When it comes to testing the knowledge acquired, the traditional dimension of pen and paper comes into play. The haptic experience of writing their solutions on a sheet of paper makes the knowledge paper-bound and "real", literally lifting pens and papers into space.

## 5. ACTIVITIES IN SCHOOLS

In addition to the developing of learning material Columbus Eye is also active in practical school lessons and interacting with schools and teachers. When the project Columbus Eye started in 2013, it was also accompanying the German astronaut Alexander Gerst on his mission "Blue Dot – Shaping the Future", who was the third German on-board the ISS in 2014 and will be the first German ISS commander in 2018.

Project days in schools and teaching-the-teacher events in cooperation with educational institutions all over Germany brought the fascinating views from the ISS directly into everyday school lessons. So far, more than 1,200 pupils and 200 teachers were approached directly. Lessons based on developed educational material have also been aired on TV and radio reaching a wide audience (RTL Nord 2016). The download numbers of the learning materials reach a number of approximately 150 each month. In order to reach as great an audience as possible, multiple workshops are held in Germany. As a result, an elective subject named "Geography-Physics" using remote sensing methods based on teaching materials of the projects Columbus Eye and FIS was established at the secondary school Alleestraße in Siegburg, Germany.

### 5.1 Workshops for Teachers

During an ongoing road show the fascinating views from the ISS can be spread to the young audience. Throughout "Teaching the teacher events" it was recognized that there is still hesitation to integrate new learning materials in schools lessons and to move away from pen and paper to computer- or mobile phone-based learning materials. Moreover, lesson preparation is time-consuming and it is still easier to use already known and tested material.

Teacher in general act as a multiplier. After using and approving learning tools they can integrate them into the everyday school lessons. During the Teacher this Teacher events they can test the learning materials in a supervised way, experiencing the easy-to-use software and self-explanatory tools and furthermore come to appreciate the accompanying teaching materials for embedding the learning units into their school routine. The presentation of Columbus Eye at teachers' workshops and educational fairs is adding to the project´s visibility in the community as seen in the sheer traffic values of our portal. The positive feedback given during and after these events encourages to continue the development of technologically up-to-date learning materials. Easy and fast integration in school lessons benefitting from the integration of new media, i.e. computer or mobile phone applications, are most emphasized.

### 5.2 Creating a New Subject: "Geography-Physics"

In collaboration with Columbus Eye, teachers of a secondary school in Siegburg, have developed a new subject called "Geography-Physics" for grade 8 and 9 in secondary education. Teachers integrated learning materials of Columbus Eye into the internal school curriculum in order to strengthen the pupils' understanding of the interdisciplinary character of remote sensing. Earth observation is the link between the two subjects Geography and

Physics whereas Geography stands for the application-oriented sciences, Physics is needed for the understanding of underlying technical and physical principles. Geography-Physics is currently taught for the first time as part of the elective subjects covering the field of natural science. The framework of the subject connects pupils with university researchers so that they can pose questions to "experts of earth observation". Collaborative field trips and GPS rallies build the bases for the pupils' scientific propaedeutic in early ages.

## 6. NEW TECHNIQUES – NEW CHALLENGES

Nowadays, new technologies and tools are developing very fast. Still, young generations keep track and are motivated by new things especially when also targeting their playful spirits. Nevertheless, competent and responsible use of new media and technology plays a key role for pupils. As discussed, e- and m-learning does not only support modern teaching but also imparts media literacy while arousing the pupils' attention. These advantages can often only integrated in school practice via externally generated learning materials as teachers do not have sufficient time and computational resources to develop complex topics and related methods themselves. This is the ongoing task for Columbus Eye in order to establish remote sensing and earth observation in school lessons.

The portal Columbus Eye portal was established in 2013 and considerably improved and re-invented in October 2016 will represent a platform for teachers and pupils but also other interested users. Here, information about the ISS can be gained, while observing our blue planet from different angles. Collaboration with more educational institutions is furthermore in focus and will be approached in the near future.

This paper shows how remote sensing and earth observation can build the bases for interdisciplinary school lessons bridging the gap between physical and mathematical background information and geographical application analysis. Future actions will focus on teaching units developed in order to communicate the knowledge and the handling of natural and man-made phenomena in times of global change. By raising the level of immersion from augmented to virtual reality the pupil's awareness of technical progress should be raised simultaneously. While the HDEV-mission will end in 2017, NASA is currently working on a successor to pursue the goal of entertaining and educating the public with the astronaut's view from above.

## ACKNOWLEDGEMENTS

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We would also like to take this opportunity to thank our former project leader, Prof. Dr. Gunter Menz, who passed away after a severe accident in August 2016. He enjoyed motivating young children and scientists for the view from space.

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# SPATIAL DATA INFRASTRUCTURES AND GEOGRAPHY LEARNING

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## Abstract

Geography, as a science and in the educational sense, is benefiting from improvements in the usability of geoportals and viewers connecting Spatial Data Infrastructures (SDI) which link to high quality geographic information. It is very useful for Geolocation services. This is due to the fact that the amount of open data has been increasing and most of the data have a spatial reference and hence called geodata. It improves employment possibilities and facilitates becoming an e-citizen using e-government information.Time and space are very important for data analysis. Therefore, it is possible to learn geography from SDI geodata, especially if it is integrated into a learning environment. Some examples will be analysed. Geodata provides us with open data and a holistic approach that lead us to come to our conclusions which in turn improve learning quality leading to the acquisition of spatial and digital competencies.

***Keywords:*** *Spatial Data Infratructures, Learning, Interactive Web Maps, WebGIS.*

## 1. INTRODUCTION

Spatial Data Infrastructures (SDI) is currently the basic element used for geographic information in a global context. Its importance is undeniable. So, the use of geographic information on new interfaces results from the integration of open geodata from the SDI created in the European Union under the INSPIRE (INfrastructure for SPatial InfoRmation in Europe) Directive.

SDI is organized in linking geoportals to services which allow one to share, interchange, combine, analyse and gain access to geographical data using interoperability and standardization. These last elements are essential and should go together. The format of geographic information (GI) is changing (Carbonell *et al* 2012) and SDI made GI available to everyone. Quite a lot of cartography resources are available online free of open data, mostly using geodata from SDI.

The Open Geospatial Consortium (OGC) services comprise standardized and interoperable SDI services. Currently, the most extended services are the Web Map Services (WMS). The services are also offered using tiles. They allow images to be loaded into a manageable rectangular set of pixels used to process the whole image without consuming a vast quantity of computer memory. The computer process is not visible. Tiling is the quickest way for image visualization today, as a set of rectangular pixel limits are imperceptible. There is no

difference in visualization. They are called the Web Map Tile Services (WMTS). Both are basic visualization services which allow one to see geodata, but one cannot make any changes, although in some cases you can add or remove a layer.

Other OGC standard services exist, such as Web Feature Services (WFS), but they are not available for all connections. It depends on the app. WFS make it possible to access the attributes tables of vectorial geodata, download it to the local hard drive and make any necessary changes. For raster datasets, the Web Coverages Service (WCS) exists. Web Catalogue Services (WCS) and Web Process Services (WPS) are also relevant, among many other standardised interoperable services (González and Lázaro 2011). They allow one to visit a catalogue of services and to process information on the cloud (cloud computing).

As a result, geographical data or georeferenced data, called geodata, is the "raw material" served by SDI through the OGC services. Geodata is open georeferencing data available on the internet and freely accessible to download and re-use (copy, analyse, re-process) for limitless purposes.

Official bodies or organizations are responsible for each piece of geodata updated and any metadata added. So geodata is characterized by quality and reliability. Metadata describes precise data geographic information or geodata such as origin, extent, quality, spatial and temporal scope, content, spatial reference and datum, identification, author and responsible body among other properties of digital geographic data following the ISO 19115 rules. Few people are aware of all these issues in spite of the fact that they are continuously using geographical information on geoservices on their smartphones. Therefore, some literacy on all these aspects is necessary. Accordingly, lectures and lessons can be completely turned around due to technological advances and transformations.

The Spanish National Geographical Institute integrates geodata from public administrations on the Spanish SDI. The utility has come about as a result of the holistic geodata approach. Necessary standardization for interoperability comes from the ISO 19100 standard and the Open Geospatial Consortium (OGC) specifications (Bernabé-Poveda and López Vázquez 2012:44, Iniesto and Nuñez 2014). INSPIRE is applied in Spain under LISIGE Law (Ley sobre las infraestructuras y los servicios de información geográfica en España) which guarantees free viewing services of a broad range of open data not, only related to the environment.

Currently, the Spanish Spatial Infrastructure Data (IDEE) Observatory that assists in the growth of IDEE, was launched in 2006 (Del Campo *et al* 2012:247). Teachers can also become aware of the advantages of using SDI (González, 2012) as an available, quality and reliable source of geodata, although it is very useful for geography and other territorial sciences in lessons. Thus, in terms of educational aims, IDEE is relatively unknown and few people know how to take full advantage of it.

The evolution of new possibilities of SDI and technologies on the Internet evolution is based on the growth of information in general and the specific increased interaction of geoinformation access, but also on the number of learning environments (Figure 1).

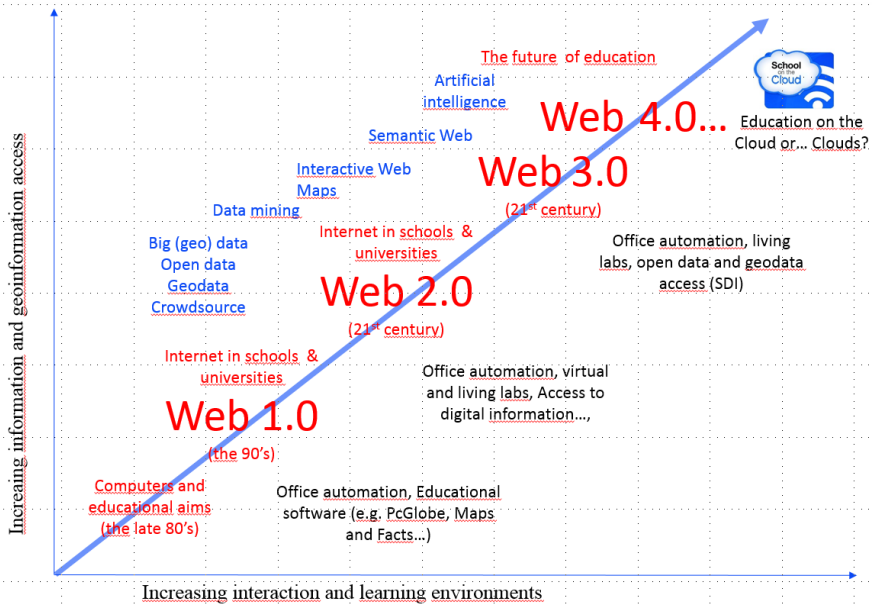


**Figure 1.** The future of geography education own draft

As a consequence, the two main competencies in geography learning: spatial thinking (Zwartjes, Lázaro *et al* 2016) and digital competencies (Lázaro, Izquierdo and González 2016) can be developed making sense of geodata served by SDI. Pokémon GO! is an example of increasing spatial competencies in a fun way using augmented reality linking cities and towns with online Pokémon maps.

The main objective of this article is to make people and geographical educators aware of the utility of SDI for learning aims specially focused on Geography using the enquiry processes (Favier and Van der Schee 2012, Kerski 2011, De Miguel and Buzo 2015). Learning lines (Zwartjes, 2012, 2014) and spatial thinking will benefit from using SDI.

The first part of this article will explain the background of spatial thinking using geographic information from SDI. The literature review will show some learning and teaching initiatives by means of their analysing. Finally, we encourage teachers to try learning a bit more about SDI geodata in order to use quality data to achieve learning results when it comes to spatial and digital competencies.

## 2. BACKGROUND ON LEARNING PROCESS AND SPATIAL THINKING

Spatial thinking is the ability to deal with a mental model of the Earth and the ability to operate using this model. Spatial thinking integrates orientation, rotation, shapes, lines, space and relationships between spatial entities. Cognitive skills will be enhanced by spatial thinking ability. Essential elements for achieving this ability are software, hardware, geodata -from many sources, although SDI geodata can be very convenient for the reasons explained above- and people, who can share the workflow. Thus, a new paradigm is appearing around the transdisciplinary approach which enhances collaborative and critical learning.

Educational policy analysis derived from the conclusions of the *School on the Cloud* project (Lázaro, De Miguel y Buzo, 2017) explains three ways of learning based on the nature of teaching: instruction, constructivism and integration (Figure 2). It should go further than the critical nature of teaching. There needs to be transdisciplinary learning based on a collaborative and participative learning-centered network, and it should help to link the Cloud and the Earth as a necessary learning ability and result of practicing education. And this result is a very important aim for citizens.

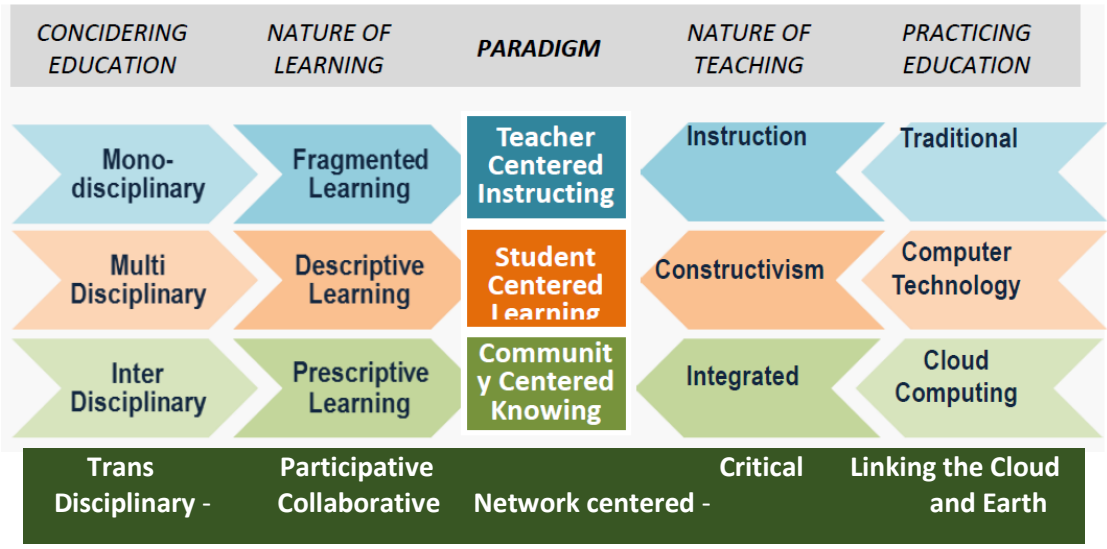


**Figure 2.** Based on Koutsopoulos and Papoutsis, 2016: 34.

Tools and media for the learning process have integrated new and emerging technologies in recent years. Thus, those of the 21st century are different than those of previous centuries. Then, as for territorial aims, there are many useful geotools, geomedia and new interfaces that allow students to build upon new knowledge in a different way linking the Cloud and Earth in a transdisciplinary frame. Digital and geospatial literacy enhance learning (Baker *et al* 2015) and this is possible to acquire by using geodata from SDI. But... how can we achieve this learning scope?

We can stress some steps, following enquiry processes and learning lines (Buzo 2016, De Miguel in Muñiz, Solem and Boehm 2016 and Zwartjes, Lázaro *et al* 2016) for a new approach to geography, in four different and clear actions:

- Observing (territory): Perceiving landscape and coming up with geographical questions
- Using: acquiring, exploring, organizing, analyzing and interpreting outdoor and other GI access such as SDI. Analyzing layered organization to understand the complexity of the elements involved in the organization of territory (physical, social, economic, political and cultural) resulting from their interaction.
- Structuring: making sense of geographical information. Structuring spatial relations such as identification, comparison, measurement, connections, directions or hierarchy, among others.
- Applying: acting on the correct and wise use of geographical knowledge (e.g. building new interactive maps with student's own data and obtaining new research conclusions).

This helps make it possible to acquire spatial thinking dimensions that the National Research Council (NRC 2006) explained as: spatial concepts, spatial representation and spatial reasoning.

## 3. SOME TEACHING INITIATIVES USING SDI FOR LEARNING AIMS

The aim of linking the Cloud and Earth has been an important task for many teachers who have been working with spatial apps and viewers given the possibility to integrate geodata from SDI and their own data from outdoor learning. Moreover, this aim facilitates required fieldwork to be updated and controlled feedback on geodata. Geodata can be compared. Laws allow dissemination, usability and reusability of geodata. Fieldwork means great educational opportunities in outdoor learning (Lázaro, De Miguel and Buzo, 2016) which proves very popular among teachers.

Main visualization initiatives, useful for learning about GISciences and linking the Cloud and Earth integrating SDI as a source of geodata are virtual globes. The most popular is Google Earth. It has quite a lot of hardware requirements and not all teachers are aware of the possibilities of connecting to SDI services and earth, sea or sky visualization.

Some WebGIS are very useful for geodata SDI integration with other geographical information sources (e.g. one's own data or ArcGIS Online platform data), creating interactive maps online, for example, ArcGIS Online (AGOL) TM, Esri® platform, CartoDB or MapBOX.

The Spanish National Geographical Institute (IGN) has created and maintained some viewers which integrate geodata from public administrations available for users (e.g. Iberpix, Cartociudad or SignA). The natural node of Spanish SDI is SignA, created so that the Spanish SDI data can be visualized on a GIS. IGN is also collaborating on very useful GPS applications for mobile devices for outdoor learning, such as Mapas de España, that works entirely with the Spanish SDI and its usability allows students to use it.

Google has updated cartography and added very detailed images. Thus, they don't use geodata from different SDI. This is the information available on MyTracks or MyMaps apps and can also be used as GPS.

Thus, we see that it is technically possible to integrate SDI geodata in different visualization apps or viewers for lectures. Using connected SDI platforms is very useful to solve the problem of fragmented geoinformation. Visualizations and simulations are possible on the platforms/viewer apps, thus linking the Cloud and the Earth should be easy and demands are continuously increasing. But only a few teachers are aware of the visualization possibilities for learning aims.

We have been collecting some of these different initiatives on table 1 using SDI for learning aims. The clear advantages of geodata coming from SDI as free and open data uses have not been discovered yet by teachers, then, there is not a frequent use of geodata from SDI as there would be in GISciences lessons. Meanwhile, GIS has indeed been trying to introduce geodata at least in Secondary Schools in many countries for a long time. Some difficulties have been encountered, already shown by Milson, Demirci and Kerski (2012). Perhaps the problem has nothing to do with the availability of tools and geodata on the cloud, but it is related to dealing with the users, teachers and students which must have a usable and accessible tool for an effective and enjoyable learning experience. The possibility of making maps on demand and interacting with them in order to learn geography is essential for our learning aim, but although it is somewhat achievable today, users feedback needs to be updated.

**Table 1**. Summary of Geography lessons using different viewers as learning environments SDI connected

| Year | Application name, type of application, owner and URL | Study case information |
|---|---|---|
| 2004 | SignA (Natural SDI Node, Spanish National Geographical Institute, IGN) (http://signa.ign.es/signa/) | - IGN. (2015). "Navegación en SignA", vídeo disponible en: https://youtu.be/ts2fvahFHFI<br>- Lázaro, M.L. de, Álvarez, J. and González, M.J. (2015). "Aprender geografía de España empleando SignA" en Investigar para innovar en la enseñanza de la Geografía. Universidad de Alicante, pp.25-39. |
| 2005 | Google Earth (Virtual Globe, Google) (https://www.google.com/earth) | - Patterson, T.D. (2007). "Google Earth as a (Not Just) Geography Education Tool", Journal of Geography, 106:4, 145-152, DOI: 10.1080/00221340701678032<br>- De la Calle, M. (2009). "Aplicación de Google Earth en la formación del profesorado de educación infantil para el conocimiento geográfico". In A Inteligência Geográfica na Educação do Século XXI. Lisboa: Associaçao de Professores de Geografia; Instituto de Geografía e Ordenamento do Territorio da Universidade de Lisboa; Grupo de Didáctica de la Geografía de la Asociación de Geógrafos Españoles.<br>- MOOC de Didáctica de la geografía a través de Google Earth (Universidades de Burgos y Alicante). Coordinado por Isabel María Gómez Trigueros, with the collaboration of Juan Ramón Moreno Vera y Delfín Ortega Sánchez. |
| 2007 / 2009 | MyMaps, for finding places MyTracks, for building tracks (Google cartography, an app for mobile Android devices) | - Gil, N., Calabuig, S. y Medir, R.M. (2014). "El webmapping como herramienta didáctica para el análisis del paisaje Núria". In Martínez Medina, Ramón y Tonda Monllor, Emilia María (eds). (2014). Nuevas perspectivas conceptuales y metodológicas para la educación geográfica. Grupo de Didáctica de la Geografía (A.G.E.) - Universidad de Córdoba. pp. 205-218. |
| 2007 | Internet Applications: Neogreography and Volunteered GIS (Wikimapia, OpenStreetMap, e-Government sites) | - Scull, P., Burnett, A., Dolfi, E., Goldfarb, A. & Baum, P- (2016). "Privacy and Ethics in Undergraduate GIS Curricula". Journal of Geography, 115:1, 24-34, DOI:10.1080/00221341.2015.1017517 (Fundamental changes on the nature of spatial data and maps) |
| 2013 | PaikkaOppi (Finnish Web based learning environment using SDI) (http://www.paikkatietoikkuna.fi/web/en) | - Houtsonen, L., Mäki, S., Riihelä, J., Toivonen, T. and Tulivuori, J. (2014). "PaikkaOppi: A Web based learning environment for Finnish Schools". In De Miguel, R. and Donert, K. Innovative Geography Learning in Europe: New Challenges for the 21st Century, pp. 89–100. Newcastle upon Tyne: Cambridge Scholars Publishing.<br>- Riihelä, J. and Makki, S. (2015). "Designing and Implementing an Online GIS Tool for Schools: The Finnish Case of the PaikkaOppi Project". Journal of Geography, 114:1, 15-25. |
| 2014 | Iberpix (Spanish IGN viewer) (http://www.ign.es/iberpix2/visor/) | - Delgado Peña, J.J. (2014). "Using the Iberpix geobrowser for teaching geography: perspectives from active learning methodologies". In De Miguel, R. and Donert K. Europe: New Challenges for the 21st Century, pp. 213–228. Newcastle upon Tyne: Cambridge Scholars Publishing. |
| 2015 | Mapas de España (Spanish SDI data from the IGN, an app for Android mobile devices) | - Available on Google Play. In the future it will be available for IOS and other operative systems (Windows 10). Used to find a treasure in the Science Week by GEODIDAC research group.<br>- Lázaro, M.L.; De Miguel, R. y Buzo, I. (2016). "Outdoor Learning and Geography on the Cloud: A Challenge for the European "School on the Cloud" Network". The International Journal of Technologies in Learning, 23 (3) pp.1-13. DOI: 10.18848/2327-0144/CGP. © Common Ground Publishing. |

| Year | Application name, type of application, owner and URL | Study case information |
|---|---|---|
| 2014 | ArcGIS Online Platform (ESRI) (https://www.arcgis.com/) | - Lázaro, M.L.; Izquierdo, S. and González, M.J. (2016). "Geodatos y paisaje: De la nube al aula universitaria" (Geodata and Landscape: From the Cloud to Lectures). Boletín de la Asociación de Geógrafos Españoles, 70, pp. 371-391. DOI: 10.21138/bage.2175. English versión: http://www.age-geografia.es/ojs/index.php/bage/article/viewFile/2245/2132<br>- Buzo, I. (coord.) (2016). "Las SIGWebs en la Geografía de Secundaria para la mejora del pensamiento espacial". Memoria presentada para la obtención del XXXI Premio "Francisco Giner de los Ríos". Área de Humanidades y Ciencias Sociales otorgado a esta metodología de trabajo (BOE 17 mayo 2016). |
| 2015 | Atlas Digital Escolar (WebMap on ArcGIS Online, ESRI) (www.atlasdigitalescolar.es/) | - De Miguel, R., Buzo, I. y Lázaro, M.L. de (2016). "Nuevos retos para la educación geográfica y la investigación docente: el Atlas Digital Escolar". (New challenges for geographical education y researching: The Digital School Atlas), Spanish Contribution to IGU Congress XXXIII (Beijing, 2016). Madrid: Comité Español de la UGI. |

## 4. ANALYSIS

All the selected initiatives are not focused on analogic maps, which are useful for locating places (climate, cities), identify some spatial patterns (physical, human, regional), learn concepts and evaluate distributions, they are focused on digital interactive maps allowing one to acquire inquiry skills and they provide a tool for territorial analysis using the previously named steps: observing, analyzing, structuring and applying. The inquiry process allows a transdisciplinary framework based on participative, critical and collaborative learning (Buzo, 2016).

Most of the projects or examples collected in Table 1 are based on an interactive learning platform connected to SDI and having as main tasks knowledge building and interaction through the geographical information provided. Many geodata sources are integrated by WMS, WMST or WFS OGC services.

Among all attempts using SDI for learning aims selected in Table 1 perhaps one of the most important is the Finnish PaikkaOppi, a learning environment for secondary schools which integrates geographical information from SDI and outdoor learning, thus students are able to link the Cloud and the Earth. The advantage is that by using geodata from SDI it will update automatically on the online maps because the official body responsible for the geodata does so on the databases which are the main source of the application geodatas. Thus, it is possible to use more reliable geographic information.

Although any country can connect by means of their own SDI to different viewer apps, the National Institutions which serve open data are not always specifically built for learning aims focused on geographical education. As for the Spanish case, there are some possibilities not experienced by many teachers, integrating geodata from SDI using IGN viewer apps previously cited (Iberpix, Cartociudad and SignA). None of them are focused on creating teaching and learning materials for a better geospatial and global understanding, such as PaikkaOppi or Atlas Digital Escolar (De Miguel *et al*, 2016° and 2016b). Both have to learn functionalities on the platform as tools. Geoinformation is necessary and it is provided in all instances, partly creating geodata for the platform and partly by SDI.

Then, the traditional work and observation turn into layered collaborative work online using interactive web cartography on the cloud (Figure 3).

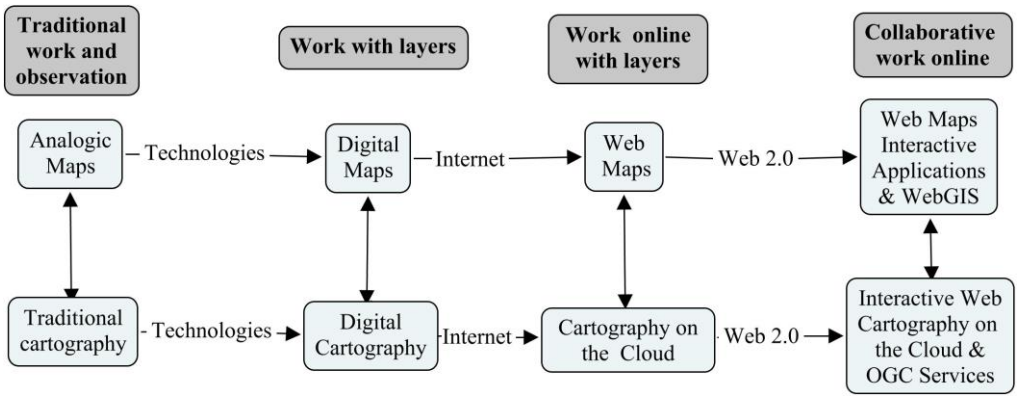


**Figure 3.** Drawn by M.L.de Lázaro

More experimentation on learning results using SDI on different viewers and learning environments are necessary. But a previous aim is to create the necessary pedagogic steps to use geodata for geographic learning achievement. The PaikkaOppi learning platform is a good example, as it is continuously updating not only new outdoor learning possibilities, but also new learning material (Riihelä and Makki 2015).

It is not easy to enumerate clear learning results as more research on the topic is necessary, but we can point out some of the desirable learning results of using a platform connected to SDI for geographical education aims:

- Encouraging critical geospatial thinking based on SDI geodata and a tool for territorial analysis.
- Understanding geographical concepts from reflecting on map content.
- Leveraging open and quality geodata from SDI portals, maintained by the official bodies of every country.
- Achieving a way of working usefully for lifelong learning anyplace, anytime and anyway.
- Using devices for learning aims, some authors call this smart learning (Lee and Son, 2013)
- Improving inquiry methodology and problem solving learning for a better territorial knowledge.
- Responding to social demand and the labour market as regards geospatial skills.
- Acquiring a basic vocabulary of a 21st century basic scientific paradigm such as digital geohumanities, geostatistic, big geodata, Spatial Data Infrastructure, Global Satellite Navigation System, WebGIS, Web interactive map.

There is widespread belief that beyond conventional tests where the learned memory contents are written, there are new interactive map tools based on SDI geodata and available to anyone with an internet connection that are more useful for acquiring spatial and digital competences. Currently, nearly 95 % of all under 15 year olds in Spain is connected to the Internet according to Spanish Statisticas Institute figures.

## 5. CONCLUSIONS

The SDI provides accessibility to a wealth of quality information as well as interoperability. Technological progress, which facilitates interoperability and access to more open data, should promote a steady improvement in data quality, especially now that the current

legislation promotes dissemination, usability and reusability of geographical data. They are also useful for citizens and e-government aims.

SDI will help to provide the necessary and useful geoinformation for the process and final linking of the Cloud and Earth. But it is also necessary to go even further. Geospatial technologies have come to schools using open data and SDI connections serving what we call geodata. They are georeferenced open data. They improve learning quality leading to the acquisition of spatial and digital competencies. This is a clear opportunity to begin the renewal of teaching methods in geography.

The PaikkaOppi or the Digital Spanish Atlas way of learning is very innovative for curriculum objectives. They allow great interaction among students as well as a process development of spatial learning by discovery using the inquiry method (De Miguel et al, 2016a and 2016b).

There are few researching the learning results resulting from this new way of learning. We can conclude that more research on geographical education using interactive web cartography in the cloud is necessary together with a transdisciplinary learning approach based on collaborative and critical learning.

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# HOW DOES STUDENTS MOTIVATION TO ACQUIRE NEW GEOSPATIAL SKILLS INFLUENCE THEIR CHOICES OF E-LEARNING CONTENT?

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## Abstract

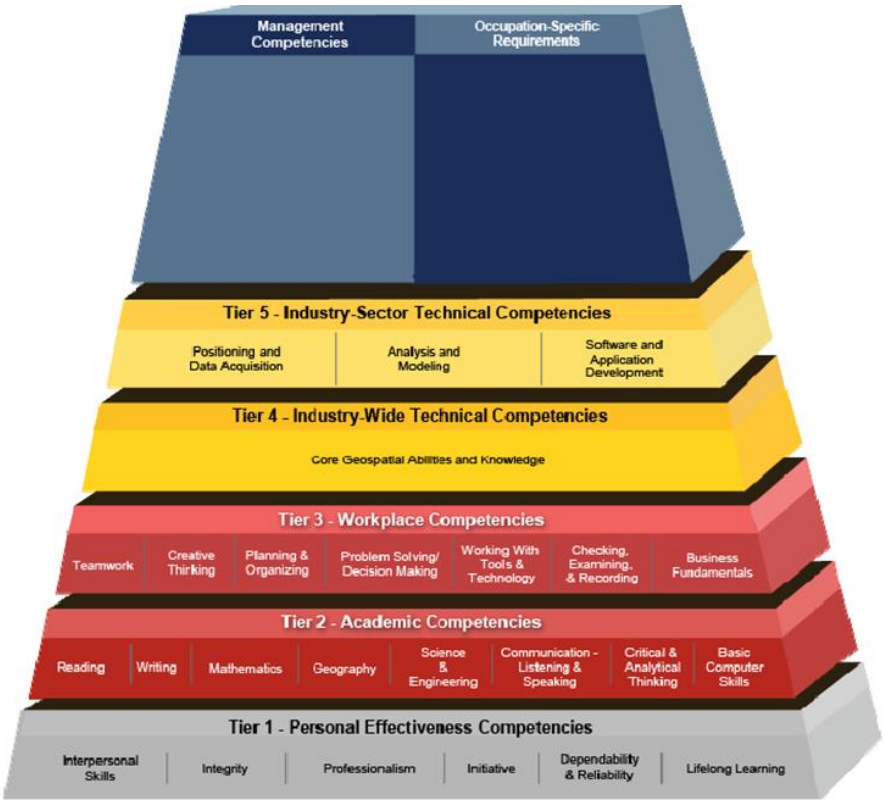
Higher education in many disciplines is affected nowadays by an evident orientation to assist students in developing a certain set of skills required by the labour market. This trend is visible also in the field of Geographic Information Science and Technology (GIS&T). The composition of competencies encompasses, apart from industry-specific technical competencies, also soft skills related to personal effectiveness, academic and workplace competencies. Moreover, soft skills are gaining in importance, being identified as future work skills. As a result, students may search for certain skills when they come into contact with a particular learning content. In this study, we investigated how the motivation to acquire specific skills influences students' behaviour on the e-learning platform. As a case study, we selected a study programme in land management carried out at the Institute of Geography and Spatial Management (Jagiellonian University in Cracow, Poland). Several different motivating factors, like GIS&T skills and the ability to co-operate, were identified and compared with students' behaviour on the e-learning platform in certain modules of the study programme. The results indicated that students only partially prospected for certain competencies during their work with the content of the e-learning platform. Students' motivation was more evident in their on-line behaviour when they wanted to acquire technical skills than when they planned to develop soft skills.

***Keywords:*** *E-learning, motivation, geoinformation, skills.*

## 1. INTRODUCTION

Higher education in many disciplines is affected nowadays by an evident orientation to assist students in developing a certain set of skills required by the labour market (Industry models, 2016). This trend is visible also in the field of Geographic Information Science and Technology (GIS&T). The composition of GIS&T skills evolves similarly to changes observed in the development of the GIS&T field. In the first half of the last decade, analysis and modelling skills were the most important in the geospatial technology labour market, but nowadays their significance is similar to software and application development skills that seem to be equally important for employers. At the same time, the importance of cartography and visualization skills was steadily declining (Hong, 2016). Currently, parallel to the development of web applications and mobile devices, the demand for web, mobile and programming competencies is increasing among GIS&T graduates (Rip et al., 2014; Barnikel and Ploetz, 2015). Over the last ten years soft skills have also gained importance in the composition of geospatial technology competencies (Hong, 2016; Comparative analysis on the state of the art of soft skills and soft skills 2.0, 2015).

Therefore, the composition of technical competencies, characteristic for the geospatial field of industry and education is increasingly being accompanied by soft skills (Figure 1). Technical competencies cover industry-sector and industry-wide technical skills. The former focus on positioning, data acquisition, analysis, modelling, software and application development skills while the latter are defined as core geospatial abilities and knowledge. Technical competencies comprise only one fourth to one third of the entire geospatial technology competencies pyramid. The remaining part belongs largely to soft skills (e.g. team work, planning and organizing, initiative, dependability and reliability, interpersonal skills) and academic competencies composed, among others, of mathematics and geographical knowledge together with critical and analytical thinking (Geospatial Technology Competency Model, 2014).




*Source: Geospatial Technology Competency Model, 2014.*

**Figure 1.** Geospatial technology competencies

The novice GIS&T students may be motivated by the above mentioned trends in geospatial technology competencies models. During their studies, they may focus on gaining those competencies with an overall goal to improve their employment prospects. Motivation is a crucial success factor for the students' performance. Both intrinsic and extrinsic motivation helps students to achieve their learning goals (Ryan and Deci, 2000). A considerable amount of work was devoted to the topic of motivation (Buckmaster and Carroll, 2008) and its influence on e-learning effectiveness (Kizilcec and Schneider, 2015; Hasan et al., 2010; Keller and Suzuki, 2004; Littlejohn, 2016). However, these studies rarely refer to a certain discipline of studies, a study programme and its specifics.

The learning goals, although generally common for a given field of study, may vary considerably between students and be oriented towards technical competencies, soft skills or academic competencies. The differences may be more significant at the post-graduate (Master of Science, MSc) level in comparison to the undergraduate (Bachelor, BSc) level. That is why at the MSc level it may be required to offer more individualized and personalized ways of providing learning content to students. E-learning content usually helps students to personalize their learning process and gives them a chance to achieve the learning goals sometimes even to a broader extent than during traditional classes (Swan, 2003). The e-learning environment facilitates students' interaction with course content and student-centred learning. On the e-learning platform it is possible to address different learning styles and students are provided with choices, for example through including additional resources for further study and allowing them to spend as much time on a given subject as needed (Waterhouse, 2005). Additionally, the online environment of study facilitates and promotes training of soft skills like communication and collaboration. Conditions for gaining these skills in the e-learning environment are potentially increased compared with traditional classes, because they are time and place independent (Peters, 2000).

In the context of the current model of geospatial competencies and their trends it is interesting to investigate if, and how, e-learning helps to acquire this kind of competencies. Various aspects of this generic problem are included in the following questions:

- Is students' motivation towards their studies convergent with current models of competencies and needs related to positions in the geospatial technology market?
- Do students prospect for certain competencies consistent with their motivation during their online part of studies?
- Do the module assessment requirements influence the online behaviour of students?
- Does the e-learning mode of studies allow students to effectively interact with learning content relevant to certain requested competencies?

To answer these questions, students' motivation to choose a specific study programme was first investigated. Then students' behaviour on an e-learning platform was traced and compared with their declared motivations during the studies. Finally, results were discussed, taking into account also instructors' observations on students' in-campus behaviour.

## 2. CASE STUDY

In 2015 a new study programme called "e-Spatial Management" was prepared in the Institute of Geography and Spatial Management (Jagiellonian University, Cracow, Poland). Students are taught how to use geospatial tools, data and methods in this discipline mainly using the project approach. Quite a substantial amount of attention is also paid to students' professional development and project management competencies, which consists mainly of different kinds of soft skills, for instance team work, planning, organizing and interpersonal skills. Such a

composition of competencies was elaborated in close cooperation with representatives of employers, who gave their opinions on learning aims (Kozak et al., 2016). Thereby the curriculum of the studies focuses on such educational outcomes that coincide with labour market needs with an expectation that graduates of the "e-Spatial Management" study programme will cope better in the labour market than graduates of traditional study programmes in geography (Piróg, 2015).

The study programme consists of 25 modules (Table 1). Some modules are organized in a bimodal form which includes e-learning and face-to-face classes. E-learning content is provided via the university platform maintained in the open-source Moodle environment.

**Table 1.** Programme of the studies "e-Spatial Management"

| No. | Modules | ECTS | E-learning | | Face-to-face classes | |
|---|---|---|---|---|---|---|
| | | | *hours* | *%* | *hours* | *%* |
| 1 | MSc tutoring - I year | 3 | 0 | 0 | 30 | 100 |
| 2 | Distance learning methods | 3 | 35 | 100 | 0 | 0 |
| 3 | Philosophy of science | 3 | 9 | 30 | 21 | 70 |
| 4 | Spatial data models & geodatabases | 6 | 33 | 55 | 27 | 45 |
| 5 | Data acquisition & GI infrastructures | 6 | 18 | 30 | 42 | 70 |
| 6 | Models and tools of spatial management | 6 | 20 | 25 | 60 | 75 |
| 7 | Environmental aspects of spatial planning | 6 | 0 | 0 | 70 | 100 |
| 8 | Local and regional development | 6 | 0 | 0 | 70 | 100 |
| 9 | Spatial analysis and geovisualization | 6 | 30 | 34 | 60 | 66 |
| 10 | Ecophysiography | 6 | 0 | 0 | 25 | 100 |
| 11 | Environmental impact assessment | 6 | 0 | 0 | 33 | 100 |
| 12 | Spatial planning documentation | 6 | 0 | 0 | 30 | 100 |
| 13 | MSc tutoring – II year | 3 | 0 | 0 | 30 | 100 |
| 14 | Urban revitalization | 6 | 0 | 0 | 70 | 100 |
| 15 | Professional development | 6 | 0 | 0 | 36 | 100 |
| 16 | Project management | 6 | 0 | 0 | 63 | 100 |
| 17 | Protected areas | 6 | 5 | 14 | 30 | 86 |
| 18 | Geomarketing | 6 | 0 | 0 | 45 | 100 |
| 19 | Decision-making support tools in regional planning and business | 6 | 0 | 0 | 60 | 100 |
| 20 | Transport | 6 | 0 | 0 | 70 | 100 |
| 21 | Environmental forecasting | 6 | 0 | 0 | 80 | 100 |
| 22 | Land management in mountain areas | 1 | 0 | 0 | 10 | 100 |
| 23 | Spatial planning in the Cracow metropolitan area | 1 | 0 | 0 | 10 | 100 |
| 24 | Land management in upland areas | 1 | 0 | 0 | 10 | 100 |
| 25 | Optional courses | 12 | 0 | 0 | 120 | 100 |

In most of the modules the e-learning platform is used as a repository for the learning content. In seven modules e-learning is practiced more interactively, in the form of high-technology constructivist courses (Weller, 2002), where students are provided with advanced e-learning content (text, graphics, hyperlinks), with knowledge-checking possibilities (tests and

quizzes) and actively used discussion fora. Although interactive online learning constitutes only 10% of the study time, a separate module called Distance learning methods devoted to this type of learning was elaborated and offered to students. Development of such a module was intended to prepare students to learn at a distance during the studies and subsequently during their future lifelong learning activities.

## 3. DATA AND METHODS

The motivation of students was examined during the module *Distance learning methods*. One of the assignments in this module aimed at preparing a mind map that describes the student's motivation to take the study programme in question. It was recommended by the module instructor to look widely at that topic and to include both intrinsic and extrinsic (Davidson-Shivers and Rasmussen, 2006) motivating factors. Thirty-four students prepared the motivation mind maps. Six students, who had already completed similar modules during their previous studies, were excluded from the analysis as their records could be influenced by prior experience. Finally, 28 mind maps were taken into account. All the desired skills and competencies depicted by students on the mind maps were collected and divided into six motivating factors. The first group of GIS&T skills covered competencies allowing students to use GIS software (e.g. ArcGIS, AutoCAD, QGIS) to solve various tasks. The next group of competencies (GIS&T knowledge) was connected with students' motivation to extend their knowledge of technology and computer science. Students' indications associated with their participation in field classes, meetings with employers, projects, classes on urban planning, regional politics and spatial management were gathered in the third group of motivating factors – spatial management competencies. The next two groups of competencies represented soft skills. Students oriented towards co-operation and networking skills were seeking opportunities of teamwork, exchange of experience and information, meeting new people, help and support. Another group of soft skills (self-organization skills) was defined by flexibility, connectivity and time management skills. Finally, the sixth group of motivating factors (academic competencies) were of a general character (neither definitely technical or soft) and comprised students indications associated with gaining a diploma of higher education, a job, training opportunity, career development and a better position in the labour market (promotion, satisfactory earnings).

In order to examine the relationship between students' motivation and their behaviour on the e-learning platform we assigned specific e-learning content to the above six groups of motivating factors. Four out of the total eight modules led in the first semester of studies with the highest e-learning hour ratio were selected for the analysis: *Distance learning methods* with content related to cooperation and networking skills as well as self-organization skills, *Philosophy of science* with the content related to general academic competencies, *Spatial data models & geodatabases* and *Data Acquisition & GI infrastructures* with the content related to GIS&T skills and knowledge. E-learning content related to spatial management skills was not investigated as this type of content was not substantially used in the modules devoted directly to spatial management topics.

As a proxy of students' interest in the particular content, we assessed for every student the number of logs on the e-learning platform. The logs were counted separately for each module's content related to a given motivating factor, in the period when the selected modules were taught (October 2015 – February 2016). Then the correlation between indications of certain motivating factors by students on the mind maps, and the number of their logs in a given module's content related to specific competencies were analysed. Spatial management skills were combined with indications related to GIS&T skills and knowledge and correlated with the respective logs in the e-learning content.

The relationship between students' motivation and their behaviour on an e-learning platform may be disturbed by module assessment requirements, as certain tasks that students have to perform may cause a more frequent use of some e-learning resources, irrespective of the students' initial interest and general motivation. To investigate if the module assessment requirements influence the online behaviour of students we correlated the number of logs for every student in a given module's content with students' grades in that module.

## 4. RESULTS AND DISCUSSION

Overall, soft skills were indicated by students on their motivation mind maps much more frequently than technical and general skills, which were in total indicated by students with a similar frequency (Table 2). Among all motivating factors related to technical competencies, the spatial management skills were indicated much more often than GIS&T skills. In turn, in the group of soft skills, cooperation and networking skills were more frequently indicated by students than self-organization skills. It seems that motivating factors indicated by students are to a large extent convergent with current models of competencies and needs related to positions in the field of geospatial technology. What is particularly interesting is that these factors reflect the increasing importance of soft skills among geospatial competencies. In particular, cooperation and networking skills are in high demand among students of the 'e-Spatial Management' study programme.

**Table 2.** Occurrence of motivating factors on the analysed mind maps

| No. | Motivating factor | Number of indications |
|---|---|---|
| ***Technical skills*** | | ***58*** |
| 1 | Geographical Information Science and Technology skills (GIS&Ts) | 12 |
| 2 | Geographical Information Science and Technology knowledge (GIS&Tk) | 5 |
| 3 | Spatial Management competencies (SM) | 41 |
| ***Soft skills*** | | ***73*** |
| 4 | Cooperation and Networking skills (C&N) | 52 |
| 5 | Self-organization skills (Org) | 21 |
| ***General skills*** | | ***56*** |
| 6 | Academic competencies (Ac) | 56 |

We found a statistically significant correlation between the combined number of indications of motivation focused on gaining GIS&T skills and knowledge and spatial management skills, and the usage of the e-learning content devoted to GIS&T skills and knowledge (0.41, Table 3). A similar correlation value (0.44) was found between the combined number of indications of motivation focused on GIS&T and spatial management skills, and the usage of the e-learning content devoted to GIS&T skills. The correlation values may indicate that some of the students interested in GIS&T skills and spatial management competencies worked more frequently with the e-learning content focused on GIS&T skills.

**Table 3.** Correlation between motivating factors and the online behaviour of students

| No. | Motivating factor / e-learning content | Correlation coefficient | Statistical significance |
|---|---|---|---|
| ***Technical skills*** | | | |
| 1 | GIS&Ts / GIS&Ts | 0.36 | - |
| 2 | GIS&Tk / GIS&Tk | 0.21 | - |
| 3 | GIS&Ts + GISTk + SM / GIS&Ts + GISTk | 0.41 | + (0.05) |
| 4 | GIS&Ts + SM / GIS&Ts | 0.44 | + (0.05) |
| ***Soft skills*** | | | |
| 5 | C&N / C&N | 0.01 | - |
| 6 | Org / Org | 0.21 | - |
| ***General skills*** | | | |
| 7 | Ac / Ac | 0.32 | - |

We found low and statistically insignificant correlation values between several other pairs of motivating factors and the usage of the specific e-learning content (correlations between motivation focused on GIS&Ts, and the usage of the e-learning content devoted to GIS&Ts, between the number of indications of motivation focused on GIS&Tk and the usage of the e-learning content devoted to GIS&Tk as well as between motivation focused on Ac and the usage of e-learning content devoted to this kind of competencies were not statistically significant). We found also no significant correlation between the number of indications of motivation related to soft skills (especially C&N) and the usage of the e-learning content devoted to this group of skills. The results showed that the behaviour of students on an e-learning platform did not entirely reflect their motivation related to acquire soft skills and academic competencies, and only partially reflected their motivations to acquiring technical skills.

In the module *Distance learning methods*, where students could find e-learning content related to cooperation, networking and self-organization skills we found a relatively strong correlation (0.71, Table 4) between module assessment requirements and the online behaviour of students. A lower correlation value (0.40) between module assessment requirements and the students' online behaviour was found in the module *Spatial data models & geodatabases*, in the case of the e-learning content devoted to GIS&T skills and knowledge. This finding confirms that module assessment requirements may significantly interfere with the ways how motivation drives the usage of the specific e-learning content. Students may pay more attention to the content which at the beginning of the studies was less interesting for them, yet they found it useful and necessary to fulfil assessment requirements.

**Table 4.** Correlation coefficients between module grades and the usage of e-learning content by students

| No. | Module | Correlation coefficient | Statistical significance |
|---|---|---|---|
| 1 | Distance learning methods (C&N, Org skills) | 0.71 | + (0.01) |
| 2 | Philosophy of science (Ac) | 0.02 | - |
| 3 | Spatial data models & geodatabases (GIS&Ts, GIS&Tk) | 0.40 | + (0.05) |
| 4 | Data acquisition & GI infrastructures (GIS&Ts, GIS&Tk) | 0.09 | - |

The answer to the question whether the e-learning mode of studies allows students to effectively use learning content relevant to their motivation, and permitting them to acquire specific requested competencies is not straightforwardly positive or negative. For example, within the module *Spatial data models & geodatabases* students who had better grades spent more time with the compulsory and additional e-learning content. Organizational resources of the course helped some students to better understand the course aims, structure and assessment requirements and as a result, their performance was better than in the case of students who did not pay much attention to this content. In reference to technical skills, it seems that the e-learning mode of studies rather improved the efficiency of acquiring technical competencies by students.

However, the effectiveness of e-learning in acquiring technical competencies may also depend on the difficulty level of a given topic. The difficulty level is in turn closely related to the knowledge already possessed by students. In the e-learning environment, the learning is more successful when students can refer to their background and prior knowledge. On the one hand, if the given topic refers too much to what students already know they may feel bored. On the other hand, if the instructor has high expectations as to the prior knowledge of students necessary to understand a new topic while the level of this knowledge is rather low, such a situation may cause frustration on their side (Simson et al., 2006). The observations made by the instructor in the module *Spatial data models & geodatabases* confirmed this relationship. Students had problems coping with newly introduced topics related to eXtensible Markup Language (XML) and Structured Query Language (SQL). Half of the students responded to the relatively difficult XML topic by skipping it, definitely proving that e-learning failed in that case. The SQL topic was more successfully studied – the e-learning content allowed students to work on the assignment individually as long as they needed, and to complete the work. Interestingly, some students managed to cope with the topic on the basis of cooperative work and therefore the use of e-learning content expressed as the number of logs was limited. It was observed that several students preferred to receive instructions from other students than to look for the original documents on the e-learning platform. Such behaviour that in practise means a lack of students' online presence is annoying for the module instructor and difficult to interpret. It may suggest students' anxiety about the usefulness of computers (Bach et al., 2007) or just manifest their strong preference towards face-to-face learning.

A similar preference may mean that students interested in acquiring academic skills and soft skills were rarely searching for them on the e-learning platform. It is really a question whether students perceive it is easier for them to acquire specific skills in distance learning than in face-to-face learning, and based on their attitude they just choose a more straightforward solution. As part of the e-learning content in the analysed modules was marked as mandatory, it is difficult to confirm clearly the above assumption. Although sometimes practised, a forced choice of e-learning for some parts of the classes as the only method of learning may cause an increase in students' frustration, a decrease in their motivation and a high risk of poor learning,

and for these reasons it is not recommended (Bach et al., 2007). To answer this question, the simplicity or complexity of acquiring technical and soft skills should be addressed. It seems that the e-learning platform was more often successfully used by students to assist tasks focused on technical skills, because of the rather simple nature of these tasks. It was quite quick and easy for the module instructor to distribute online spatial data, software and instructions which were needed to accomplish technical tasks. On the one hand, to benefit from these possibilities students do not need to possess any advanced online skills. Additionally, distribution of this kind of materials outside the e-learning environment would be rather problematic.

Activities that support students in the process of acquiring academic and soft skills are more complex, especially with reference to tasks that encourage collaboration between students and supervise their progress. Provision of such a support on an e-learning platform is, therefore, more time-consuming for the course instructor and requires him or her to consider in advance several possible scenarios. At the same time, students need to be more patient, assiduous and more experienced in online learning. Therefore without any direct advantages or evident incentive on both sides – instructors and students – online learning may not be an interesting alternative to the face-to-face classes and may not be successfully practised.

## 5. CONCLUSIONS

The study confirmed that motivating factors indicated by students of the "e-Spatial Management" study programme are rather convergent with current models and needs related to the competencies in the field of geospatial technology. They reflect the increasing importance of soft skills, especially in relation to cooperation skills. However, according to the analysis of students' online behaviour, students do not keenly seek this kind of skills on the e-learning platform. Also, general academic competencies are not practised online as a preference. It seems that technical skills are more likely trained at a distance than soft skills, because the nature of this kind of competencies is rather simple in comparison to the complexity of soft and academic skills. Also in this case, however, the potential of e-learning is associated with the level of difficulty of a given topic. Topics already familiar to students were more successfully studied further online than new complex issues.

It was shown that module assessment requirements could influence the relationship between students' declaration towards motivating factors and their behaviour on an e-learning platform. Therefore further work is recommended to investigate how this factor relates to the online behaviour of students and how it means that they adopt the proposed learning strategies allowing them to complete the course and obtain a good grade rather than follow their motivating factors. It seems that a balanced composition of both these driving forces could have a positive effect on the learning performance even if a considerable amount of the learning process within a module is moved to the e-learning environment.

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# SPATIAL SKILLS DEVELOPMENT IN OUTDOOR EDUCATION: A COMPARISON BETWEEN GRADUATE STUDENTS AT THE UNIVERSITIES OF MÁLAGA (SPAIN) AND LINKÖPING (SWEDEN)

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## Abstract

The learning of geospatial skills is essential as a transversal matter in many disciplines and as a fundamental skill in lifelong learning. Outdoor Learning offers a perfect scenario to teach such skills in a more active and efficient way. This paper presents the development of these issues with a group of postgraduate students from the University of Málaga (Spain) and Linköping (Sweden) by a set of activities specially created for such a goal. After some introductory classroom and field-trip sessions, practical activities were carried out in order to encourage the use of new technologies in geolocation in connection with historical heritage awareness. At the end of the experience it was conducted an analysis of results from questionnaires with the participant groups. The content of these questionnaires deals with important educational issues such as the opinion of students or the skills acquisition after the experience.

***Keywords:*** *Outdoor Learning, Spatial skills, Field trip, ICT, Geolocation.*

## 1. INTRODUCTION

This paper deals with the development of an educational action carried out in Linköping (Sweden) and Málaga (Spain) where the use of new technologies, spatial geolocation, heritage awareness and outdoor activities are joined together to contribute to the improvement of spatial and digital skills by the students. Levels of satisfaction and learning perceived by the participants were evaluated by using a questionnaire.

Our purpose is to encourage Outdoor Education in a formal education environment, and with students from any educational stage or subject, beyond the area of Geography.

## 2. BACKGROUND

Outdoor Education is a very recent line of work and research, but it has a large number of supporters worldwide, it is strongly rooted in countries such as United States, Canada, Australia, New Zeeland or Southeast Asia (Nicol, 2002; Lugg, 2007; Ross, Higgins and Nicol, 2007; Ho, 2014).

However, up to 1980 Outdoor Education was given little scholarly attention. Since then, experiences and movements allowing its consolidation as a methodology for learning have increased. The following cases can be highlighted: United Kingdom (Outward Bound movement), Scandinavia ("friluftsliv" or open air), Germany ("Erlebnispädagogik" or experiential pedagogy) and more recently in North America and Australia (Higgins y Kirk: 2006; Beames, Higgins and Nicol, 2011; Gray and Martin: 2012). At all events, many studies have proved the actual increase in Outdoor Education, because it improves the relation between students and environment, resulting in positive effects in their education (Ross, Higgins and Nicol, 2007; Waite, 2007, 2010, 2011; Schmidinger, Molin and Brandt, 2014).

### 2.1 Literature review

Outdoor Education has a strong pedagogic component benefited from different disciplines such as Geography, Environmental Sciences, History or Physical Education, among others. In spite of being a new academic approach, Dahlgren and Szczepanski (2007, 11-22) indicate the importance of its inclusion in the learning processes, recognised by philosophers, scientists and education theorists of all time (Plato, Aristotle, Parmenides, Democritus, Socrates, Zeno, Seneca, Descartes, Spinoza, Locke, Hume, Kant, Schelling, Hegel, Darwin,...). They highlight, particularly, the works of authors such as Comenius, Rousseau, Basedow, Pestalozzi, Fröbel, Ellen Key, Piaget, Dewey and Molander, among others, who praise the direct use of the environment and experiential learning, as fundamental methods for education. Moreover, more recent studies (Dyment and Potter, 2014) advocate for its inclusion in the academic world as a discipline. Outdoor education improves the students' ability for interpreting and analysing the processes and phenomena of their environment, by combining conceptual, theoretical and experiential knowledge (Dahlgren and Szczepanski, 2007, 23). In that way, the landscape becomes a basic setting to apprehend and learn the relations between environment and society, which shape all its elements. It is a multi-sensory experience, where what you have learnt settles in your mind for a longer time, because, as stated by Dahlgren and Szczepanski (2007, 51), "a combination of feelings, action and thinking characterises the educational perspective of a highly pragmatic action-focused outdoor education".

Outdoor Education can be conducted in various settings, through different activities and to reach diverse purposes, by nature-based experiences pursuing a sustainable life (Davis, Rea and Waite, 2006; Clarke and Mcphie, 2014; Nicol, 2014), museum-based learning experiences, (Holmes, 2011), by promoting team working in higher education (Cooley, Burns and Cumming; 2015) and fieldwork at school to know the neighbourhood (Beames and Ross; 2010), establishing urban routes to improve the perception of students of secondary schools in areas at risk of social exclusion (Delgado, Campoy and Subires, 2015), the use of digital technology as a learning tool (Zimmerman and Land; 2014; Lai et al., 2013; Lombrinos and Asiklari; 2014; Esteves and Rochas: 2015), or encouraging sport activities (Gatzemann, Schweizer and Hummel, 2008). The wide range of experiences, ways of application and types of students indicates the high academic interest that this emerging discipline arises worldwide.

## 3. METHODOLOGY

### 3.1 Educational context of the experience

The action was carried out in the context of two official Master's programmes offered by Linköping University (Sweden), "MSSc in Outdoor Environmental Education and Outdoor Life", and the University of Málaga (Spain), "Master's Degree in Teaching Compulsory Secondary Education, Post-Compulsory Secondary Education, Vocational Training and Languages", respectively.

The first one consisting of 60 ECTS credits, has two versions, one in Swedish and the other in English for foreign students mainly, it aims at how outdoor studies can enhance learning and contribute to healthy habits, sustainable development and active citizenship (LiU, 2015a). It is organised by the National Centre for Outdoor Education, a subunit of the Department of Culture and Communication at Linköping University.

The programme focused on experiential learning based on nature, culture and society. Teaching includes outdoor field-related experiences in cultural and natural landscapes, and how society, natural and cultural landscapes can be used as resources for learning and understanding our physical environment.

Main skills acquired by the students in the programme (LiU, 2015a) related to their knowledge and promotion of activities outside the classroom to further develop a better understanding of the environment and more responsibility for health, citizenship and sustainability, by using landscape and environmental and cultural experiences as resources for learning.

The programme comprises four modules (LiU, 2015b): Theory of Outdoor Education, Methods of Inquiry and Theories of Research, Outdoor Education and Outdoor Didactics, and Thesis.

The second one is a Master' programme comprising 60 ECTS credits, multidisciplinary and focused on training and qualifying graduates from different university degrees for work as teachers in Secondary Education, Vocational Training and Languages (UMA, 2016a). This Master' programme is organised by the Faculty of Education at the University of Málaga.

The programme focuses on pedagogic and didactic training for those education stages, by providing an appropriate cultural, personal, ethical and social background for the teaching practice, promoting collaboration with other school professionals and the use of classroom-based research processes, and favouring understanding the relations between learning models, school context and the didactic options for the teaching practice (UMA, 2016b).

The program comprises four modules (UMA, 2016b): Generic, Specific, Practicum and free choice credits.

### 3.2 Activities carried out to develop geo-spatial skills

#### *3.2.1 The seminar "Developing geolocation skills in outdoor activities"*

Within both Master's programmes, we held a nine-hour theoretical/practical seminar, over 2 consecutive days at Linköping University (Table 1), and 5½ hours over 4 non-consecutive days at University of Málaga (Table 2).

**Table 1.** Seminar Schedule at Linköping University

| Time | Location/Methodology | Content |
|---|---|---|
| Day 1 | | |
| 30 minutes | Computer room/Instructor presentation | Module presentation. Introduction to geolocation skills |
| 1 hour | Campus Valla LiU/Outdoor practical activity | Breaking the ice: Geolocation activity at LiU Campus Valla |
| 1 hour | Computer room/Instructor presentation | Project OUTDOOR ICT (Objectives, methodology, outcomes) |
| 2 hours | Computer room/Teamwork | Design of activities to promote geolocation skills at Linköping Old Town |
| Day 2 | | |
| 3 hours | Linköping Old Town/Outdoor practical activity | Geolocation activities carried out at Linköping Old Town |
| 1 hour 30 minutes | Computer room/Discussion | Final session: Seminar assessment and conclusions |

**Table 2.** Seminar Schedule at the University of Málaga

| Time | Location/Methodology | Content |
|---|---|---|
| Day 1 | | |
| 30 minutes | Computer room/Instructor presentation | Module presentation. Introduction to geolocation skills |
| 1 hour | Campus Teatinos UMA/Outdoor practical activity | Breaking the ice: Geolocation activity Campus Teatinos UMA |
| 30 minutes | Computer room/Teamwork | Design of activities to promote geolocation skills at Málaga Old Town |
| Day 2 | | |
| 1 hour 30 minutes | Computer room/Teamwork | Design of activities to promote geolocation skills at Málaga Old Town |
| Day 3 | | |
| 1 hour 30 minutes | Málaga Old Town/Outdoor practical activity | Geolocation activities carried out at Málaga Old Town |
| Day 4 | | |
| 30 minutes | Computer room/Discussion | Final session: Seminar assessment and conclusions |

In Linköping, the seminar was held with all the participants in the English version of the programme, coming from different countries. The group included 13 students from Greece, China, Austria, Finland, Germany, Island, United Kingdom and India. All were females but one male participant coming from Greece, most of them with previous degrees in Pedagogy and/or Teaching (except an Engineer).

In Málaga, on the other hand, there were two groups with 41 students each one (Groups C and J), most of them with Spanish nationality and quite balanced in respect to their sex (43 men and 39 women), All of them with a previous degree in History, Art History, Geography or Philosophy.

This seminar presented three fundamental aspects:

1. To encourage digital skills in general (particularly those related to geolocation,
2. To promote active learning methodologies linked to outdoor activities,
3. To develop activities to improve heritage awareness about our natural, historical and cultural environment.

Those were key aspects in the results of the project OUTDOOR ICT (ref. 2011-1-HU1-GRU06-03650-2), funded within the Lifelong Learning Programme of the European Union (Delgado, 2013).

Building on this context, we carried out a learning experience in the area of the development of geolocation skills by using common handheld GPS devices (mobile phones or tablets) with free software (Commander Lite, Google Maps, Google Street View o Google Goggles). The seminar was held at Campus Valla LiU and Campus Teatinos UMA, as well as at the Old Town of Linköping and Málaga.

Our theoretical/practical seminar, "Developing geolocation skills in outdoor activities", perfectly fitted in both Masters' programmes, for both content and methodology (alternate sessions in the classroom and outdoors). The main difference was that in Linköping it was carried out during two consecutive days as a block, while in Málaga it had to be adapted to the timetable of other subjects and activities, so it took more days.

To meet the goals of the seminar, a dynamic was created where participants could increase their interest in Geography (as they mostly were students of Pedagogy, Teacher Education, History or Art History), and improve the learning of different skills useful for their professional practice: use of digital devices, geolocation, spatial orienteering, appreciation of the heritage richness of their local area, encouragement of a healthy lifestyle, among other things. All those abilities are included in the general objectives of both Master's programmes. Therefore, we decided to choose an activity that drew together all these aspects. Orienteering and Geocaching offered multiple possibilities to reach those goals, because they are activities that integrate mental and physical exercise and command of technology (applications, websites, mobile phones, GPS devices, etc.), where age is not a limiting factor, as it can be adapted to all ages and levels (Tejedor Lorenzo, 2006).

### *3.2.2 Breaking the ice: a route through at Campus Valla LiU and Teatinos at UMA*

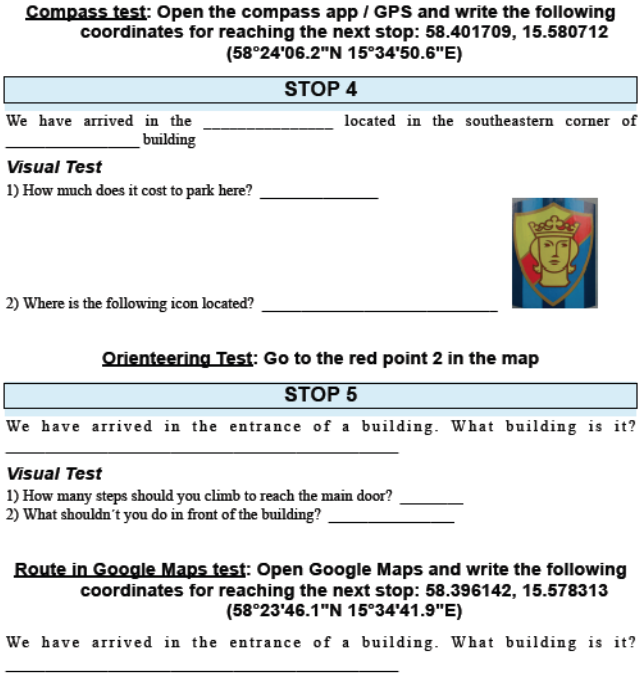
One of the first activities, carried out in the seminar to break the ice and start from the beginning with an active outdoor methodology, was to prepare a route through Campus Valla at Linköping University and Teatinos at UMA, where participants had to reach progressively 6 different stops, as well as to pass 2 visual tests by answering ten questions related to visual elements near the stops.

They were provided with an instruction sheet with the cues to get to the different stops and the questions to be answered at every stop (Figure 1).

To get to the stops, students had to carry out three types of activities related to geospatial skills:

- Orienteering Test. The location of the place to be reached was indicated by a red dot on a map of the area, participants should use the map to orientate themselves and establish the best route to get to the place.
- Test with Compass. They were given the next place coordinates (latitude and longitude) and they typed them in a GPS device or some app (e.g., Commander Compass Lite), which indicated with a compass the direction and distance to the stop to be reached.
- Test with online maps. They were given the next place coordinates (latitude and longitude) and they typed them in Google Maps, which established the route on

foot to be followed on the map of the area. In this case, they only had to follow the route marked by the software.



**Compass test: Open the compass app / GPS and write the following coordinates for reaching the next stop: 58.401709, 15.580712 (58°24'06.2"N 15°34'50.6"E)**

**STOP 4**

We have arrived in the _____ located in the southeastern corner of _____ building

***Visual Test***

1) How much does it cost to park here? _____

2) Where is the following icon located? _____

**Orienteering Test: Go to the red point 2 in the map**

**STOP 5**

We have arrived in the entrance of a building. What building is it? _____

***Visual Test***

1) How many steps should you climb to reach the main door? _____
2) What shouldn´t you do in front of the building? _____

**Route in Google Maps test: Open Google Maps and write the following coordinates for reaching the next stop: 58.396142, 15.578313 (58°23'46.1"N 15°34'41.9"E)**

We have arrived in the entrance of a building. What building is it? _____

**Figure 1**. Fragment of the instruction sheet for the route at Campus Valla, LiU.

By alternating the types of tests, we promote the use of different materials and resources, so helping to understand different contents and to encourage the acquisition of several geospatial skills (Table 3), distinguishing between complex and simple spatial orientation. Their difference is that, in complex orientation, students must know how to interpret a map, to position themselves, to locate the starting and finishing points of a route, and to establish the best itinerary, knowing the different elements (buildings, streets, squares, parks, etc.) present on the map, while in simple orientation, they must only know how to follow a route established by a digital device, either by a compass or by a line marked on a digital map. The level required for the orientation skill is different in both cases.

**Table 3.** Main didactic aspects of the geolocation tests on the routes at the University campuses in Linköping and Málaga

| Materials | Concepts that should be known | Skills that can be achieved |
|---|---|---|
| Orientation Test | | |
| Physical map | Cardinal points<br>Scale | Complex spatial orientation<br>Map interpretation |
| Test with Compass | | |
| Digital compass (GPS device or app for cellphone/tablet) | Longitude, Latitude<br>Cardinal Points<br>Basic Essentials of Compass | Simple spatial orientation<br>Compass use<br>Basic digital skills |
| Test with online maps | | |
| Digital map (GPS device or app for cellphone/tablet) | Longitude, Latitude<br>Cardinal Points<br>Scale | Simple spatial orientation<br>Map interpretation<br>Basic digital skills |

The activity as a whole draws on the philosophy of Geocaching, activity whose aim is to hide objects in the countryside or in a town, to note down their coordinates and make them public so that other users can seek them with a GPS location device. The hidden object usually is a container, of different sizes, depending on the point, with some message, a guestbook or even gifts, and where the user may opt for taking one on the condition that another one is left in its place. In our case, for logistic reasons, caches were replaced with visual tests encouraging students' observation, intuition and critical reasoning.

It is worth noting that before the field trip, it would be right to hold a session in the classroom to introduce the students to the different devices and computer applications to be used. It must also be highlighted the importance of creativity when establishing the stops and their tests. For example, in one the stops a spiral staircase was used for two reasons: to promote healthy habits and less sedentary lifestyles (walking up stairs instead of taking the lift) and to learn in a basic but vivid way, how the landscape offers at ground level a very different perspective that from a bird's eye view. So, they should discover from above which geographic element they could espy. It was a compass drawn on the ground a few metres away from the stairs and made up of tiles. Many were surprised for having passed so many times and not noticing the compass until then. The interpretation of aerial photography, and lately, remote sensing have therefore become common techniques in Geography.

The route at Campus Valla (LiU) was 3.2 km long and its duration was 74 minutes (Figure 2). The route at Campus Teatinos (UMA) was 2.7 km long and lasted 62 minutes.

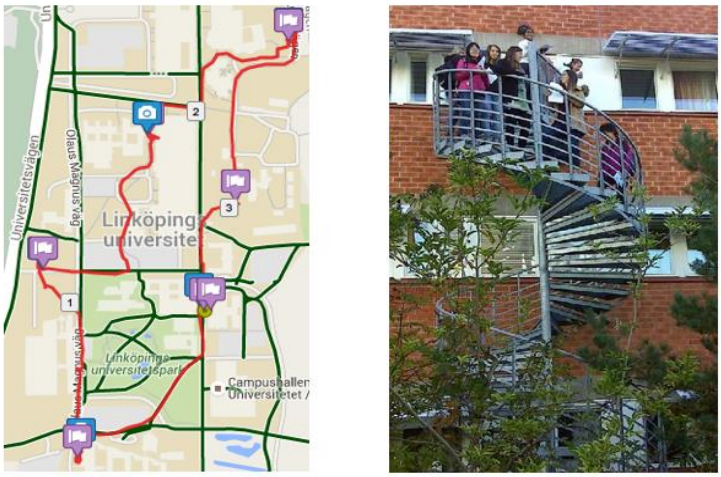



**Figure 2.** Route taken at Campus Valla LiU and an image of the southernmost point

### *3.2.3 Team working: Thematic routes at Linköping and Málaga old towns'*

After taking the route at the University campus, the following activity was proposed to the participants: they should make, building on the experience carried out in the morning, a route at old town, but taking into account the following aspects:

- The route should have three stops and two tests (mainly visual) at every stop.
- Their length should be 45 minutes at the most.
- They could use three types of tests according to their tastes and availability of materials, by using all the three types, two of them or only one.
- Moreover, what is most important and distinct from the morning route: They should create a thematic route, i.e. the three stops should have some kind of connection among them to give meaning to the route as a whole.

The class was divided into groups and each one worked on its route with support from the instructor. The intention of adding the thematic aspect was that instead of finding a cache, a physical object, as they usually do in geocaching activities, the "cache" would be the place itself, by establishing in every stop two tests. Thus, it was encouraged at the same time the development of geographical skills of vital importance such as orientation, map interpretation (map of the town) and observation of the environment, together with digital skills by using geolocation software (Google Maps and Google Street View) in common devices such as smartphones or tablets. We also used Google Goggles, a computer application that allows identifying, with images from our own device, objects or landmarks, by providing information about them. It is worth noting that users themselves uploaded the database of images and information related to the different places in a collaborative and selfless way, which it is a significant example of what we know as a web 2.0 or social web. Learning those applications may be useful for the acquisition of digital skills (To process and upload images and texts, search information, etc.) and the awareness about heritage and environment (highlighting landmarks or places of special natural and/or cultural importance).

Being an activity focused on the significance of places added an element of awareness of their cultural or heritage value, enhanced by using Google Goggles, if wanted. Moreover, since a team conducted the activity, it also encouraged collaborative work and social skills.

In the following session, the students took the three routes. At Linköping University, although it was somewhat strenuous because they took them one after another, covering some 6.7 km in 2 hours 45 minutes, the result was highly satisfying:

- In general, the three routes complied quite well with their allotted time. Only one of them took more time because a fourth stop was added, which could not be reached but it would have given the route a special component.
- All the groups focused their routes on locate their points through digital maps (Google Maps). That is a widely used application that they are very familiar with, which favoured their choice. Orientation tests were not established (maybe because they wanted to use the digital component), nor were those with compass (maybe because of the need of using a more specific software).
- Regarding the thematic aspect of the routes it must be emphasised a very high motivation for their elaboration and originality, as they were interesting and even entertaining.

Those routes were:

1) A walk through Central Park in Linköping (Trädgårdsförening), visiting different places of interest such as the Tropical House, the Belvedere Tower or the Nature Centre. This group used Google Goggles, although they did not find with it any of those monuments,
2) Swedish typical food, visiting different shops such as a bakery, a fishmonger's shop and a supermarket, emphasising their typical products and their anecdotes.
3) Sweetshops, visiting three of the most popular in the city, and highlighting some curious anecdotes. A fourth stop, curious but necessary, completed the route: Consultation at the local dentist's office.

- Creativity in the tests must also be highlighted. As well as visual tests, the groups included questions where they should do some physical activity or ask people working at the established places about particular aspects.

At the University of Málaga, carrying out the different prepared itineraries was somehow more complex, as there were many groups and they could not take the routes at the same time. Moreover, not all the groups prepared itineraries, although they did participate in the practical session at the city centre. Besides, the time devoted to the activity at the city centre was an hour and a half against three hours taken in Linköping. Due to all the above, and for practical reasons, they took jointly an only route, so that after finishing it, each group had the opportunity of taking one or two more routes by their own in a specified time. Afterwards, all the groups met at a place to finish together with the activity. The outcome was also satisfactory:

- The routes adjusted quite well to the strictly geographic area of Málaga old town. Only a route had some more distant points, so that they could not be finished.
- Most itineraries, alternated test for locating points on a map and orienteering tests based on previously given geographic coordinates by using Google Maps. Only a group chose to use exclusively points on a map. None of the groups used orientation with compass, maybe for the need of using specific software they were less familiar with.
- In respect to the thematic nature of the routes it is worth noting the high motivation for their preparation and originality, all of them were interesting and even curious. Some of the routes chosen were:

    1) "To discover Málaga among books and paintings: archives and museums", visiting some of the most relevant buildings in this line of Málaga old town.
    2) "Route of historic bars in Málaga", visiting three of the oldest bodegas in the city.
    3) "Explore the different historical periods in Málaga", taking a walk through the main landmarks from the contemporary age to the Phoenician age.
    4) "Archaeology of Roman Málaga", giving some additional information so that participants answered some questions about locating elements of the Roman town.
    5) "From museum to museum and the Game of the Goose", locating some of the most important museums in the city.
    6) "Civil War in Málaga", a very original route and even quite unknown, visiting some landmarks (e.g. the place where political prisoners were held) from this event of the recent Spanish history.
    7) "Routes of Málaga Sculptures" highlighting these significant elements of the street furniture.

- It is worth noting the creativity of the tests. Besides visual tests, the groups included issues such as asking questions or doing some physical activity, although by the content of most routes it is clear the background of the participants, most of them came from History and Art History.

## 4. ANALYSIS

Once the activity had finished, in both Linköping and Málaga, a survey was conducted among the students to know their opinion about the activity carried out, the abilities acquired in it and how useful was what they had learnt from their daily life and their academic and/or

professional performance. The questionnaire includes open-ended and close-ended questions; and a Likert scale was used as an assessment tool.

Having results from the same activity in two different spaces, although in similar contexts –two postgraduate master's programmes for training teachers of social sciences- allow us drawing conclusions from the relevance, interest and adequacy of the activity to the student's profiles, and also making comparisons between both experiences.

In Linköping, ten out of thirteen students (76.92 %) participating in the seminar answered the survey, while in Málaga, where there were 82 students matriculated in the course (divided into two groups), answered 37 of them (42.05 %). Although the percentage of participation in the survey in Málaga was lower, the results obtained from the 47 answered questionnaires are significant enough to make a comparative analysis of both experiences, and to draw some initial descriptive conclusions applicable to the participating groups and some evidence about the usefulness of training Social Sciences' teachers in the development of geospatial skills for outdoor education.

In respect to the profiles of the students participating in the survey, while in Linköping predominate the female sex, nine out of ten answers were women (90%), in Málaga the number of men was higher than that of women (56.76 % against 43.24).

In Linköping, their ages ranged from 22 to 26 years, and the Degree obtained before taking the MSSc in Outdoor Environmental Education and Outdoor Life was related to the field of Education (Pedagogy, Primary Education, Physical Education, Chinese as a Foreign Language), except an Engineering graduate. As it was a Master's programme with an international focus, imparted in English, The students had taken their degrees in seven different countries, 5 in Europe (Austria, Finland, Greece, Island and the United Kingdom) and 2 in Asia (China and India).

In Málaga, the range of age was much wider, from 22 to 58 years, although most students were in a bracket from 22 to 27 years old. The average age, however, was 28 years, because there were six people over 30 years –three of them over 50–. As their speciality was Social Sciences (Geography and History, and Philosophy) within the "Master's Degree in Teaching Compulsory Secondary Education, Post-Compulsory Secondary Education, Vocational Training and Languages", the students came exclusively from that field of study. Participants with a Bachelor's Degree in History (64.87%) dominated over students with a Degree in Art History (21.62%), Geography (10.8%) and Philosophy (2.7%).

Let us start with the analysis of the results. When consulting students about the interest, relevance and utility of what they had learnt from their everyday life and professional practice, in Linköping (Figure 3) there is a majority of those rating these aspects with 4 or 5 (agree and absolutely agree). Thus, 90 percent of those surveyed agree or absolutely agree that what they had learnt was relevant, interesting and useful for their everyday life, and 80 percent for their professional life.

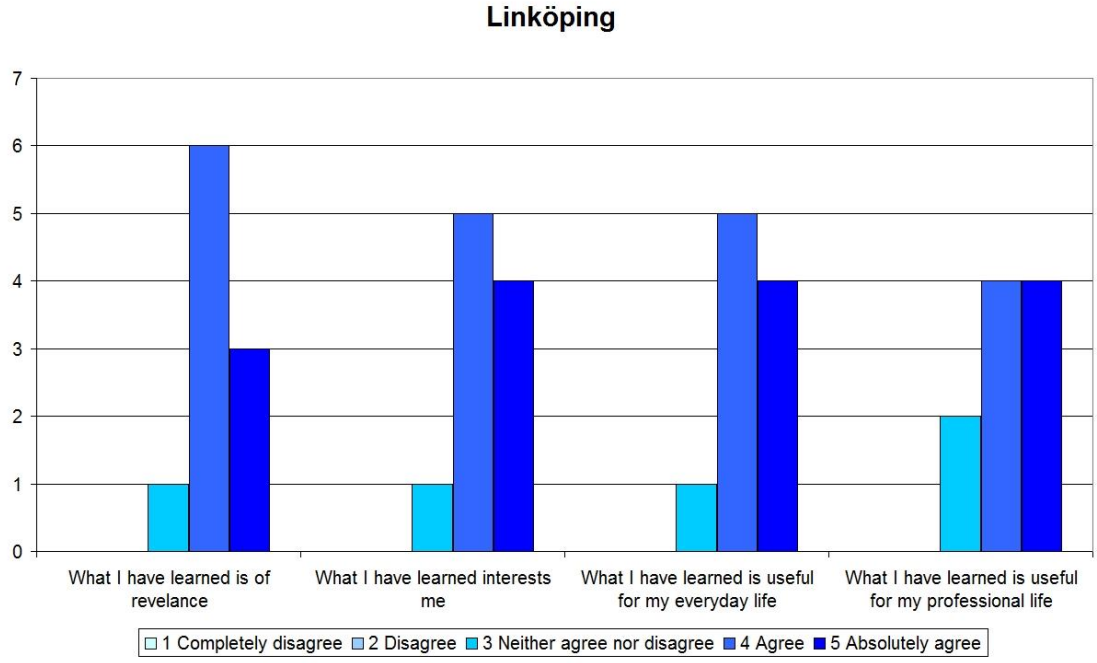



**Figure 3.** Opinion about the relevance, interest and utility of what they had learnt

In Málaga (Figure 4), there also was a prevalence of positive opinions. However, some differences with Linköping can be observed. Thus, to the question about the utility for everyday life, although the number of positive opinions (4 and 5) was higher, the most repeated option was 3 (neither agree nor disagree). In proportion, two thirds (67.57%) of the surveyed agree or absolutely agree with what they had learnt was relevant, for three quarters (75.67%) it was interesting and useful for their professional practice, and for a proportion slightly below a half (48.65%) it was useful for their everyday life.

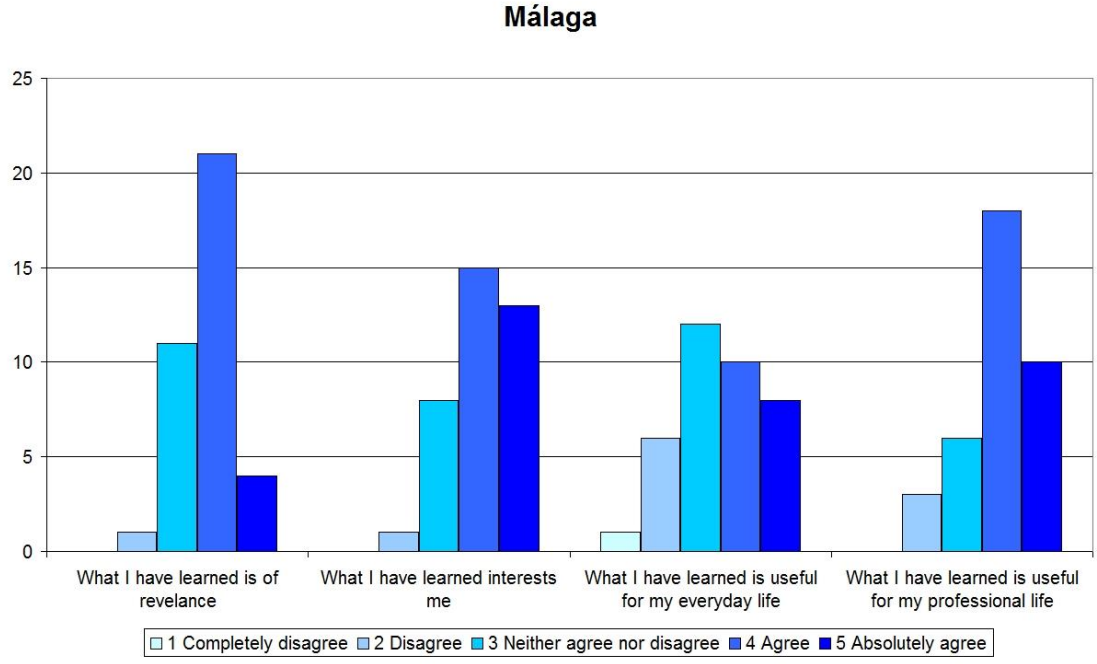



**Figure 4.** Opinion about the relevance, interest and utility of what they had learnt

By comparing the average rates obtained in Linköping and Málaga (Figure 5) respectively, we observed that points in Málaga were lower than those in Linköping, particularly, for the question about utility for everyday life. To look for a possible explanation for that we should consider the profiles of the students targeted for this training programme, although in both cases it was training for teaching Social Sciences. Thus, while in Linköping they were students of a Master's programme focused on outdoor education, in Málaga the programme was intended for secondary school teachers. The preconceived idea they had about their future teaching practice was different (the former in the open air, the latter in traditional classrooms), and this seems to influence their own perception of the relevance, interest and utility of what they had learnt. There was little difference in the case of utility for professional life, but highly evident in the case of utility for everyday life. Although there are no available data about the high or low level of sedentary lifestyle and physical activity of the participants, it can be observed differences in their lifestyle habits.

In the light of the results, students from the master's course in Linköping seem to be more inclined than those from Málaga to carry out outdoor activities requiring geospatial abilities – not only in a professional way, but also in a personal way, in their leisure time, or in their everyday life, and in their interaction with the environment- and to consider the course to be more useful. Moreover, in Linköping, students came from different countries of world, and since they are people that had learnt to manage themselves outside their own environment, the development of this kind of abilities was basic for them.

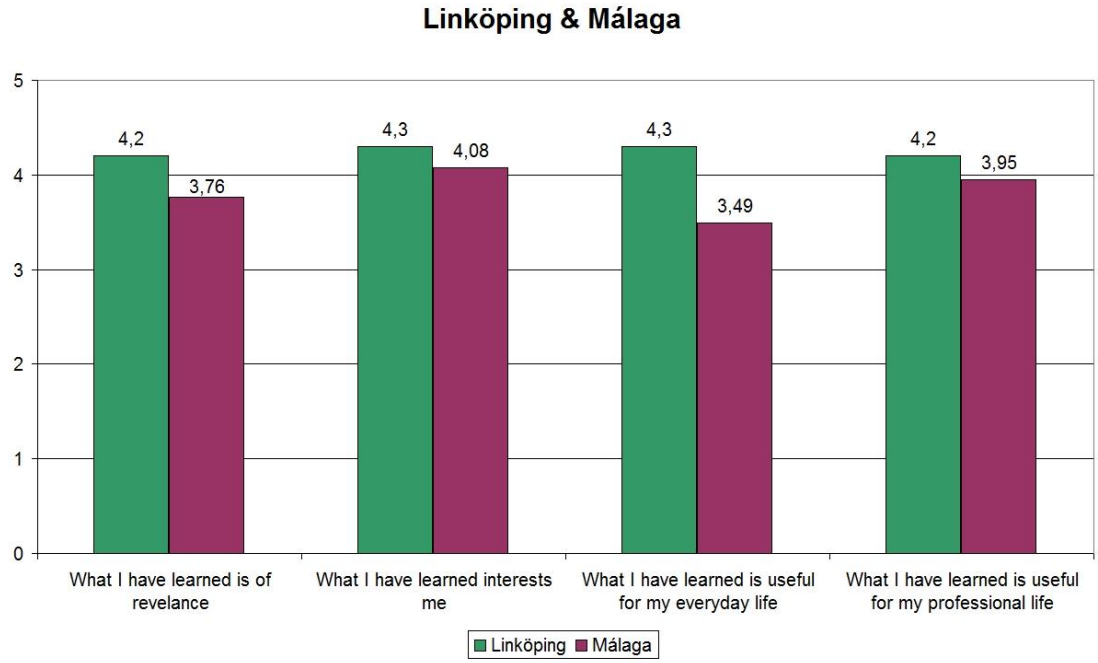



**Figure 5.** Opinion about the relevance, interest and utility of what they had learnt

The level of satisfaction in Linköping (Figure 6) with the methodology used, the atmosphere in the classroom, the support received and the way that classes were given, was very high. There were 90% of positive opinions for methodology and 100% on the three other questions presented. The was no negative opinion ant it is worth noting the high level of satisfaction with the way classes were given, rated with a 5 by all the students that responded to that question.

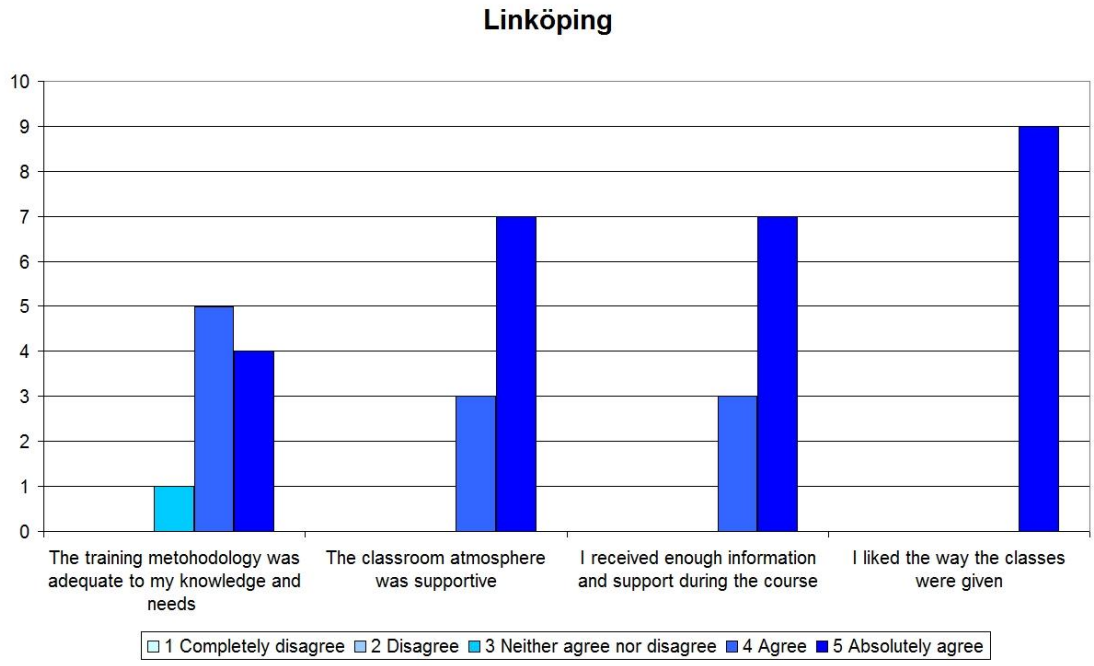



**Figure 6.** Methodology, support in the classroom and level of satisfaction with the teaching

In Málaga (Figure 7), it can also be noticed a high level of satisfaction with all the questions presented, with no negative opinion. 78.38 percent agree or absolutely agree with the methodology used, 94.59 with the statement that the atmosphere in the classroom was supportive, 89.19 percent with the information and support given during the course and 81.08% with the way the classes were given.

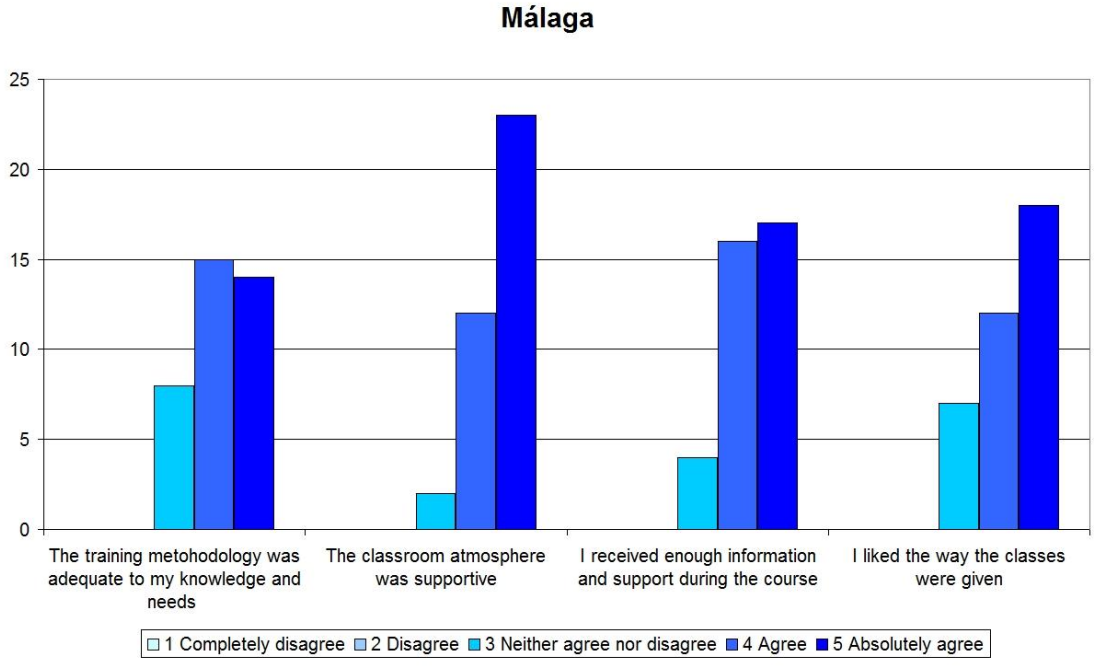



**Figure 7.** Methodology, support in the classroom and level of satisfaction with the teaching

Although in this case, the level of satisfaction was very high in Linköping and Málaga (Figure 8), a little difference can be observed and the values from Linköping are again, for all the items, slightly higher than those from Málaga.

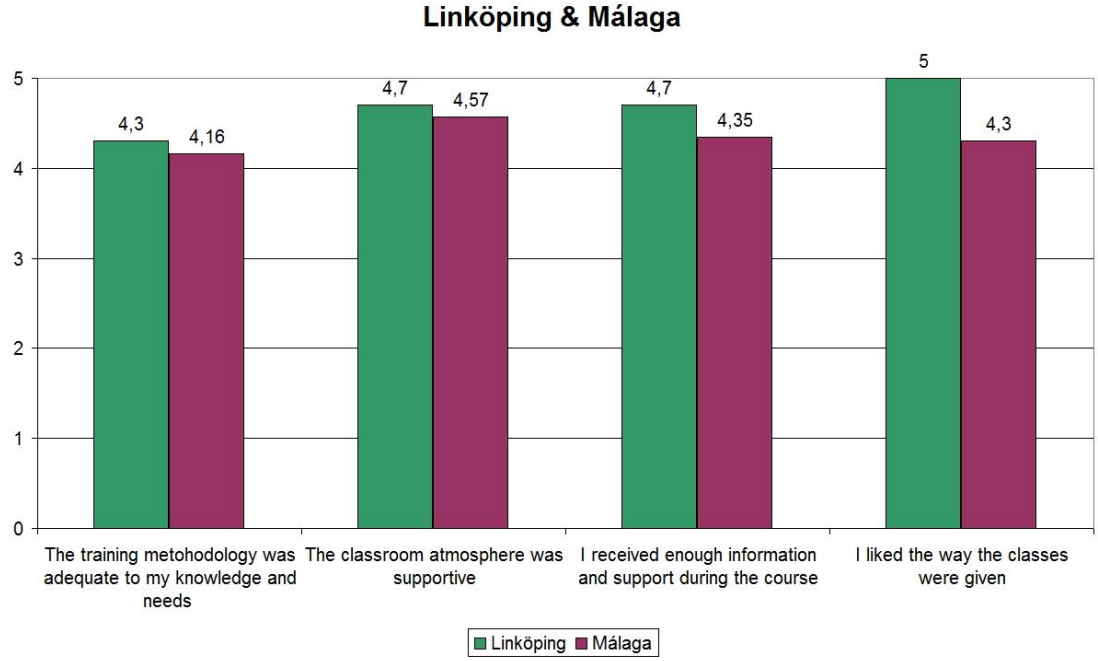



**Figure 8.** Methodology, support in the classroom and level of satisfaction with the teaching

Students' participation and their level of motivation were other key issues for assessing the activity. In Linköping (Figure 9) all the students surveyed –except a person that neither agrees nor disagrees- consider that they actively participate in the development of the classes. As for levels of motivation, the highest increase was for outdoor activities -90 percent of positive responses- and team working -100 percent-. The level of high motivation when using tools was 80 percent.

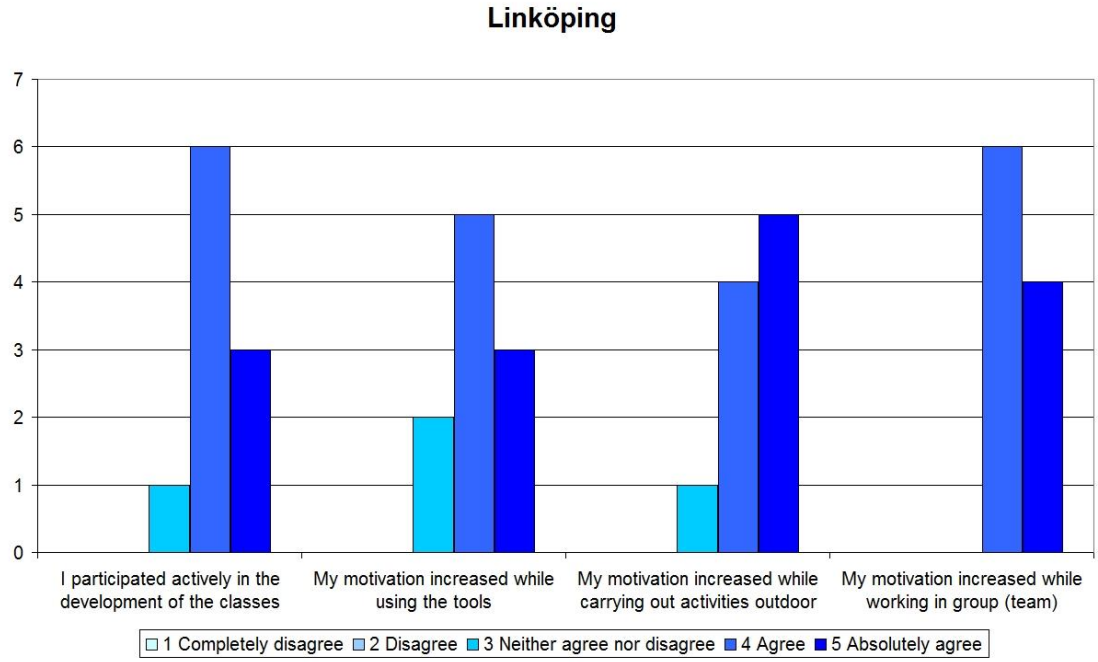



**Figure 9.** Participation and level of motivation

In Málaga (Figure 10), 81.08 percent of the students answering the survey considered that they actively participated in the development of the classes and most responses were 5. In

respect to the levels of motivation, the highest rating was for outdoor activities (89.19 percent) and team working (86.49 percent). The increase in motivation was lower when using tools (67.57 percent of positive responses).

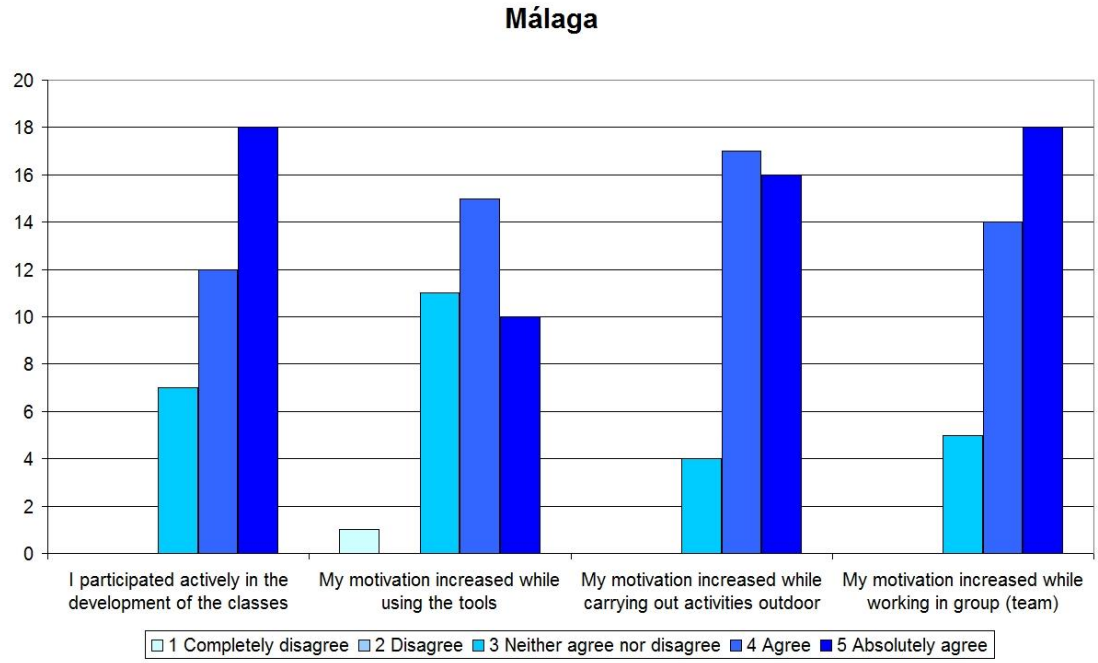



**Figure 10.** Participation and level of motivation

Calculation of average ratings (Figure 11) allowed us to notice that there was a strong similarity between Linköping and Málaga. In addition, it can be observed that students from Málaga gave a higher rating for their active participation in class than those from Linköping. In respect to the levels of motivation, in both cases, the increase of motivation is higher when they carry out outdoor activities and when they work in groups, and slightly lower when using tools.

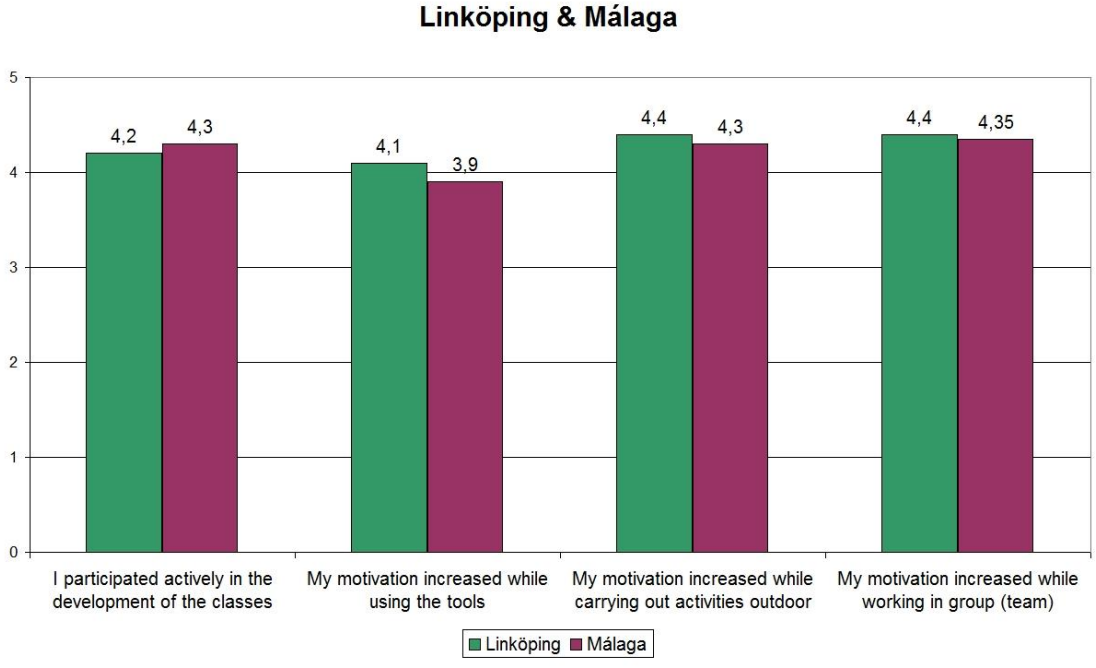



**Figure 11.** Participation and level of motivation

In Linköping (Figure 12), all the students participating in the survey indicated that the seminar met their expectations.

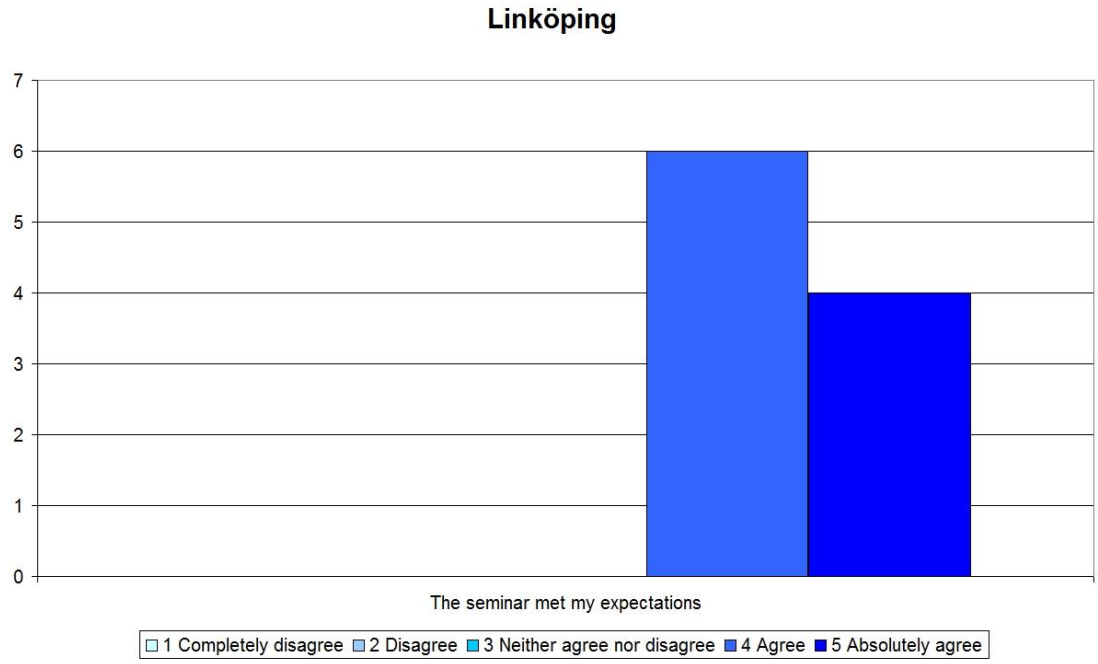



**Figure 12.** Fulfilment of the expectations

In Málaga (Figure 13), the students for whom the activity met their expectations were a majority of (86.49 percent). There also were 10.81 percent who neither agree nor disagree, and 2.7 percent (one student) who rated negatively the fulfilment of his expectations, with 2.

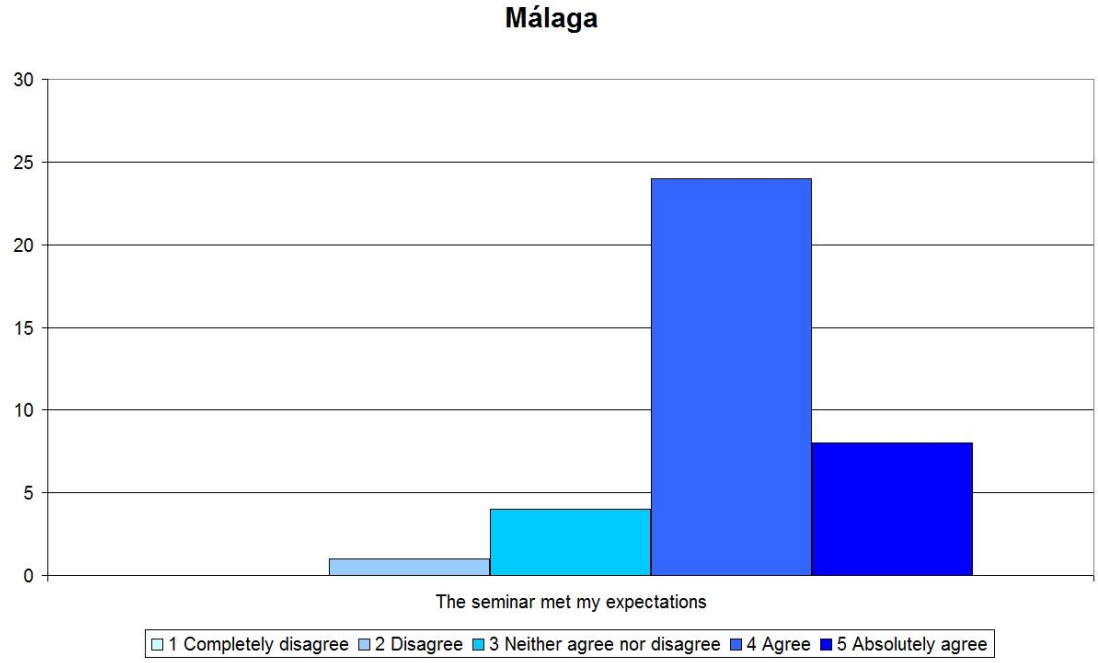



**Figure 13.** Fulfilment of the expectations

When comparing the average rating from Linköping and Málaga (Figure 14) it can be noticed that the level of fulfilment of the expectations in Linköping is higher than that in Málaga. Therefore, we go back to the idea that students from the master's programme

imparted in Sweden have, due to the subjects of that postgraduate programme, more inclination to carry out outdoor activities than those from Málaga, and this has an influence when assessing the activity as a whole.

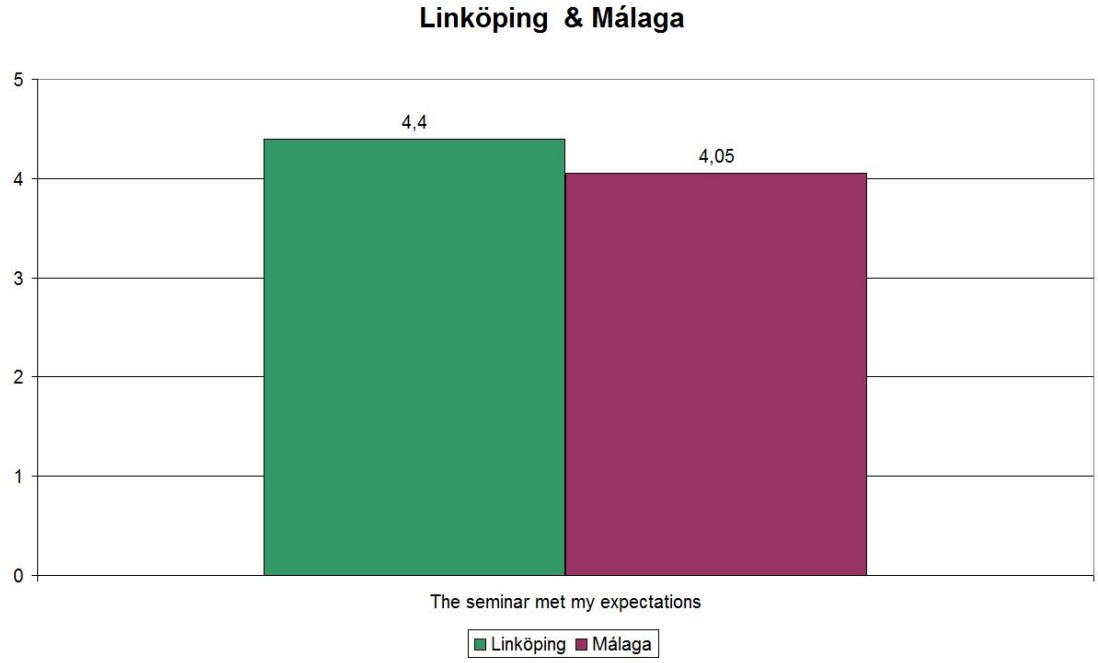



**Figure 14.** Fulfilment of the expectations

In the section of the survey where students should explain why they rated negatively some of the aspects previously evaluated, in the case of Linköping there was no negative response. In Málaga, they answered the need for more time to carry out the activity or not to be motivated, for coming from a field of knowledge different from Geography and not having previous knowledge. On the contrary, those having previous knowledge about the subject expected a higher level of depth.

There were students, in both Linköping and Málaga that took advantage of this space for setting out not negative reasons for their ratings, but positive.

*"We take part in the activity or study. It's fun and more effective to study when work in a group or study outdoors using the new tools appeals to me a lot" (Linköping, 2015)*

*"I have evaluated negatively no aspect because I consider that this part of the subject has been developed in an interesting way, I have learnt a lot and above all, the tools used can be useful for the classes" (Málaga, 2016)*

Besides the assessment of the activity as a whole, it was important to know the students' opinion of the different sections into which it was divided. In Linköping (Figure 15), the activity with more ratings of 5 was the outdoor trip to the city centre, followed by the session of work in groups. As for percentages, 80 percent of students assessed positively the presentation of the activity and the outdoor exercise "breaking the ice"; 90 percent, the work in groups and outdoor exercises; and a hundred percent the debate and conclusions.

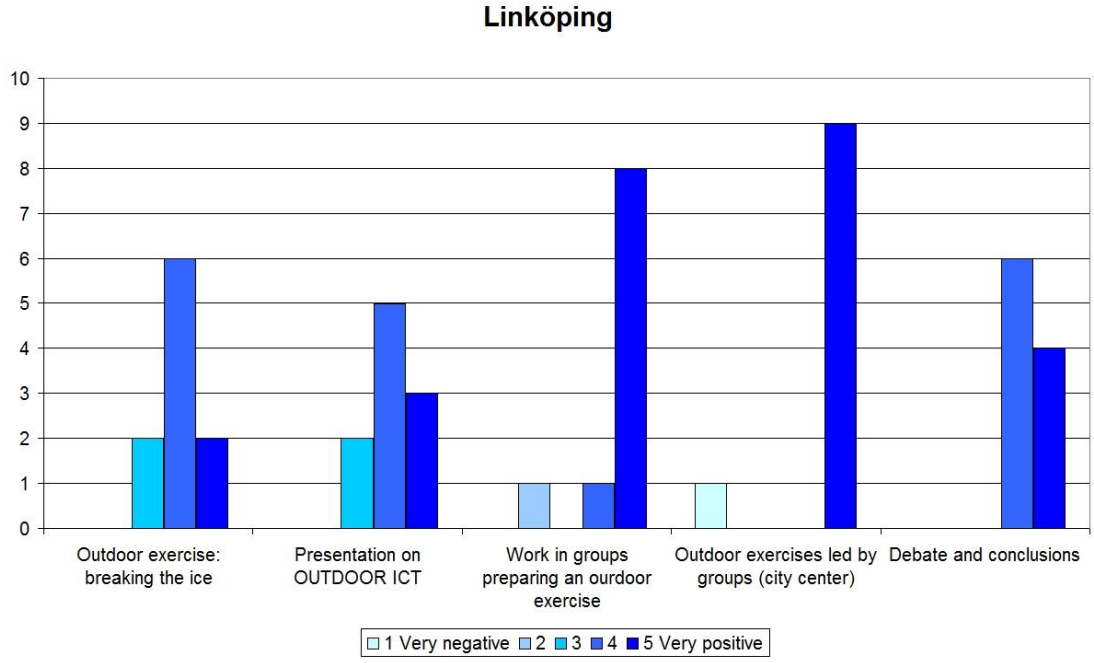



**Figure 15.** Assessment of the seminar's activities

In Málaga (Figure 16), the activity with more ratings of 5 was also the outdoor exercise to the city centre. 89.19 percent of the students rated positively the two outdoor sessions at both the Campus and the city centre; 81.08 percent the work in groups preparing the exercise; 75.67 percent, the presentation of the activity; 64.86 percent, the debate and conclusions. In this last case, the reason for lower ratings may be that, due to the few hours of lessons and the high number of participants on the itineraries, a session of debate and conclusions could not be held with sufficient time and depth.

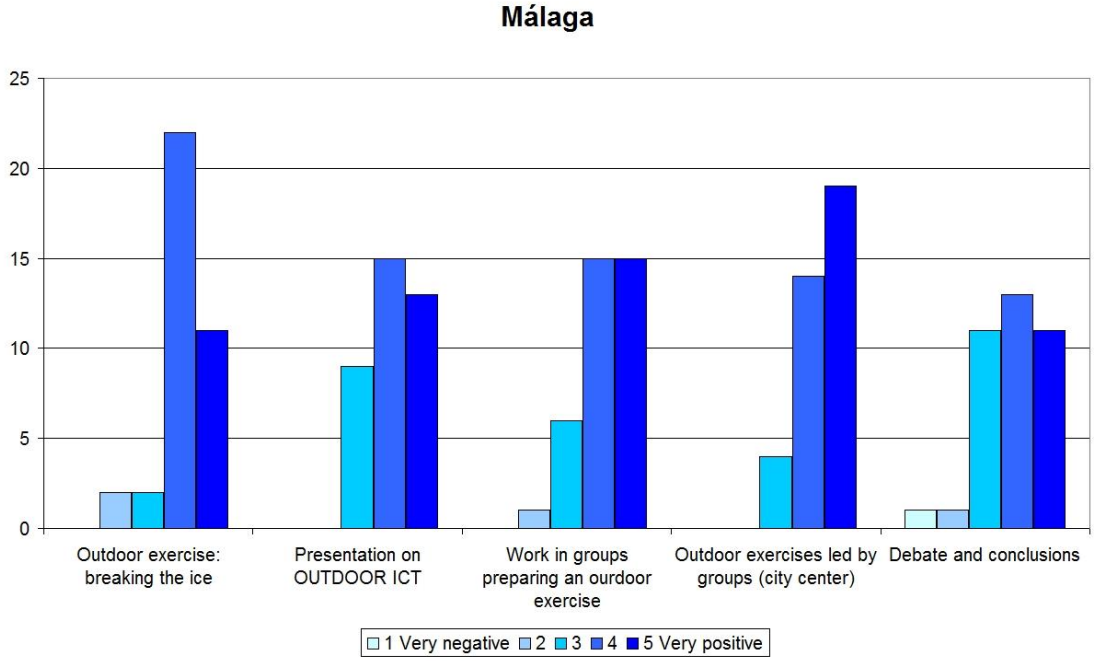



**Figure 16.** Assessment of the seminar's activities

In both Linköping and Málaga (Figure 17), students were more interested in practical activities. The two highest rated activities were the outdoor group tests at the old town and team working for preparing those tests. Both breaking-the-ice starting session and the presentation of the activity had similar ratings of the students from both universities, whereas it can be observed marked differences in the discussion and conclusions, better valued in Linköping than in Málaga, as stated above.

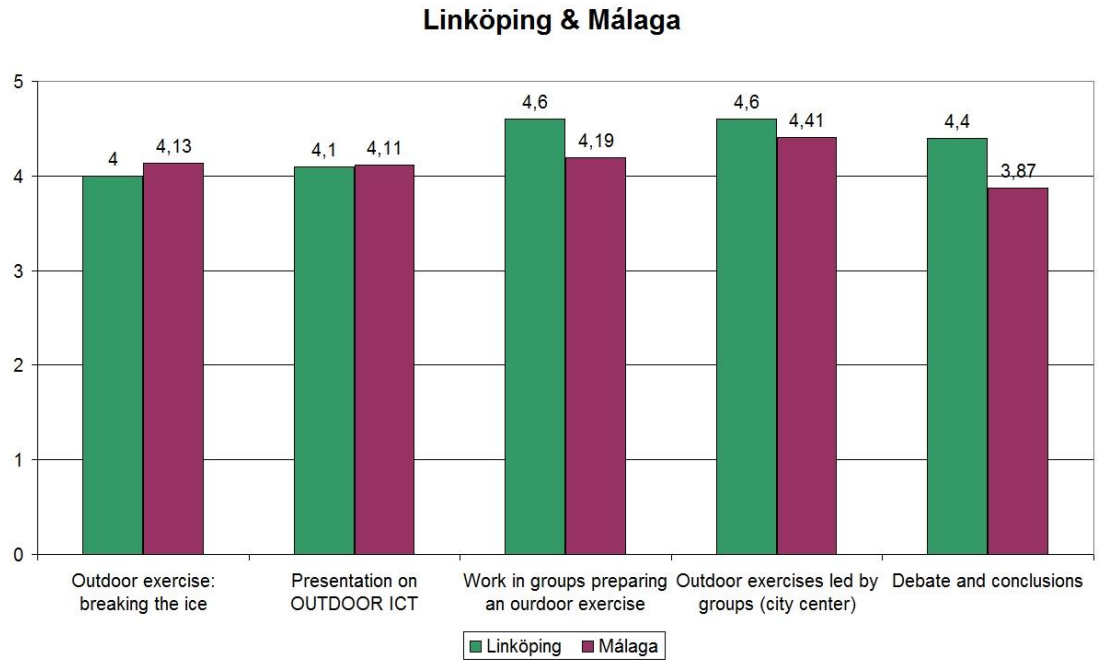



**Figure 17.** Assessment of the seminar's activities

Another key issue was to know the level of previous knowledge of the students on the use of GPS, compass applications and Google Maps. In this way, we would be able to check to what extent the activity had contributed to the acquisition of skills by the students when using those tools. We should not forget that they are digital natives, very accustomed to the use of technology.

By calculating the average from the answers of all the students participating in the survey, we obtained the following results:

The perception about the level of knowledge on the use of GPS before and after carrying out the activity is quite similar for the students from Linköping and those from Málaga (Figure 18). Before the activity, the average was 6.2 and 6.51, respectively, while afterwards it increased up to 7.9 in Linköping and 7.76 in Málaga.

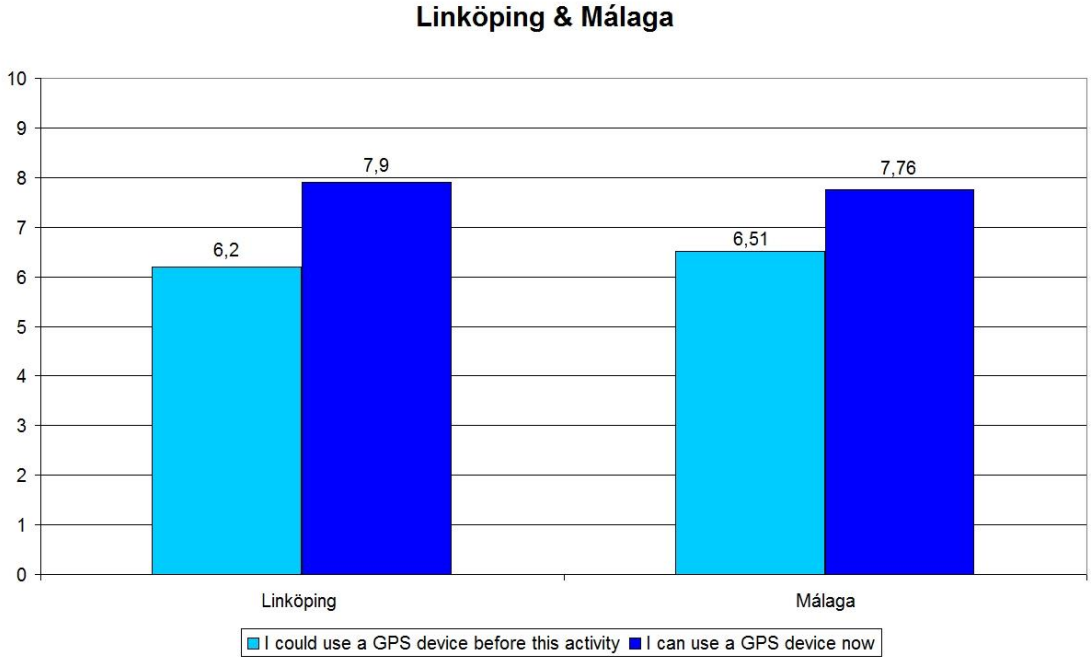



**Figure 18.** Level of knowledge about the use of GPS before and after the seminar

In respect to the compass, the average on the level of previous knowledge was in both places below 5 (Figure 19). Málaga students, who started from a lower level, had a more significant increase in their perception of the use of the tool. In Linköping, the difference between before and after the activity was 1.8 points while in Málaga it raised 3.46.

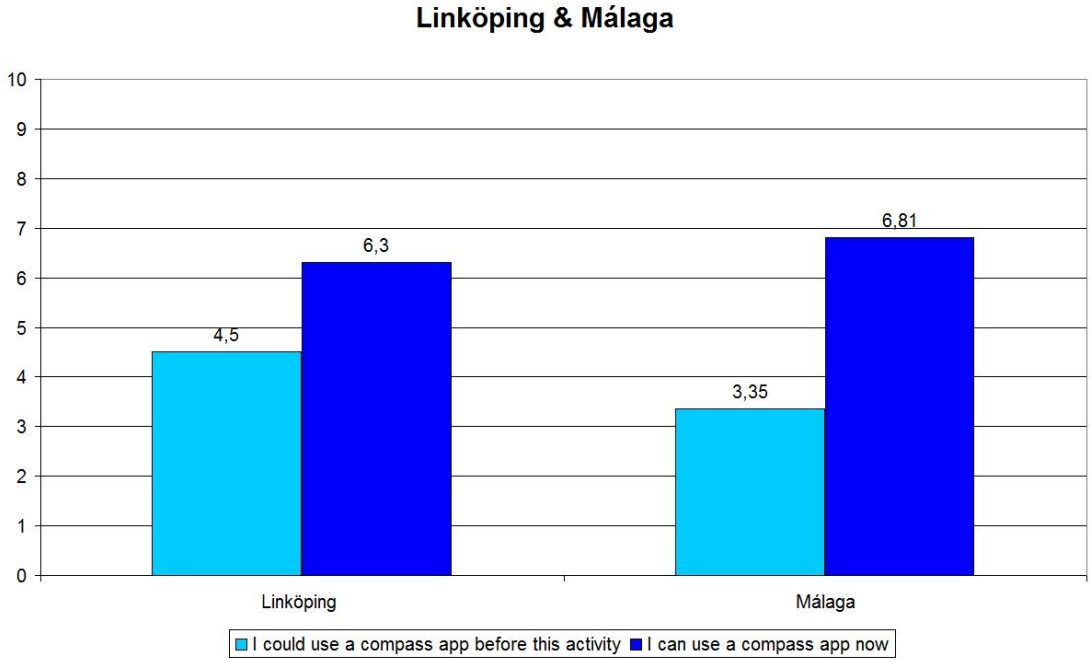



**Figure 19.** Level of knowledge about the use of compass apps before and after the seminar

As for Google Maps (Figure 20), the level of use of the tool was quite high for all the students before participating in the activity. In both Linköping and Málaga, it was around 8 and raised up to 9.3 after finishing it.

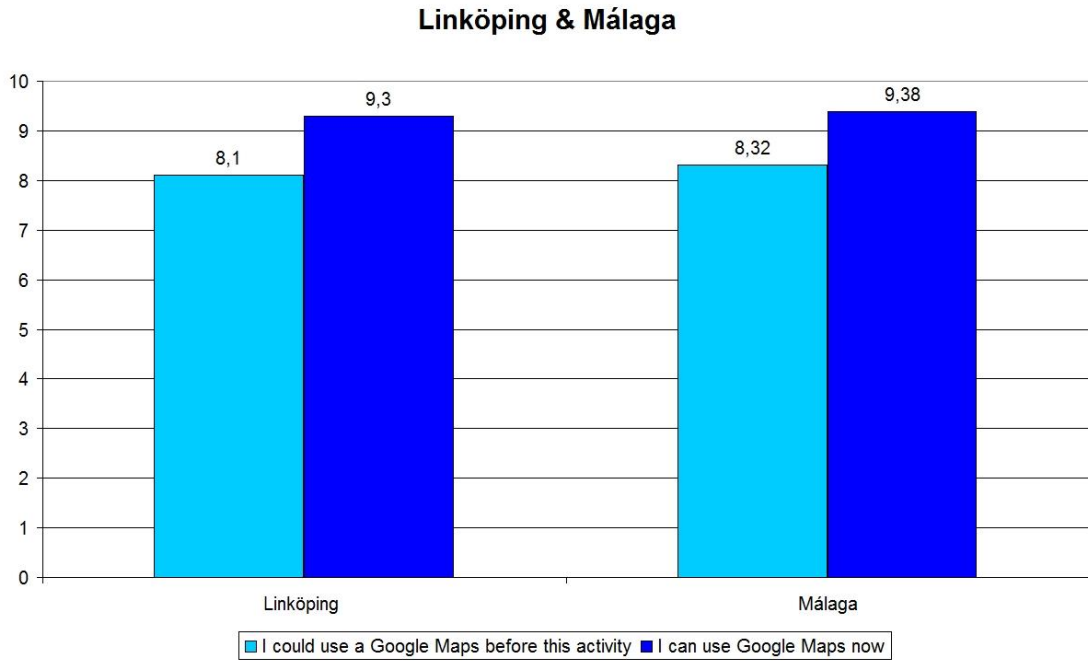



**Figure 20.** Level of knowledge about the use of Google Maps before and after the seminar

When asking the students which of the three methods used –orienteering, compass or route with Google Maps- they preferred (Figure 21), the most repeated answer, in both Linköping and Málaga, was Google Maps, 40% and 56.76%, respectively. In Linköping, also, 30 percent opted for a combination of orienteering and Google Maps; and in Málaga, 2.7 per cent opted for the joint use of the three methods. As for the choice of orientation exclusively with a map of points, the percentages are quite similar among the students of both Master's, 30 per cent in Linköping and 24.32 in Málaga. There certainly was a significant difference in respect to the compass, as in Málaga was chosen by 13.51 percent of the students, while in Linköping, nobody chose that option. Finally, in Málaga, 2.7 percent preferred not to choose any of the three methods.

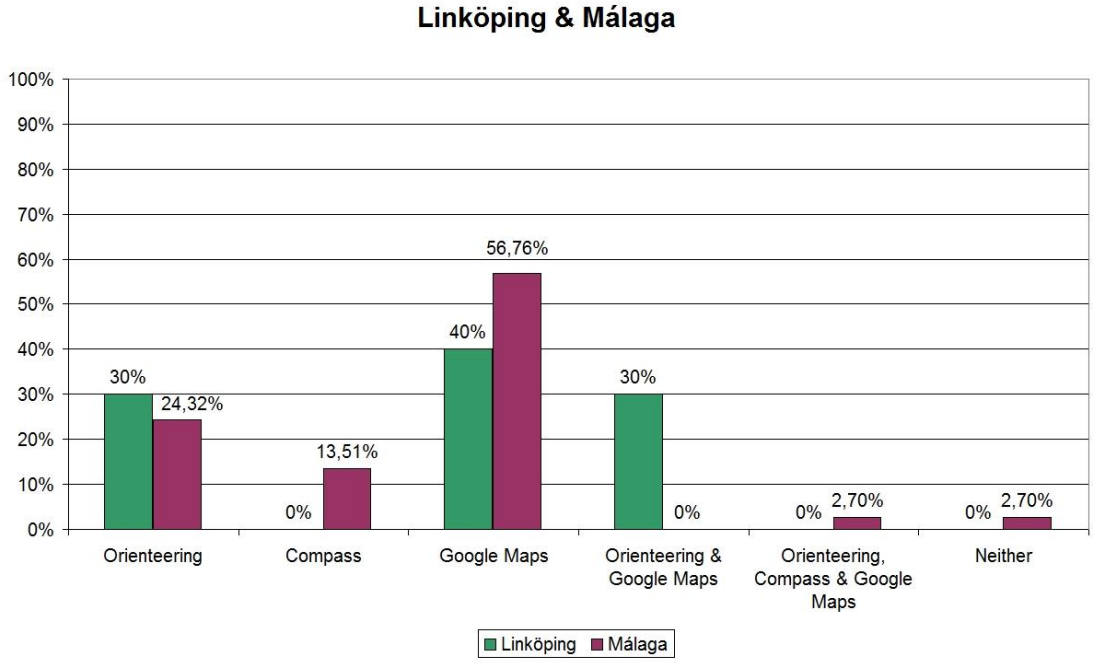



**Figure 21.** Favourite of the three methods used

The reasons mentioned by those who chose Google Maps included that it is a tool used in our daily life, that they are familiar with, because they used it frequently, and they also considered that it is quicker, simpler and handier: "because it's an application that I use several times per day and has a lot of great aspects" (Linköping, 2015); "because it is a tool that, unlike others, is already in our everyday life" (Málaga, 2016); "because is very easy in handling, is very clear about the directions and I am more used to it" (Linköping, 2015); "because it is a handy and quick tool, it also help you to make better planning" (Málaga, 2016).

Some students highlighted that it was more visual and allowed them better orientation: "it is more visual and realistic, so it makes easy the spatial positioning" (Málaga, 2016); "because we can see the route. As well as the direction. It makes me clear about where I am and where I'm going to" (Linköping, 2015).

One of the best-valued aspects of the tool was its practical usefulness and the possibilities it offered: "I can use it for my everyday life" (Linköping, 2015); "it has more tools to use" (Málaga, 2016)...

Expansion of mobile phones also helped to Google Maps to become the favourite option for many students, because it allowed combining the different methods, and its application to teaching and to the development of digital skills:

> *"It is handier to work with on the street, because you do not have to take any thing extra but your mobile phone, besides it allows you to watch it at different scales very easily and above all, you may say that includes the two other options and allows the students to work with ICTs". (Málaga, 2016)*

Those who chose map orienteering did so because it was a challenge for them and they considered that improved their sense of direction and allow them to develop skills that they would not acquire otherwise: "in spite of finding more useful the route with Google Maps, orientation with points seems to me more attractive for the challenge it implies" (Málaga, 2016); "it is a bigger challenge and it develops better orientation" (Málaga, 2016); "because it gives a stronger sense of place though might be sometimes hard" (Linköping, 2015); "it contributes to acquire skills that you would not develop otherwise" (Málaga, 2016); "because it requires higher attention by the students to space and sense of direction" (Málaga, 2016).

One student also highlighted that the activity could be carried out without turning necessarily to technology: "What I liked most was the map with points, as you can follow the activity without depending on mobile devices" (Málaga, 2016).

Students who chose the compass had in common their origin –University of Málaga-, and their degree –Bachelor in History-. The reasons they argued for choosing this tool were similar to those preferring orientation. They highlighted the need for knowing how to use it, the challenge its use implies for them, and how interesting is to use it as a tool: "I had not used it before and for me it is interesting and beneficial" (Málaga, 2016); "the use of the compass seems to me very interesting because its use is a challenge for me, it is the most difficult tool for me to use" (Málaga, 2016).

Besides consulting the students at what extent, they considered what they had learnt to be useful for their professional life; they were requested to include some practical example of how they could put it into practice in their academic and professional. The most common response, in both Linköping and Málaga, was to use it in their own teaching, by conducting practical activities. Let us remember that the goal of both Master's degrees is to train teachers, and the intention of these students is to develop themselves as professionals in this field.

In Linköping, "[…] to teach students the use of compass or Google maps to find the way or their positions"; "create games and outdoor activities to teach to the students useful everyday objects"; "Conducting real time activities on GPS for children"... were some of the proposals made by the students of the course. They highlighted also that… "increase use of technology in school", or allowed working with ICTs in a "cross-curricular" way". Several students focused their proposals on childhood education, although others extended them to secondary and university education.

In Málaga, where the Master's is oriented at training teachers of secondary education, most students considered conducting this kind of orientation activities in their future classes of Geography, History and Art History:

*"It could be interesting for secondary and high school students to conduct an orientation itinerary in groups, as we have done in class, and to link it to a historical, archaeological or museum-based subject, in both urban and rural areas" (Málaga, 2016)*

*"I would like to be able to take with my students an itinerary through Málaga old town, so that they watched in the morning several monuments in chronological order, for them to learn about the place they live in, and to acquire skills such as awareness for the cultural and historic heritage" (Málaga, 2016).*

Some students indicate the playful nature of the activity, the use of alternative to traditional methods, and even the possibility of using these resources within the space of Education Centre itself and the field trips: "To take advantage of some outing from the school to include this method and make the trip funnier and more entertaining". One student highlighted its application to students from any education stage: "in general, this kind of activities is good for any professional working with children, teenagers or even adults". Two students highlighted also that they would apply what they had learnt on their own Master's practice. Other uses proposed by students from Málaga, were for indicating their own position, carrying out thematic routes or creating virtual visits.

When asking the students about what they had liked most of the activities carried out, in Linköping they highlighted preparation and taking the route through the city: "The last practical activity in the city centre. We had the opportunity to practice the three methods taught as well as having fun and getting to know the city at the same time ".

Students also valued particularly the learning acquired, the new opportunities open for their work as educators, the class atmosphere and the working methodology itself: "I really enjoy that kind of activity in which we can discover useful information by ourselves as well as the way we worked, i.e. on groups"; "The methods were useful both in everyday life and professional life. The atmosphere of the seminar was very warm and open for questions and talk".

In Málaga, there are four elements repeated in the comments made by the students surveyed: breaking out of their routine, outdoor teamwork, motivation and recreation.

The idea of breaking the routine appeared in several responses, linked to other aspects such as team work, motivation, entertainment or practical application: "the most entertaining has been to take the route as a team and break the routine of just staying in class explaining how it is with no practice"; "it is a way of breaking the dynamic of taking classes within the classroom, and increasing in this way the students' motivation".

The fact that they were outdoor group activities, and the increase in motivation entailed is another aspect most valued by the students: "to be able to work in groups and in the open air"; "companionship, change in group dynamics, because we had always been in class

during the whole Master's, and how collaborative it was"; "to work in the open air was an extra motivation for the students, besides it improves the sense of direction"...

Another key idea was to learn in an entertaining way: "by playing a game we have learnt to learn. Getting away from rote and traditional learning. Thank you!"

In addition, the activity adapted easily to any subject, what made it be more entertaining and motivating. For example, one student highlighted "the wide range of subjects to which this methodology can be adapted and also how entertaining it was". Another important aspect is to put into practice what they had learnt in the classroom, "to be able to make your own itinerary, because you put into practice what you have learnt", allowing the students "to become aware of the utility of this kind of activities".

One student highlighted the development of digital skills, another one valued to know other options from the tools they usually use for other purposes. Moreover, taking the activity allowed them to know better the city of Málaga. All of this entailed a key idea: To be aware of the place as a learning space. As one student highlighted "to be aware of what the entire city offered me to take it to a classroom".

Finally, for the question about what they would change in the activity, a student proposed "more input on which app´s" and how to work with coordinates, others, to learn more about teacher's methodology or make more competitive the outdoor activity, introducing some new element, such as, for example, a prize with a time limit. On the hand, one student indicated that she "would change nothing".

In the case of Málaga, a third of the students participating in the survey indicated the need of having more time to carry out the activity, especially for the last session of debate and conclusions: "To have had more time in the sessions for taking as a whole all the itineraries presented by all the work groups from the class" (Málaga, 2016)

As an alternative, one student suggested, "to reduce the number of itineraries at the centre for being able to take them thoroughly and with more time", and another one, to change the duration of the activity in relation to the itineraries through the city.

Other students suggested increasing the level of difficulty of the activity and making longer itineraries, or that the groups should be smaller. Some also suggested, as in Linköping, make the activity competitive: "I would look for a way to making them more participative by carrying out some kind of contest among the groups". Finally, several students stated that they would change nothing.

## 5. CONCLUSIONS

The results obtained in Linköping and Málaga were highly satisfying. As the survey shows, the activity was useful for the student to increase their level of knowledge about orienteering and using GPS devices, compass and Google Maps, by developing their geographical and digital abilities. In addition, it allowed proving that students were interested in applying what they had learnt to their future professional practice, by using active methodologies, which encourage critical thinking, team working and learning to learn, as well as improving social abilities. Outdoor activities, outside the classroom, and their practical implementation in real contexts were highly valued by the students of both Master's programmes, as demonstrated by the high level of motivation and creativity when carrying out the activities and the result of the survey.

Comparatively, we can observe a difference between students from Linköping and Málaga when carrying out outdoor activities, whereas for the former it was their natural environment, for the latter it was "alternative" to the traditional, which it was a classroom. That is why for the students of the Master's programme in Málaga, the idea of breaking out of their routine was so apparent. Nevertheless, the positive results of the experience carried out at both

universities support the adequacy of outdoor activities within the curriculum of a Master's programme for teachers' training, as well as their relevance to carry them out for all the education levels.

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# INFORMATION IN GEOGRAPHICAL SPACE AS THE BASIS OF CROSS-DISCIPLINARY RESEARCHES IN CULTURE GEOGRAPHY

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## Abstract

This article contains an attempt to integrate the ideas of structural processes within the boundaries of the geographical envelope of the Earth, and to identify new universal dependence. The article describes the theoretical and methodological aspects of the study. The existing approaches to the definition of information are considered, main problems of information studies and geography possibilities in the search for solutions have been highlighted. A new definition of information as an organized diversity of systems and models, terminology of systems and information studies, the conceptual model of the interaction of the information field and space, main methods of information storage have been proposed. The following has been presented: potential for the development of methods of semantic reconstruction in semiotics and archeology; determination of the age and origin of objects; importance of fundamental research information for the creation of the theory of natural and cultural heritage.

***Keywords****: Information, geographical space, natural and cultural heritage, culture geography.*

## 1. INTRODUCTION

The notion of "information" plays a critical role in geography, provides its external cross-disciplinary communication and participates in the development of the scientific world in the information society.

*The content of the geography* – a science that integrates the knowledge in the system of Earth Sciences, fills the idea of *information as an inherent property of matter*. Object of geographic research – geographical envelope – is considered as a geographical system at a global scale, which is based on flows of matter, energy and information. Information, as the complexity and organization systems, is considered in evolutionary geography and biogeography, geophysics and geochemistry of landscape, historical and cultural geography, as well as in the studies: on biosphere – by V.I. Vernadsky, on ecosystems – by V.B. Sochava, on rhythms in nature – by E.V. Maximov, and other studies of great methodological value by D.L. Armand, A.G. Isachenko, V.I. Paranin, B.B. Rodoman, A.Y. Reteyum and others (Paranin, V.I. 1990, 1995; Paranina, A.N., Grigoriev, Al.A., Eidemiller, K.Y. 2014). In

the context of expansion of informational space and the development of interdisciplinary communication, specific geographical projects dedicated to information are implemented.

## 2. BACKGROUND

### 2.1 Literature review

In the era of *information society* the notion of information has not received any universal definition yet. However every branch of knowledge has its own definition, which meets the challenges of theoretical and practical studies (N. Viner, 1968; K. Shannon, 1963; V.M. Glushkov, 1964; A.D. Ursul, 1979; A.N. Kolmogorov, 1987; V.M. Lachinov, S.A. Polyakov, 1999; V.G. Gamaonov, 2000; E.H. Liiv, 2001; E.G. Kapralov, 2005, etc.): the Latin term *informatio* means "data, messages"; in computer science and cybernetics "information" is a measure to eliminate the uncertainty (entropy); in the information theory (computing and communications) it is the number of received, processed or transmitted messages (bits); in synergy - the level of the organization (consistency, coherence, ordering) of system; in informologics – a measure of reflection of reality, etc. (totally about 400). These definitions are applied as needed in geography, but have a limited ability to simultaneously describe coherent geographic space and its diverse parts (Paranina, G.N. 2001, 2005).

The variety of existence and diversity of studies on information provide a number of objective difficulties and contradictions: 1. Information is considered as a feature of substance (attributive concept), or it is bounded only to the processes of administration and self-administration (functional); 2. The term "information" is used in the meanings that reflect different functions: process (a ratio, a relationship), and condition (the result of action on the structure); 3. The uncertainty of values depending on the direction of the information process: source system acts as potential information, and the system as a receiver of information that is relevant; 4. The growing subjectivity of perception of knowledge, reflecting personal experience and professional orientation, level of socio-cultural development of society; 5 *The shortage of knowledge of qualitative aspects of information processes and social demand for research information in nature are escalated.*

### 2.2 Potential of information approach in geography

The advantage of geographical research of information is studies in an "ideal laboratory" of nature: 1. without destroying the natural horizontal and vertical connections; 2. in geographical coordinates of space-time; 3. taking into account the genesis of systems and all forms of movement.

The new *definition of information as an organized diversity of nature and its models* [10], was formed in the course of our studies of the structure and functioning of natural geosystems and reflection of natural processes – lighting regime of the Earth (semiotics of nature) in the graphic sign and knowledge (semiotics of culture).

### 2.3 Objects and methods of a research of information in geography of culture

System research on information in geographical space integrate practical and theoretical results obtained in three main blocks of "nature - society - sign systems" using maps, remote photographic materials, scientific publications on the issue and on the sites, work data of own field research.

In 1990-2000 studies of the structure and functioning of local and regional geosystems of the North-West of the East European Plain and the structure of soil and vegetation cover of the North-East of Siberia were carried out. In 2000-2008 social aspects of the problem were studied. Since 2009, the authors have carried out comprehensive studies of natural and cultural heritage in the North, North-West and in the Center of the Russian Plain, the South Urals and Siberia (Altai, Sayan).

The authors used variuos methods, which included the following: methods of field studies (topographic and landscape mode), thematic maps and data remote sensing of the Earth (landscape interpretation, selection and description of the lineaments of the landscape, the planetary fracture systems, areas of planning of artificial and natural and man-made objects, development of rose diagrams), standard laboratory analytical and statistical methods, methods of metrological analysis of archaeological objects, astronomical and paleo-astronomical calculations (altitude and azimuth position of the sun – using the astro-calculator, length and direction of the shadows – using basic trigonometric functions), and methods of mathematical, cartographic and conceptual modeling (Paranina, G.N. 2011, 2012, 2014, 2015abc; Paranina, G.N., Paranin, R.V. 2009; Paranina, A.N. Paranin, R.V. 2015ab).

## 3. ANALYSIS OF INFORMATION PROCESSES IN GEOGRAPHICAL SPACE

The definition of information as an organized nature and diversity of its models is based on the most widespread of the existing definitions - *information as the presence of any irregularities in the space-time distribution of matter and energy* (by V.M. Glushkov, 1964), whose approach to research of information in geographical space takes into account two considerations: 1. it is impossible to cover *all* the diversity of nature, 2. it is important to consider first of all objective, repeatable and necessary connections – the laws of nature – for a human to adapt in the environment. The conformity of a new definition to the basic definition of V.M. Glushkov is maintained by the adopted modern scientific paradigm of understanding of randomness as the unknown-term pattern, bringing together "any heterogeneity" and "organized diversity."

The new definition allows us to consider the transfer of information, both individually in natural and artificial systems, and the "nature-society" system, which is important for the development of a number of new interdisciplinary areas, including environmental geography and geoecology, historical, semiotic, sacral and cultural geography (geography of culture). In 2013-2015 this definition was approved at international symposia on optics, where its applicability to problems of experimental research has been approved. Simultaneously, upon the recommendation of opticians physics, the concept of "field" was included in the theoretical tools of research information in the geographic space.

The philosophical basis of our definition of the concept is the attributive information system paradigm and the theory of reflection. Scientific methodology provided by the concepts of "structure", "algorithm", "order" (organization and self-administration), and the specificity of the geographical approach – used in geospace on the basis of geographical research methods, taking into account the general laws of the structure and functioning, dynamics and evolution of geographical envelope. Based on this definition of information a geographical approach was developed, which is based on the methods and objectives and can be described as system-information.

### 3.1 Conceptual framework of system-information approach

Conceptual framework of system-information approach establishes a link between the basic properties and functions of the information system and geographic space-time in the context of the current scientific paradigm (Table 1).

**Table 1.** The ratio of the basic concepts of system-information approach.

| Information | Key notions | Processes | Vertical structure of field – space | Information resources | Use by humans |
|---|---|---|---|---|---|
| The form of continuity - the information field; the form of discreteness - space-time | Actual information (structures) and potential (processes), active (actual) and passive (latent) | Reflection at interaction: transmission, encoding, saving and transformation пер | **Informational:** knowledge | Culture | Various forms of adaptation, including creation of an information system for life support |
| | | | **Geocultural:** material and non-material culture | | |
| | | | **Georgraphical** geographical envelope of the Earth | Nature | |
| | | | **Space:** planet Earth, Solar system, Universe | | |

*Information field is a continuous heterogeneity of distribution of matter and energy in space-time.* In the block diagram (Table 1) information field transfers continuity of information as an attribute of matter, infinite in breadth and depth, and discreteness is regarded as a form of information through the space-time. The main states of the information are considered: potential and actual, active and passive. Reflection is considered as the basis for all kinds of information exchange. Vertical heterogeneity of the information field is represented as a system of embedded subordinate spaces – levels of implementation of organized diversity of nature.

The spherical model, which we developed on the basis of the classic concept of the shell structure of the Earth, is the most objective reflection of correlation of spaces - cosmic, geographical and geo-cultural. But the shell structure of the Earth does not include information space, it is only conceived as a part of culture. To illustrate the hierarchy of all the allocated spaces a multi-tiered pyramid (Figure 1) can be used. Although, in fact, each successive level seems to be the point on top of the previous one.

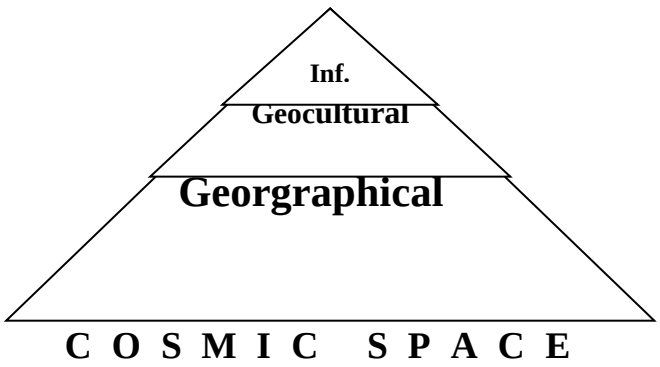


**Figure 1.** Vertical structure of the information field

*Cosmic space* encompasses the Universe and the objects of the Solar system, including planet Earth, subordinated to the laws of space.

*Geographical space* is understood as a form of existence and a communication method of geographical objects within the geographical envelope of the Earth – it is an external circuit

on the diagram. By age, by the mass of material, by energy and information, by social functions the geo-space is the foundation and geo-cultural and informational spaces. The special position of geo-space is based on the fact that a constructive impact of space is refracted through its features (spherical, spatial-temporal organization, evolution and other general geographic regularities).

On the basis of the geographical space a *geocultural space* is shaped – a form of existence and way of communication between objects, processes and phenomena of the "second" nature. In geographic science culture is traditionally reviewed as an expertise of adaptation. It is aimed at the survival and development of society. Geocultural space is studied by the principle of geographical determinism, taking into account multifaceted reflection of the landscape in culture and culture in the landscape (Streletsky, V.N. 2005).

Culture includes the knowledge, allocated in the *information space*, whose objects are the signs of nature, material and non-material culture and their relationship, disclosed by the system of concepts, which collectively shape information model of the world (IMW). In contrast to mythopoetic model of the world of humanitarian studies, the IMW reflects quantitative compliance, i.e. objectively discloses cause-effect relationship. Information space is the most dynamic subsystem of geospace, the top of "iceberg" of natural and cultural diversity – the developed part of resources of the information field, available for use at this stage of the development of technology (civilization).

While territoriality of geo-cultural space is obvious, and it is considered in geography of culture and historical geography as a form of geo-system, the *information space may seem independent from geo-graphical space-time*. Here all idealistic concepts are implemented in the consciousness of modern society originate. Unlike humanitarian approaches, geography has a rich evidence base, quantitative methods and theoretical tools to review information about the processes in the system "nature-society" on a materialist basis.

At every level – the "floor of the pyramid" and then – within each area (i.e. in relation to the system under consideration), it is possible to distinguish potential and actual, active and passive information. *Potential information* is an original property of matter and any super-system in the "nested doll" of hierarchical relations, based on the movement (processes); *actual information* (realized) is a variety of existing systems and models (structures); distinguishing of the active and passive states of the information does not imply absolute opposition, and various forms of participation in the information process - direct and indirectly hidden.

Following the algorithm of the system approach, the structure of the study takes into account a factor of *goal-setting* proposed in cybernetics, which is considered by the subject-associative idealist thinking as the absolute world of consciousness and control. Our concept of information modeling is based on the general geographic regularities in which the administration is understood as the constructive role of the super-system (on K.N. Dyakonov), which determines the range of capabilities of the system (in our case - potential information, its highest possible expression - chaos); further it is assumed that all forms of movement "from chaos to cosmos" are directed by potential difference (the implementation of the global free energy into information – according to A.D. Armand); it is taken into account that the environment of the geographical space is Cosmic space – an example of high orderliness (especially when compared to the dynamic landscape of the Earth). The reflection of this order is manifested at all levels: the geographic space exists according to the geographical laws, but is subject to space - in terms of the adequacy of the structures exposure, gravity field, tidal, and other manifestations of interactions; geocultural space – is similarly subordinated not only to social, but also geographical and cosmic processes; finally, the information space reflects (models) integral information field, but in the part which relates to the existence of humans. It is also clear that, under the leadership of external

regulation, quality of system determines the overall development of a set of internal processes (self-regulation and self-administration).

The primary objective of information modeling in all forms of life is adaptation. *Adaptation* (Latin *adapto* – to adapt) is the process of adaptation to changing conditions of the external environment. The concept is used in biology (*biological, physiological*), archeology, ethnography, geography of culture, evolutionary geography and interdisciplinary *studies (ecological, social*). We *consider adaptation (and inherent orientation in space-time) as the main condition for life-support and way of studying of the matter*. This idealization of study conforms to the theory of reflection, in which the ultimate goal of the movement of matter is perception.

In this study, *adaptation is optimization of human activities on the basis of an adequate modeling of natural processes*, and to characterize informational adaptation component it is proposed to use the concept of *"information system of life-support"* – a system of evidence, tools and concepts, which characterize the vital facilities, processes and phenomena of the world. Obviously, the system-information approach extends the semantic content of health and safety – a science of safe human interaction with the environment. Taking into account the spatial component of the process, we can speak about the *geographic adaptation.*

*Information resources* are the diversity of the world, available for use in the block diagram on the genesis divided into natural and cultural (Table 1), with respect to the technology real and potential are distinguished, and a detailed analysis can be considered separately for each space level. In this case, the resource of each level can be traced to the influence of the super-system design and its parts (external relations), and the feedback from the subsystems (internal relations) – whose combination provides a flow, and therefore – stability of the entire system.

Obviously, the information resources of geographical space are formed in the first place under the influence of planetary-cosmic nature, but also reflect the impact of human activities. It is very difficult, but important to highlight these factors: in geo-ecology, for example, it is the problem of estimating the parameters of anthropogene effects and the ecological state of the landscape. *Information resources of geo-cultural space* are formed at the intersection of the factors geographical environment and social experience - culture: there are acute problems of the dating of objects of nature and culture, the division of artificial elements of autochthonous and allochthonous genesis, their cultural and ethical features. But still no methodology has been developed for the definition of the nature the origins of the tradition. Resources of information space also reflect all levels of supersystem and complexity of internal organization - databases, systems of signs and knowledge. Paradoxically, the problem of allocation of natural and artificial component has not been identified yet. For example, in semiotics, there has been enough separation of signs based on the principle of reflection of the subjective (the sign-symbol as agreed) or objective reality (sign-icon – by similarity), and the third group, distinguished by to C. Peirce, specifying connection denoted in space-time (signs indexes), has not been used.

The structure of the developed information system approach also includes concepts: *information processes* – transmission, encoding, saving and transformation of information or reflection of the diversity of the interaction of objects, phenomena, the processes of the world; *information cooperation* – exchange of information, understood as non-deterministic process, as impact and response do not always coincide in space and time; *information flow* - a high level process of internal and external information exchange; *information society* – a society in the conditions of high flowage of information; *systemic crisis of civilization* – a society under conditions of violations of information flow.

The definitions designed to study the information in the geographic space, do not alter existing definitions, but rather complement and make them more precise, expanding the

scope of their application. To compare, we can give some example of specific definitions of "*information processes* – processes of creation, collection, processing, accumulation, storage, retrieval, distribution and consumption of information," (Federal Law number 85 dated 04/07/96); "*Information interaction* is the interaction of two or more subjects, the purpose and the main content of which is to change the available information at for least one of them" (Dictionary of business terms).

### 3.2 Law of conservation of information

Different manifestations of information allow us to formulate the **law of conservation of information** – information *does not disappear, but it passes from one states to another.* In a classic example of a falling coin corresponding movement is the potential information on its possible stationary states when a certain part of the information is realized, the resumption of movement reveals prospects for the realization of hidden potential. The law of conservation, one way or another, is developed by many researchers, in particular, synergetic theory of information "in any structural transformations of discrete systems that occur without changing the total number of elements, the amount of chaos and order in the structure of the system always remains constant (conservation the amount of chaos and order)"[Vyatkin, V.B. 2012, p. 3].

Schematically, the combination of the basic states of the information can be presented at the intersection of two axes (Figure 2): 1. The potential / real - on the horizontal axis; 2. Active / Passive - on the vertical axis.

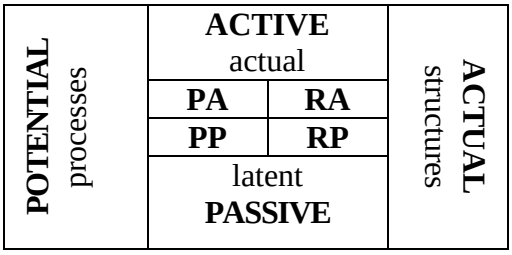


**Figure 2.** Basic states of the information

There are four types of combinations of states: PP - a potential passive, PA - potential active, RA - a real active, RP - real passive. States are determined with respect to a particular system (relative), and are connected through their active form - the interaction and movement. For example: PP - the universe; PA - solar activity; RA - geosystems, the system; RP - Memory: geological, genetic, cultural, etc.

The transition of potential information of landscape in the state is considered as implemented on the materials of our ecological and geographical studies of slope geo-systems in the middle reaches of the river Luga. The transition of potential information in the lighting mode signs and knowledge in the process of orientation in the space-time-looking has been studied by the example of the development of navigation technologies and patterns of information-insulating simulation.

Highlighting of potential and actual information states in natural and natural-cultural systems coordinates with the contents of the famous principles: geographical determinism, the potential difference as a motion base, exponential development and others. For example, large resources of unrealized potential information may explain the exponential nature of the structural processes in the early stages of development and the "plateau leveling" parameter in approach to equilibrium (climax ecosystems, shaped longitudinal profile of the river, the slope of equilibrium profile, etc.).

The increasing complexity of the system can be considered as the transition of information from the potential state to the implementation, degradation – as the reversed process, the direct participation in the implementation process – an active, current status, and memory structures – as a relatively passive, but, in fact, - latent. In the developed systems, memory shapes most of the information and is an essential foundation of stability, even if a large part of it is not used (mass strata of geological structures formed by indigenous landscapes, the gene pool of the population, the individual experience, the traditional national culture). Use of memory – models of successfully completed states, continues constantly and ensures quality preservation.

### 3.3 Ways to save the information

Ways to save the information are of particular theoretical and practical interest. A state of "chaos" in this search can become the “starting point”. It is noteworthy that the current scientific paradigm does not have a clear definition of this concept. When considering options for its manifestation, the authors emphasize that any conceivable chaos bears rudiments and elements of the structure. Moreover, even a theoretical complete homogeneity can be seen as a clear example of the organization.

#### *3.3.1 Variety reproduction*

In the anisotropic geographical space homogeneity is completely excluded. Heterogeneity can be understood as the cause and the result of the movement and ***preservation of information, "in the broadest sense" - an opportunity to develop or reproduce the structure at any point in space-time.*** Thus, the development of natural environments – water, land and air at different stages of evolution of the organic world conducted similar to the formation of adaptive devices (convergence of signs of different species in similar environmental conditions). The possibility of this type of saving was proved by our research of semiotic productivity of astronomical instrument - the gnomon of a sundial-calendar, which in ancient times gave the world a reliable astronomical basis of all measurement systems, and with it - all the sciences and arts. The symbolism of the gnomon-stick as image of eternity, formed on the basis of its ability to transmit information of space-time as long as there is a light source. As you can see, this type of conservation is based on relatively conservative super-systems, i.e. information in the potential state. Using state index (Figure 2) it can be displayed as a PA - RA.

#### *3.3.2 Coding of information*

***Saving data "in the narrow sense"*** is provided by the *transition to economic compressed shape*, which allows us to create a model (Latin modulus - Measure) - proxy object of the original object. Based on the concept of an algorithm for navigation of the natural process of coding models of different types (Navigation, toponymic, map, semiotic, linguistic, sacred) and shows that the *basis of IMW is the space-time*. This confirms the adequacy of reflection of information of nature throughout the history of civilization.

Objective process of replenishment, complexity and updating models leads to the enrichment of the culture and the accumulation of cultural memory RA – RP. When saving the external shape, the gap between practice and active involvement in the development process, leads to the loss of the original content. Studies in the Humanities, because of lack of specific knowledge about the natural processes, have to create reconstruction "from above" (from the present to the past), through search of repetition in those modifications, applying a

status of the original element to it. This path of reconstruction is used in comparative linguistics, cultural studies, archeology and gives, as a rule, artificial schemes and unverifiable results.

System-information research based on the navigation IMW showed that algorithm of repeating *allows to reconstruct, i.e. restore the information,* and compare the resulting models with the object under study. This is the reconstruction of "from below", i.e. from the source (origin). This method of reconstruction can significantly improve the quality of created models, for example, the definition of autochthonous ancient artifacts with calendar functions on art history criteria are based on the subjective opinion of the expert. Comparison with single objects of a similar style and performance art, and the calculation of the astronomic , geographical and landscape settings (playback of information of super-system) objectively shows the degree of functional correspondence of the tested object to the conditions of a particular space and time.

*3.3.3 Pro-accuracy of systems*

Of course, in a dynamic world, complete repetition and copying never happen. "Prototypes" of systems and models do not persist unchanged. Therefore, the most widespread way of saving in geographical space is ***dynamic stability and development***, assuming the maximum information flow systems. The stability of this type is widely seen in nature and may be designated as PP-PA-RA-RP.

Flexibility of geo-cultural space is manifested in the sacralization and conservation of vital elements in terms of any socio-cultural transformation. Elasticity of information space is reflected in the adequate response to the real change in the nature and society, regardless of the units originating from controversial sources. Thus, the limited management decisions, and the total as instruments of globalization, are opposed to the new means of navigation, communications, software and system analysis technology, as an expression of immunity of holistic natural and cultural organism – the humanity. History shows that no matter what deformations natural and cultural environment experiences, information flows restore the broken quality. It can be assumed that such a dynamic stability will reproduce and maintain geosystem of planet Earth in balance, as long as the Sun exists (Grigoriev, A.A., Paranina, G.N. 2012).

## 4. CONCLUSIONS

According to authors, the research of interaction of information of the nature and culture can be a basis of development of geography of culture. Main conclusions of a research:

1. The authors formulate the definition of information that provides simulation tasks in the whole geographical area "information as organized variety of systems and models" on the basis of theoretical generalizations and results of the field of geographical research
2. The methodological proof of rational reconstruction algorithm of natural and cultural heritage "from below" is given, i.e. the process of development of geographic space-time.
3. Research of information in geographical space provides restoring of connections in a single geography, increase efficiency of interdisciplinary research and general information flowing, as the basis for stability of our civilization.

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# TYPES OF CULTURAL PALIMPSEST LANDSCAPES IN THE MEDITERRANEAN BASIN: DELIMITATION AND MAPPING

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## Abstract

Cultural heritage sites in the Mediterranean basin reflect long–term cultural and land-use changes associated with different regional civilizations. We integrated data on historical heritage sites and civilization areas using GIS-mapping and modeling. Analysis of the World Heritage Database allows classifying 190 sites into eight cultural landscape categories – rock paintings, remnants of ancient settlements, architecture monuments, monasteries/castles, temples/necropolis, historical city centers, nature management systems, cultural landscapes, and defining eight civilization époques – prehistorical, ancient, antique, early medieval, late medieval, modern age, and recent. Each type of civilization change corresponds to a territory where cultural landscapes of various eras are superimposed to form a landscape palimpsest, including two- and three-layer systems formed under the impact of two or three civilizations. The resulting map and data are useful for comparative studies focusing on the relationship between the length of historical records and the "civilization" time-scale in which past cultural landscapes existed.

***Keywords:*** *Landscape palimpsest, civilization, world heritage, mapping.*

## 1. INTRODUCTION

The European Landscape Convention defines "landscape" as a "synthesis of objectively existing reality and a way of its perception, experience and judgment" (The European Landscape Convention, 2002). This is an example of the productive legal definition of such a multidisciplinary concept as landscape and, at the same time, it fosters discussion on how the typology and mapping of landscapes that combine natural and cultural properties can be carried out on such a basis. This is rather urgent for Russia's geographical science because the "cultural landscape" concept has undergone an essential transformation over the past two decades (Kulturny landshaft…, 2004).

In Anglo-Saxon geographical tradition, the landscape as a phenomenon of culture has been actively studied since the beginning of the XX century (Sauer, 1925). The idea of landscape as a "text" with its own "dictionary," "grammar," and "syntax" was suggested by an English historical geographer W.G. Hoskins (1970) whose well-known work "The Making of the

English Landscape" laid the foundation for a series of landscape studies in Britain resulting in the national program of landscape inventory ("Historic Landscape Characterization") (Fairclough, 1999; Planning…, 1994). This aspect was developed in-depth by D. E. Cosgrove perceiving a landscape as a kind of document imprinting mute social realities of a historical era with the sign system (iconics) and symbolics [Cosgrove, 1984, p. 269].

The studies conducted in the following years in different countries of Europe proved that if a landscape is a "text," this text has been erased and rewritten many times. Thus the "palimpsest" concept used by D. Crawford (1953), the author of "field archeology," is quite applicable to it. By the "interpretation of landscape" (in the words of M. Aston) the British geographers managed to reconstruct the history of cultural space as a space inhabited by the nation in of different chronotopes (Appleton, 1975; Aston, 2002; Rippon, 2008). Such reconstruction allowed linking the material elements preserved within the landscape, which represent the nature of the anthropogenic impact, with the corresponding "cultural layer," and revealing the combinations characteristic of different historical epochs.

The mapping of cultural landscape palimpsests is closely related to the notions of the "cultural heritage object" and "civilization." Cultural heritage is a group of resources inherited from the past, which people identify, independently of ownership, as a reflection and expression of their continuously evolving values, beliefs, knowledge, and transitions. Information about the status and global value of cultural objects was taken from the UNESCO Natural and Cultural Heritage List. Since 1992 the areas formed as a result of significant interactions between people and the natural environment have been recognized as cultural landscapes, which have the status of mixed properties. Such objects account for only 5% of the total; however, the majority of the objects categorized as cultural heritage could also tell a lot about the human-nature interactions.

Objects of cultural heritage are the traces of various civilizations preserved within a landscape which, among other things, reflects the nature of their interactions with the environment. After civilization transition, the elements of material heritage of other cultures could appear within the object and either replace entirely the elements of the previous historical stage or coexist in parallel with them. In any case, the cultural landscape of a heritage object becomes multi-layered, which is important for further typology and classification. Thus, this paper treats "cultural landscape" as a purposefully formed natural and cultural territorial complex that has structural, morphological, and functional integrity and develops under particular physiographic, cultural, and historical conditions. Its components form certain characteristic combinations and are, in a certain way, interrelated and mutually conditioned (Kulturny landshaft …, 2004, page 13).

Another important concept used for analysis of cultural landscape palimpsests is civilization. According to F. Braudel, civilizations are "the realities of long, inexhaustible duration endlessly adapting to their destiny" (1949). He understood civilization as a space, a niche, and a cultural and geographical zone possessing a unique originality and interacting with other zones (civilizations). It is particularly true for the regions with a long history of civilization development, including, undoubtedly, the Mediterranean. From the point of view of mapping, the areas of civilizations reflect the spatial distribution of the system of values characteristic of various historical eras and, therefore, the cultural landscapes characteristic of a certain historical era.

This paper discusses the identification of cultural and landscape palimpsests based on analysis of civilization distribution areas and objects of cultural heritage of the recognized world importance. If civilizations had a long history and developed unidirectionally, their areas are imposed over each other and form zones of palimpsests of traditional cultural landscapes of different historical eras.

## 2. CONCEPTUAL FRAMEWORK

The idea of landscape as an object created almost exclusively by physiographic (natural) processes was predominant in the Soviet geography (Kolbowsky, 2013). This approach had the advantage of considering landscapes as natural resources within the Soviet (and then – Post-Soviet) nature management paradigms. The concept of "cultural landscape" partly corresponded to the syntagm "anthropogenic landscape" in the national scientific and geographical terminology, and it was also, in many respects, synonymous to the concept of "historical landscape" (Kulturny landshaft…, 2004). The modern Russian geography is increasingly tending towards the equal importance of both natural elements and the elements of material and spiritual culture comprising a cultural landscape (Kalutskov, 2008; Kulturny landshaft…, 2004 не нашла в ссылках Cultural Landscape 2004).

The mapping of cultural landscapes becomes particularly complex if their subjective components, in particular, the esthetic qualities, are considered. A number of studies of the authors who developed the ideas of "environmental aesthetics" deal with the intricate relationships between a "national paysage" and a "cultural landscape" (Bell, 2004; Porteous, 2004; Matthews, 2002; Parsons, Daniel, 2002; Kaplan, Kaplan, 1989; Carlson, 2008; etc.).The technique of assessing the impact on landscape esthetic properties (the so-called Visual Impact Assessment) is a practical result of research on visual and esthetic properties of landscapes.

There are also good examples of the regional analysis of the history of cultural landscapes made by Russia's geographers, for example, in the Russian Northwest (Isachenko, 1998) and the Central Russia (Nizovtsev, Marchenko, 2004). A special direction of research is the investigation of cultural landscapes within the country estate complexes (Isachenko, 2003).

It appears that the main distinction between the above-mentioned international and national studies in the field of cultural landscape mapping is the very understanding of the "cultural landscape" system. Many (but not all!) European interpretations of the concepts of "cultural landscape" and "landscape" regard them as synonyms, especially when speaking about rural landscapes that keep material traces of anthropogenic transformation during various historical epochs. Forming landscape as a thin, suitable for existence layer between the society and nature, people introduce a number of cultural impacts that manifested themselves in the pattern of developed space, the characteristic mosaic of rural areas, the urban patterns, and the stylistic features of the private and public property. The feedback of such cultural landscapes influences the nature of perception, the ways of landscape differentiation and assessment, and the formation of landscape iconics, i.e., cultural codes, symbols, and images.

In the course of anthropogenic impact, humans introduced various influences of culture which resulted in transformation of landscape structure and configuration of landscape patterns, development of traditional land management, creation of the linear and polygonal elements in a rural landscape, etc. – all of which constitute material and non-material cultural heritage. Elements of landscape structure and land use of different historical periods make an essential contribution to ecological stability and historical identity of a cultural landscape (Cullotta and Barbera, 2011). Cultural landscape palimpsests are formed as a result of consecutive change of different civilizations within the same territory; therefore they can contain several layers (Khirfan, 2010).

Due to specific features of historical, social, and economic development, traditional cultural landscapes do not form a continuous cover within any region. As a rule, three types of their configuration are possible at the regional level: (1) historical and cultural monuments with the status of protected cultural landscapes are points within the territories transformed during the later industrial development; (2) ancient roads, trade ways, hydraulic engineering

constructions, channels, etc., inherited in modern farming systems are lines often combined with small areas of traditional forms of environmental management (can also be objects of protection; and (3) the areas of historically developed agricultural management, with elements characteristic of them – polyculture, terraces, water-mills, and farms remained in modern system thanks to specific environment and the long history of civilization development which has already checked them for sustainability.

Agricultural terraces, the most ancient of which date back to the Ancient Greek civilization, are also important elements that played a larger role in the development of mountain landscapes of the region (Dotterweich, 2013). At present, they are under different types of land use in the Mediterranean, i.e., extensive grazing of cattle, citrus plantations, olive groves, and vineyards (Stanchia et al., 2012). Slopes of different steepness, often up to 40 degrees, are terraced in the Mediterranean, (Brancucci, Paliaga, 2005). The density of terraces varies considerably depending on the length of the slope breakers and its ratio to the area under terracing (from 5 to 800 meters per hectare) (Varotto, Ferrarese, 2008). Nowadays, the terraced slopes account for 0.3 to 65% of the area in certain regions (Liguria) in the Mediterranean (www.alpter.org).

The rates of landscape transformation are rather high in all European countries; however, the history of the formation of cultural landscapes in different parts of Europe differs quite strikingly due to both the potential of landscapes and the changes of chronotopes typical of respective civilizations. The identification of cultural and landscape palimpsests is of special interest in the regions with the longest and particularly complicated civilization history, e.g., the Mediterranean. The same-type characteristic civilization changes resulted in the presence of traces of several civilizations simultaneously within the modern cultural landscape.

Such an interpretation of cultural landscape leads to transformation of the concept landscape territorial structure, its typology, and scale. It also makes it necessary to represent cultural landscape as a spatial model suitable for mapping at different territorial levels.

From the point of view of spatial representation, cultural and landscape palimpsests are the systems integrating natural and historical subsystems. The overlay and combination of their particular components allow defining independent areas of the spatially distributed phenomena. The difficulties arising in the process of mapping are associated with both the complex nature of the cultural landscape and different temporary and spatial scales of the processes leading to its formation (Brenner, 2004). The cultural landscape as an object of mapping represents a set of the interconnected elements of three types: points, areas, and lines. The main characteristic of point elements is their position associated with features of the location. Polygon elements differ in size, configuration of borders, and form. Tracks (lines) bear property of the direction and have the extent (length) (PaHisCat, 2016). This algorithm of mapping is useful at the local level of GIS-modeling of the spatial structure of landscapes of high cultural and nature protection value.

## 3. METHODOLOGICAL FRAMEWORK

### 3.1 Study area

In this paper, we present the study of the historical cultural region of the Mediterranean. The concept “Mediterranean” is very complex for geographers and historians and suggests various definitions of its borders. From the point of view of physical geography, the region’s borders are defined by such criteria as the marine catchment basin, the olive growing area (Sustainable Future…, 2005), the Mediterranean type of climate (Isachenko, Shlyapnikov, 1989), etc. Depending on the nature of the influence of the Mediterranean civilizations on adjacent areas, the historians distinguish between the “Big” and “Small” Mediterranean

(Abulafia, 2003). Within the Mediterranean, the influence of the environment on civilization development is more obvious than anywhere else (Braudel, 1949). The civilization factors played a role in both the differentiation of the region and its integration. According to the French geographical school, the Mediterranean or "The Mediterranean world" (Braudel, 1949) is a uniform region with similar natural, historical, and cultural features. Its borders correspond most exactly to the climatic zone where cultivation of olive tree and the upland grain cereals (Birot, Dresch, 1956), or the Mediterranean type of agriculture, is possible (Sustainable Future…, 2005).

### 3.2 Methods and data

Methodological approaches used for identification and mapping of cultural-landscapes palimpsests combine the techniques of historical-geographical and landscape regionalization. The technique of landscape palimpsests mapping developed for the Mediterranean included three stages: (1) the inventory of historical and archaeological data on the World Heritage Sites and systems of environmental management and identification of typical cultural landscapes of different civilizations; (2) GIS-mapping of the areas of civilizations distribution; and (3) identification of areas of cultural and landscape palimpsests and creating NATURAL AND CULTURAL portraits of the areas (Figure 1).

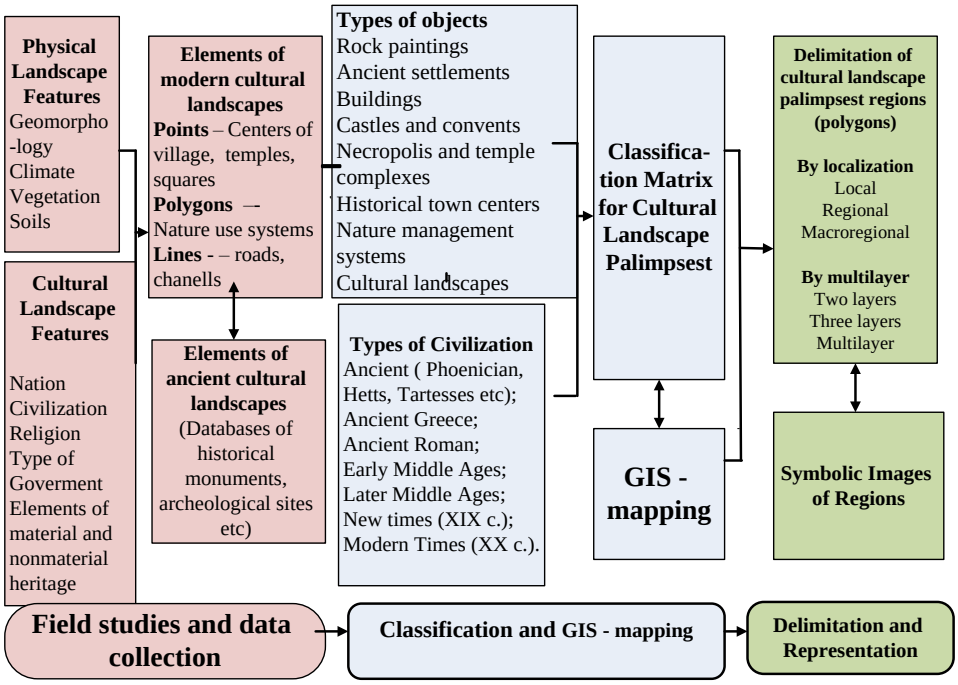


**Figure 1.** Stages of the landscape palimpsest delimitation and mapping

The main source of the inventory data was the global database of the UNESCO World Natural and Cultural Heritage (whc.unesco.org); for certain regions and periods the database of heritage sites wad supplemented by regional databases (BIC Andalucia etc); digital atlases available for certain regions (DARMC) were used for the inventory of cultural landscapes. In the GIS database, each object was characterized by its name, type, country, geographical coordinates, altitude, date of origin, ethnos/civilization, the existence of overlapping civilizations, type of landscape (if possible), object of protection, and the presence of management problems. Information about the state of cultural-landscape complexes and specific features of land development was obtained during field observations in 14

Mediterranean countries in 1991-2015. The results of the field observations allowed compiling the bank of georeferenced photo data and the attribute base for more than 80 World heritage sites.

All identified objects were reclassified depending on their geometry (points, lines, or polygons), functional purpose, and typicality in relation to the main type of development (Table 1).

**Table 1.** Typicality of the World Heritage sites

| Functional purpose | Type | Typicality in relation to the main type of development |
|---|---|---|
| Rock paintings | Points | Medium |
| Ancient settlements | Points, rarely polygons | High |
| Buildings | Points | Low |
| Castles and convents | Points, rarely polygons | Medium |
| Necropolis and temple complexes | Points | Medium |
| Historical town centers | Polygons | High |
| Nature management systems | Polygons | High |
| Cultural landscapes* | Polygons | High |

*and the objects on the List of the UNESCO World heritage under such nomination.
Note: no linear geometry was identified)

The specified categories of objects represent various typical values of cultural and landscape complexes of the region and they all can be used as sources of verified and comparable data on their properties and time of development (Butzer, 1982; Berrocal, Garcıa, 2007; and Gullino, Larcherb, 2013).

Similar work was also carried out on a reclassification of the objects' civilization eras. Analysis of historical and archaeological data allowed assigning the civilizations' areas in the Mediterranean to different stages of society development. At the same time, the identification of various types of civilizations during the historical period (AD) was rather difficult. After Le Goff (1992), we were able to identify the Christian civilization of the medieval West (within the Iberian and Apennine peninsulas), the Byzantine civilization (the Balkan Peninsula and Asia Minor), the Arab civilization, and the Ottoman civilization during the early and late Middle Ages. Classification of civilizations and their "collision" in the new and recent historical stages is, to a large extent, governed by cultural and religious factors (Huntington, 2003). On the other hand, this period already corresponds to the industrial stage of society development, when other factors, including technogenic, played central role in spatial differentiation. In this context, the areas of palimpsests were constructed just up until the fall of the Roman Empire.

The data on the reclassified objects were used for the creation of schematic cultural landscape profiles of the Mediterranean regions in Excel.

The resulting database became the basis for the thematic GIS "Civilizations and cultural and landscape complexes of the Mediterranean" compiled in ArcMap 10.0. In addition to the object data, it includes the following thematic layers:

- boundaries of the Mediterranean region based on different indicators (digitized boundaries of the water catchment area, bioclimatic region, and the olive growing area);
- landscapes of the Mediterranean (digitized map compiled using the maps by E.P. Romanova, E.V. Milanova, A.V. Mededev and A.G. Isachenko);

- areas of 16 main civilizations of the Mediterranean (to Modern times and formation of the Western European civilization) digitized using the Atlas of World Archeology (2003) and the Atlas de Europa Medieval (2011)).

Processing of the regionalization data on the natural conditions, the course of civilization development, and the modern and relict cultural landscapes has yielded two types of the cultural landscape regions belonging to different hierarchical levels. Regions of the first type are uniform in terms of their natural features, and the regions of the second type have the same type of cultural and landscape palimpsests. Boundaries of the first-type regions correspond to the boundaries of the natural regions of the Mediterranean, while the second-type regions are limited by the areas of civilization distribution. Depending on the number of layers, two- and three-layered cultural and landscape palimpsests were identified: local, regional, or macroregional, in terms of their localization.

At the final stage of work, the multiple-criteria zoning of the region in terms of the expressiveness of the Mediterranean cultural landscape was done.

## 4. RESULTS AND DISCUSSION

Nine historical and geoecological regions of the first type were identified the Mediterranean; they differ in uniformity of natural landscape structure:

Iberian – with high inner karst plateaus in the central part and northern semi-humid and southern semi-arid mountainous landscapes;

South France – with northern semi-humid landscapes of folded flysch mountains and maritime plains;

Apennine – with predominant mountainous semi-humid landscapes and accumulative alluvial-proluvial plains widespread in the periphery;

Balkan – with folded flysch middle mountains in the north and limestone karst mountains in the south and with the equal share of northern semi-humid and semi-arid landscapes;

Asia Minor – with predominant semi-arid landscapes of folded flysch and limestone Karst Mountains;

Levantine – with the equal share of semi-arid landscapes of folded flysch mountains and subtropical desert-steppe hilly plains;

Maghreb – with southern semi-arid landscapes of flysch low and middle mountains and accumulative plains of intermountain and submountain basins, and subtropical desert-steppe maritime landscapes;

Lower Nile – with anthropogenic irrigated landscapes of accumulative and deltaic plains;

Island – with diverse landscape structure, predominance of fault-block mountains and accumulative plains on large islands and local presence of volcanic and limestone mountains.

The diversity of natural features of historical regions was particularly important for civilization development of the Mediterranean.

The history of civilization development of the Mediterranean embraces about eight thousand years (the time of emergence of the ancient Sumer civilization (Hunt et al., 2007)) of which the most ancient stages of human society are the longest ones. The analysis of historical and archaeological data allowed for rather reliable localization of the areas of civilization distribution in the Mediterranean at different stages of development of human society.

Comparison of civilizations distribution and landscape features of the Mediterranean manifests two major patterns that had developed in the region by the time of the golden age of the Ancient Roman Empire (Figure 2).

The earliest civilizations originated in the southeast of the region in river valleys of subtropical desert and steppe landscapes (McClure, 2013). Gradually, semi-arid landscapes became involved in development; the last were the western areas with northern semi-humid landscapes. Thus, changes of local civilizations followed changes of the gradient of moistening — from drier to more humid. This direction was connected with changing nature of environmental management of civilizations — from the irrigated agriculture to forestry and mining development. Also, there is evidence of evolving preference of landscape levels: after landscapes of river valleys of Mesopotamia and the Nile River delta initial development, the islands in the Aegean Sea, coastal plains of the Asia Minor and the Balkan peninsulas, and then denudation plateaus and folded structures of the Apennine and Iberian Peninsula became involved in development.

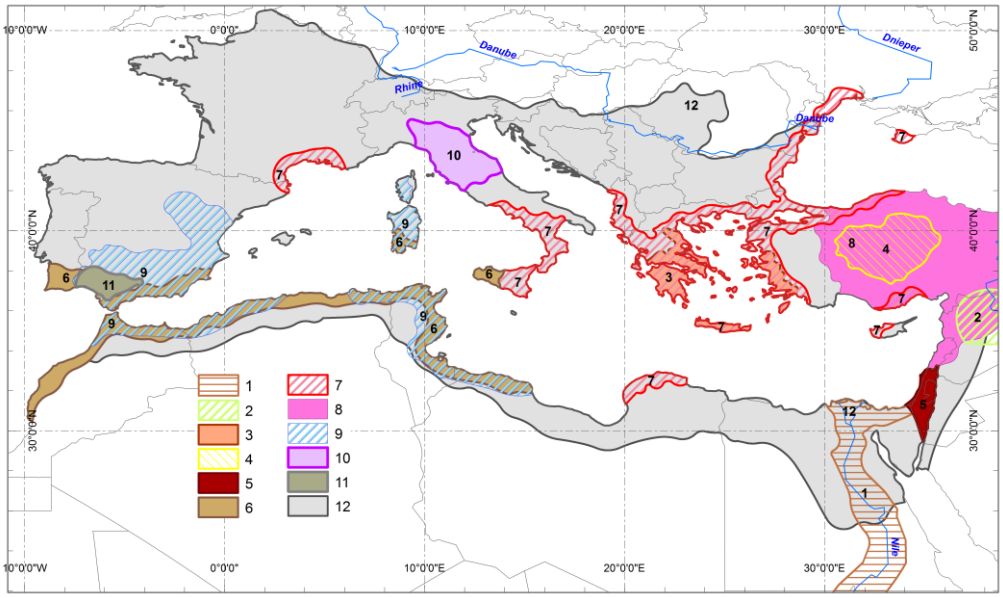


**Figure 2.** Ancient civilizations: 1 – Ancient Egypt (II thousand years BC), 2 – Sumer (III thousand years BC), 3 – Creto-Mycenean (XIV c. BC), 4 – Hittian (1250 BC), 5 – Judaic (VI-VIII c. BC), 6 – Phoenician (end of VI c BC), 7 – Ancient Greece (end of VI c BC), 8 – Assyrian (VII c. BC), 9 – Carthaginian (III c. BC), 10 – Etruscan (end of VII c BC), 11 – Tartessian (end of VII c BC), 12 – Ancient Roman (395 AD)

Various types of civilizations were classified after the fall of Roman Empire. In the periods of the early and late Middle Ages and after Le Goff (1992), we were able to distinguish the Christian civilization of the medieval West (within the Pyrenean and Apennine peninsulas), the Byzantine civilization (the Balkan Peninsula and Asia Minor), the Arab civilization, and the Ottoman civilization (Figure 3).

The spatial distribution of civilizations within the regions allows classifying them into local, regional, and interregional (macroregional). The civilizations that remained in their own zonal types of landscapes during development and kept the traditional system of environmental management based on the potential of their landscapes were classified as local. Regional civilizations, unlike local, occupied more than one zonal type of landscapes and had a diversified system of environmental management. Interregional civilizations were distributed within several zonal types of landscapes, and also had the developed system of environmental management (sometimes written in the documents (Dotterweich, 2013)), which allowed considering various geographical features of their area of distribution.

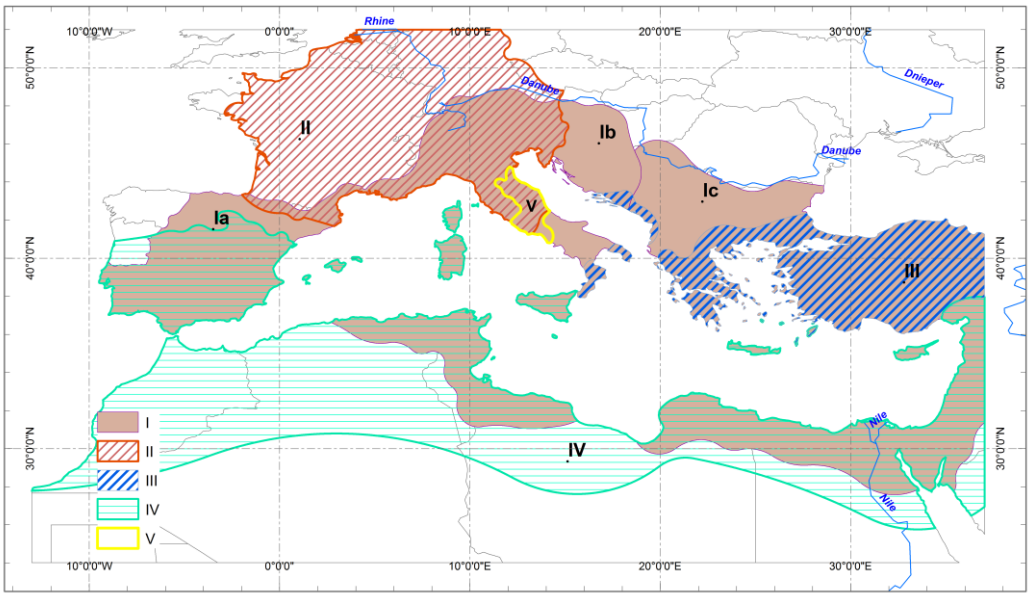


**Figure 3.** Civilizations of the Middle Ages: I – civilizations of the epoch of Barbarians diffusion: Ia - Visigoths, Ib - Ostrogoths, Ic – Vandals; II–Carlovingians; III – Bizantians; IV – Muslims; V – States of the Church

As a rule, local civilizations were first to develop. These are Sumer, Ancient Egypt partly Cretan-Mycenaean and Hittite, and Judaic, which were distributed over rather small areas. Practically all of them, except for Judaic civilization, did not survive until our days; however, their existence, in the majority of cases, accounted for hundreds, and even thousands of years.

Regional civilizations are Phoenician, Ancient Greek, and, later on, the Arab and Ottoman civilizations. They occupied larger territories; the material evidence of their existence is preserved both within the area of the civilization itself and the areas that were under their influence. Thus, many Ancient Greek landscapes in Asia Minor survived to our days – several cities centers of the Hellenic culture, such as Ephesus, Miletus, and Didim, are located in the present-day Turkey.

The civilization of Ancient Rome, which occupied the maximal area in the region in the II-IV centuries AD, became the major interregional civilization. By 117 AD, there were already numerous large cities within the Roman Empire. According to some estimates, the population of Rome reached about one million inhabitants. Alexandria and Antakya had more than 100 thousand people each, and the Athens, Pergamum, Izmir, Ephesus, Ostiya, and Carthage had at least 50 thousand people (Atlas of World Archaeology, 2003). Later, the ancient Roman civilization was forced out by other civilizations; however, traces of this civilization remain in many regions of the Mediterranean

Each part of the Mediterranean approached the time of the Roman Empire with its own pre-civilization and civilization history. The history of landscape transformation for the whole region during this period is difficult to reconstruct. The reason is not only the various levels of availability of historical data for the very large territory. The subsequent civilizations quite often “remade” or even destroyed the pattern of previous development. Thus, on the Aegean coast of Asia Minor (in particular, in the area adjacent to Pergamum), the cultural landscapes of the antique era were largely buried after the invasion of Ottoman Turks.

Other areas, on the contrary, experienced the consecutive change of civilizations; each of them left the material traces in the landscape. The evidence of nature transformation in the most southern area of Spain Andalusia, by Phoenicians, Romans, Arabs, and actually Catholic Spaniards are preserved to our days (Historia de Anadalucia, 1981, Costejon, 1985).

Each historical and geoecological region of the Mediterranean is characterized by a specific type of civilization changes, which determines the type and structure of cultural and landscape palimpsests. Based on the historical data, we have identified that, by the time of the fall of Roman Empire, there were already eight types of two-layer and seven types of three-layer cultural and landscape palimpsests within the region (Figure 4).

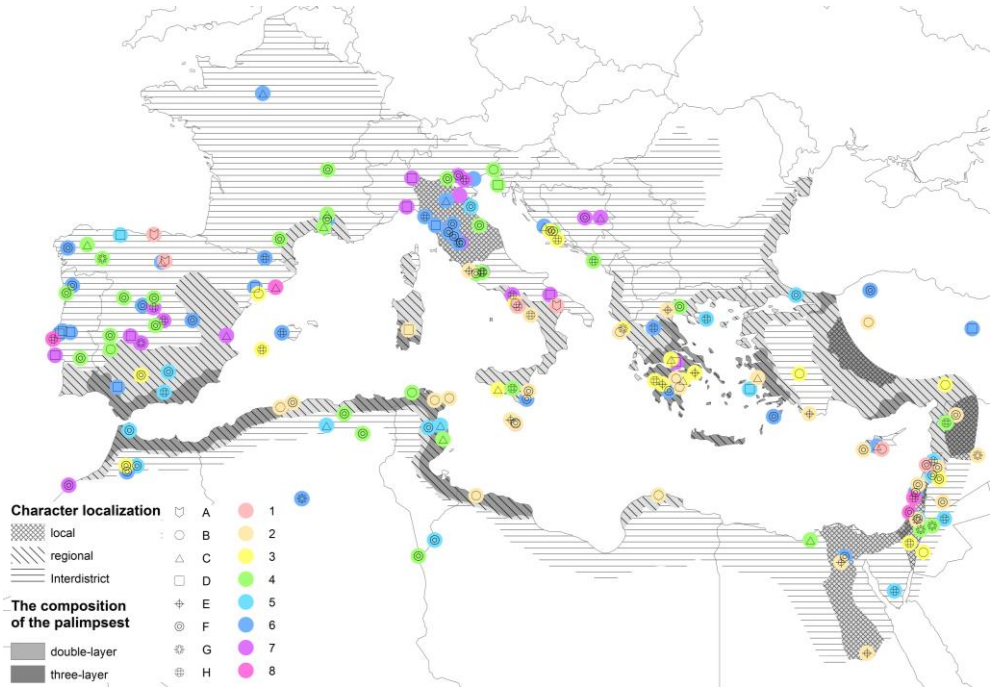


**Figure 4.** The types of civilization changes and the nature of the palimpsests (level of scale and composition), from XX c. BC to V c. AD). The World Heritage sites: A – rock paintings, B- ancient settlements, C - buildings, D - castles and convents, E - necropolis and temple complexes, F - historical town centers, G - nature management system, H - cultural landscapes; age of World Heritage sites: 1 – Stone Age, 2 - I-II thousand years BC., 3 – VI-IV c. BC., 4 – III c. BC. – VIII c. AD. , 5 – VIII-XI c., 6 – XII – XIV c., 7 – XIV – XVII c., 8 – XVIII – XIX c.

These areas underwent a transition of local civilizations into regional and, finally, the interregional Ancient Roman, covering the whole Mediterranean.

Comparison of the areas of civilizations distribution and location of the World Heritage sites demonstrates that the main foci of the cultural and landscape framework coincide with the last stage of the ancient Roman civilization. Analysis of the World Heritage sites network showed that one-third of them passed through more than one historical era, i.e., they represent palimpsests. At the same time, 60% of such objects are more than thousand years old. Large-scale water transfers from humid mountain areas to the coast and intermountain valleys are characteristic of the Roman time; almost universally in the Mediterranean, it is possible to find aqueducts, the heritage of that era. Along with aqueducts, manifestations of civilizations in the landscape are associated with theaters and amphitheaters that are usually located within the treeless steppe areas of piedmont plains (Pucci et al., 2011). In fact, the Roman civilization “multiplicated” its cultural landscapes across the Mediterranean, thereby integrating its territory into a uniform cultural and landscape area.

By the type, nearly one-third (32%) of all objects are historic centers of the cities — most of them are in North Africa, Levant, and on the Iberian Peninsula. Systems of environmental management and cultural landscapes (both objects of this category, and park ensembles with some of their objects) account for more than one-fifth (23%) of all considered objects. Another 26% of the objects are other types of areas, i.e., remnants of ancient settlements,

rock paintings, and monastic and castle complexes. The listed types of objects are mostly relicts of a cultural landscape, but some of them are still used for the same functional purpose.

Comparative analysis of certain regions of the Mediterranean (types of the World heritage sites and time of their emergence) allowed creating their historical and geoecological portrait. On the Iberian Peninsula where the material evidence of all civilization eras exists, the share of the late Middle Ages objects (the era of the formation of the Spanish nation and the Reconquest) is the largest. The role of historic centers of the cities, systems of nature management, and cultural landscapes that emerged in antique time and peaked during the Ancient Roman era in the structure of cultural and landscape complexes of the global importance of this region is high. On the Apennine Peninsula, the types of objects are similar, but the share of cultural and landscape complexes relating to modern times is higher.

From the point of view of cultural landscapes heritage within the civilization palimpsests, it is important to compare civilizations in terms of the principal systems of nature management. For example, the subsequent civilization could adopt the experience of the previous (this is the case of the Romans who, in many respects, adopted and improved the experience of the classical Greece) (Vos, Meekes, 1999). An example of the opposite situation is the change of the Roman system of cultural landscapes at the time of vandals' invasion leading to its physical degradation and destruction (Le Goff, 1992). In some regions of the Mediterranean, for example, in its African part, the system of Roman cultural landscapes still didn't manage to recover completely.

## 5. CONCLUSIONS

Cultural landscapes "accommodate" a particular ethnos and they are also the space for civilization development of a number of ethnoses. From civilization perspective, the notion of "cultural landscape" as a historic space reflecting the forms of existence of different spatial-temporal relations (or chronotopes, according to G. Knabbe) gains another meaning as well.
The analysis of geographical and historical and cultural factors of formation of cultural landscapes in the Mediterranean demonstrated the existence of rather extensive transitional strip with a number of characteristic "Mediterranean" elements in the nature, culture, and economy, and a number of elements associated with the neighboring regions. Overlaying basin, climate, and vegetation zones allowed us to include in the macroregion both the catchment basin of the Mediterranean Sea and the territories with typical landscapes of the western sector of the subtropical belt. They could be found in the Central Spain and Portugal, and also the central part of Asia Minor. The northern boundary of the Mediterranean region is unclear in such definition. It is possible to include in it both the sub-Mediterranean landscapes of the Central Balkans, and the mountain landscapes of Northern Italy.

The similar "spread" of the Mediterranean is also accurately marked by civilization borders. Along with the transitional strip, the core of the Mediterranean cultural landscape could be traced by characteristic material evidence of antique civilization, inherited agricultural activity (cultivation of traditional Mediterranean olives, grapes, or wheat), and the pronounced winter maximum of rainfall.

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# POPULATION-HEALTH-ENVIRONMENT (PHE) SYNERGIES? EVIDENCE FROM USAID-SPONSORED PROGRAMS IN AFRICAN AND ASIAN CORE CONSERVATION AREAS

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## Abstract

Do Population-Health-Environment (PHE) initiatives provide synergies above and beyond more traditional singular efforts? Some development practitioners note the potential to combine solutions to population-environment (PE) together with health-environment (HE) initiatives for the global conservation of natural resources in developing countries while simultaneously improving human health and livelihood security. PHE advocates in the policy arena have promoted the importance of integrating "conservation, health, and family planning (FP) interventions" in the management of some of the world's most socio-economically impoverished as well as ecologically rich environments. However, scant scholarly evidence supports these claims. In this paper, we probe the potential effectiveness of integrated PHE investments for conservation outcomes. Data was collected in World Wildlife Fund (WWF) designated high priority marine and terrestrial conservation sites with USAID-sponsored PHE programs in the Philippines, Nepal, India, Mozambique, Madagascar, Kenya, Cameroon and the Central African Republic. We conducted individual and focus-group interviews with 754 individuals: WWF staff, staff from partner health and environment organizations, and local men and women in the program service areas. Quantitative and qualitative results indicate diverse, and in some cases dramatic, improvements in maternal and child health and conservation measures that overall appeared to benefit from the integrative PHE approach. Results also point toward the importance of promoting PHE interventions within the framework of livelihood improvement.

***Keywords:*** *Population-Health-Environment, conservation, sustainable development, family planning, fertility, migration.*

## 1. INTRODUCTION

### 1.1 Population, Health, and Environment Interactions

Growing population pressures on natural resources, especially fertility and migration, are among the core foci of Population-Environment (PE) research. Yet the relationships embedded in PE solutions vary significantly due to the complexities of different places. While highlighted in only a minority of studies as a major driver, PE dynamics is well established as a significant

determinant of land intensification, extensification, and degradation (Carr 2005; Carr 2002; Carr and Bilsborrow 2001; Miller et al. 2010; Mishra 2002; Pan et al. 2004; Walker et al. 2002). Fertility and in-migration have been positively linked to deforestation in Latin American agricultural frontiers (e.g., Carr 2008; Pan and López-Carr 2016) and migrant remittances have been observed to increase consumption and increase pressure on the local environment (Davis and Lopez-Carr 2010). Yet PE dynamics are far from simple. Where human populations depend on local natural resources for survival in remote areas of high biodiversity, per capita human impact on the environments of high conservation priority has been observed by some scholars to be particularly high in developed and developing regions and in marine and terrestrial environments (Chen and Lopez-Carr 2015; Carr, Suter, Barbieri, 2006).

Case studies have demonstrated that there is a large variation in regards to the effects that population change can have on local environments (Carr 2008; Carr et al. 2009). In response to the inherent complexity of these interrelated systems, researchers have applied models to tease out the relative impacts of different variables (Arlinghaus et al. 2008; Miller 2010). Some authors highlight how PE dynamics may form positive feedback loops, in which environmental decline contributes to high population growth rates, which further degrades environmental conditions (Bhattacharya & Innes 2008). More research is needed, however, to understand the relative contributions of distinct variables in impacting coupled PE outcomes under different population and environmental conditions and across distinct regional and local contexts. Even less is known about the role health and livelihoods play in PE dynamics and more research is needed in this area before conclusive evidence emerges.

### 1.2 Population and Environment in Protected Areas

Population pressures are particularly high in and around conservation priority areas in the developing world; these populations, in turn, suffer disproportionate climate change impacts on fragile subsistence agriculture based livelihoods (Aukema et al 2017). One widespread form of environmental intervention is the establishment of protected areas (PAs): politically delineated areas where human access or use is limited or prohibited. When excluding the needs of resource-dependent locals, hard-line, or "fortress", protection strategies can limit economic development opportunities and increase poverty at the local and nation scales, which, in turn, can lead to environmentally unsustainable resource use as locals forfeit future sustenance for near-term survival (Adams et al. 2004; Barrett, Travis, and Dasgupta 2011; Naughton-Treves, Holland, and Brandon 2005; Andam et al 2010).

Another unintended consequence of protected areas can be increased exploitation and degradation of the environment surrounding them, due to increased population growth outside of the borders, and in-migration to take advantage of NGO or government-sponsored development opportunities (Bamford, Ferrol-Schulte, and Wathan 2014; Carr 2009; Estes et al. 2012; Hartter et al. 2015; Wittemyer et al. 2008). When planned at multiple scales and across multiple institutions, environmental degradation surrounding Pas does not universally follow PA establishment (Joppa, Loarie, and Pimm 2009).

### 1.3 Family Planning and Poverty

Research on the relationship between high fertility and poverty has evolved through a number of contrasting viewpoints (Kelley 1988; Merrick 2002; Sinding 2009). The religious and political controversies that can accompany contraception initiatives can cause difficulty in successful implementation and adoption. Despite this, it does seem to be clear that nearly all women choose to plan their families when given the choice and that providing family planning resources along with the other necessary conditions of economic development can result in

significantly improved poverty reduction rates in the developing world. FP is accompanied, or enabled, by increased investment in human capital in the form of health and education spending, and increased labor force participation for women (Ashraf, Weil, and Wilde 2013; Canning and Schultz 2012; Das Gupta, Bongaarts, and Cleland 2011; Miller 2010).

### 1.4 Family Planning and Conservation

In addition to economic improvements, associations have emerged in some research between family planning and conservation outcomes. Although research in this area remains nascent, several studies have demonstrated that family planning significantly lowered pressures on local conservation outcomes (Das Gupta, Bongaarts, and Cleland 2011; Stephenson et al. 2013). More, appropriately designed research is needed to demonstrate potential family planning-conservation synergies (Bremner et al 2013). Recent calls for holistic human and planetary health research and practice may serve as a ripe framework for advancing such research (Whitmee et al 2015).

### 1.5 Health and Environment

Health-Environment (HE) dynamics describe a wide range of issues including disease transmission, nutrition, fertility, and access to healthcare. Some argue that the developing world typically faces the same HE problems as the developed, just without as many resources to combat their effects (Von Schirnding 2002). However, HE dynamics are significantly more problematic in developing countries where ecosystem services of surrounding natural environments are often compromised, which can exacerbate socio-economic challenges and lead to poor health. The former has been studied in some depth, while the latter is just recently receiving due attention. Nutrient deficiency is often a direct result of poor water quality (Reimann et al. 2003), chronic lung disease a result of air pollution (Smith 1993), and lack of proper shelter a driver of vector-borne environmental diseases (Von Schirnding 2002). These are some complex and multidimensional dynamics inherent in coupled HE processes.

Climate change promises winners and losers in the HE equation. In much of the developing world, it will further exacerbate already existing HE problems. Climate change has been identified as a key driver of the increasing rates of disease among populations, especially among children, as well as in decreasing food security (Brown and Funk 2008; Lobel 2008; UNICEF 2008; Shea 2007; López-Carr and López-Carr 2014). For the most part, climate change HE solutions to date have been designed to provide mitigation measures for developing regions (Ali and Jacobs 2013; Chapman et al. 2014; Gaffikin 2013; Lopez-Carr and Marter-Kenyon 2015). Ultimately, where population pressures collide with climate change and natural resource pressures, population size, dynamics, and distribution are key variables in sustainable development solutions (Lopez-Carr et al. 2010; 2014; 2016). While the literature is now large on human impacts on the environment, less is known about how populations interact with the environment to produce salutary environments for people and the planet.

### 1.6 PHE Evidence

As the effects of global environmental change are becoming increasingly deleterious, identifying population and health, independently and in conjunction, as components of environmental consequences is critical for a successful analysis of resource management. Conversely, identifying resource impacts on human population and health outcomes is essential for achieving holistic health policies (Pan and Lopez-Carr 2016). Population-Health-Environment is an integrated framework for development initiatives. PHE projects attempt to

improve outcomes in all three dimensions by combining the solutions to population-environment (PE) with health-environment (HE) for the global conservation of natural resources in developing countries. In doing so, PHE recognizes the importance of considering "conservation, health, and family planning interventions" in the management of some of the world's most impoverished as well as ecologically rich environments (Hahn, Anandaraja, and D'Agnes, 2011; Honzak and López-Carr 2012; López-Carr 2013).

PHE was adopted as an approach by a number of international development agencies and organizations at the beginning of the new century, including the United States Agency for International Development (USAID), the World Wildlife Fund (WWF), Johnsons and Johnson Foundation, Pathfinder International, The Packard Foundation, and others (Honzak and Lopez-Carr 2012). It has been championed by sources in conservation and development agencies and think tanks in the so called 'grey literature', notably by the Woodrow Wilson Center and its Director of Population, Environmental Security, and Resilience, Roger-Mark De Souza (e.g. De Souza, Williams, and Meyerson 2003). USAID and multiple international and local organizations have implemented a number of initiatives in the developing world in places such as the Phillipines, Ethiopia, Kenya, Madagascar, Nepal, and Tanzania (Hahn, Anandaraja, and D'Agnes 2011; Harris et al. 2012; Hoke et al. 2015; Gonsalves et al. 2015; Sinaga et al. 2015; Torell et al. 2012).

Numerous evaluations suggest integrated PHE program effectiveness compared to single sector initiatives. A comparative cross-sectional evaluation of a PHE project's family planning (FP) outcomes in Ethiopia (n=960) found that the program was effective in this regard, as well as providing "better integration of environmental conservation activities…into FP and health activities" (Sinaga et al. 2015). A qualitative, interview-based evaluation of a different PHE project in Ethiopia found that integration of a community based FP intervention into an existing environmental program resulted in positive outcomes and synergies (Gonsalves et al. 2015). Similarly, the introduction of FP content into an existing marine conservation program in coastal Madagascar led to increased access of FP services, which was enhanced by infrastructure and networks of the pre-existing program. Positive synergies were achieved as community members who have not engaged in the conservation initiative were contacted and engaged when they accessed FP services. In addition, researchers found that this combination of interventions resonated positively with locals' perceptions of the program and enhanced the marketing and education efforts (Harris et al. 2012; Mohan and Shellard 2014).

A robust evaluation of a fully integrated PHE program in Nepal found positive outcomes in pre-determined population, health, and environmental outcomes (Hahn, Anandaraja, and D'Agnes 2011). In the Philippines, D'Agnes and others (2010) demonstrated the success of integrated PHE in tackling both reproductive health and sustainable fishing practices, as compared to separate interventions. Similar island-based PHE projects have been implemented in places like Madagascar and Kenya and have also shown success (Hoke et al. 2015). Non-peer reviewed published evaluations of PHE programs told much the same story (Diamond 2010). We found no published work where PHE programs were deemed to be ineffective, save one non-academic publication where the program's impacts seemed very limited (Torell and McNally 2013). However, more attention will be required to scale-up PHE projects through improved standardization of data collection and analysis (De Souza 2008; Ghiron et al 2014).

In this paper, we review the evidence linking population, health and environmental outcomes in WWF-managed PHE programs in several priority global conservation areas. We describe the study sites and data collection below followed by a presentation of results of overall program effectiveness. We conclude by summarizing findings and discussing future research opportunities and policy implications.

## 2. METHODS

### 2.1 Study Sites

We evaluated a multi-country PHE program, funded by USAID and Johnson & Johnson Foundation during the first decade of the new millennium. The countries involved in the project included the Philippines, Nepal, India, Mozambique, Madagascar, Kenya, Cameroon, and the Central African Republic. The program sites were chosen, in collaboration with WWF, because of their designation as high priority marine and terrestrial conservation areas, and the urgency of need for the local populations. The particulars of the project differed for each site, but each shared goals to facilitate the provision of basic health care, FP, and promote environmental conservation. Promotors of PHE believe that conducting these efforts in concert adds value to each independent outcome. In remote, ecologically rich ecosystems, people's well-being is closely tied to the sustainability of the natural resource base. In such regions, of which six of the eight studied are home to indigenous peoples, survival and well-being depend largely on subsistence agriculture and successful stewardship of natural resources through hunting and gathering, fishing and forest resource extraction for food, medicine and building materials. People with some of the highest poverty, fertility and mortality rates on Earth interact intimately with some of the most precious ecosystems. In sum, this is where the human-environment coexistence is in flux; it is where human populations grow most rapidly, suffer most acutely and directly depend upon and effect the richest forest and marine ecosystems.

The eight PHE sites are located within marine and terrestrial ecosystems in southern and Southeast Asia and central and eastern Africa and Madagascar, ranging from 80 to over 20,000 square kilometers (Table 1). Quirimbas National Park (QNP) in Mozambique and Kiunga Marine National Reserve (KMNR) in Kenya combine marine and terrestrial systems. The Roxas District project of the Philippines in the Coral Triangle is a marine site.

**Table 1.** Geographic and Human Landscapes Evaluated, Conservation Area, and Subjects interviewed.

| **Country** | **Priority place** | **Ecoscape** | **Area (sq km)** | **Number in focus meetings** |
|---|---|---|---|---|
| Philippines | Coral Triangle | Marine | 1,174 | 118 |
| Nepal | Eastern Himalayas | Terrestrial | 83 | 64 |
| India | Eastern Himalayas | Terrestrial | 600 | 144 |
| Madagascar | Spiny Forest | Terrestrial | 21,000 | 4 |
| Mozambique | Coastal East Africa | Marine & Terrestrial | 7,500 | 210 |
| Kenya | Coastal East Africa | Marine & Terrestrial | 600 | 74 |
| CAR | Congo Basin | Terrestrial | 3,159 | 60 |
| Cameroon | Congo Basin | Terrestrial | 21,789 | 80 |
| ***Totals*** | | | ***55,905*** | ***754*** |

The remaining five sites are terrestrial. The Indian and Nepalese sites face each other across their country's borders south of the foothills of the Himalayas, in a region known as the Terai Arc. Madagascar's site is in the unique dry Spiny Forest. Lastly, the Central African Republic (CAR) and Cameroon sites are nestled deep within the Trinational Sangha landscape in the Congo Basin's humid tropical forest. Each site is home to anywhere from 10,000 to 125,000 people with the number of communities ranging from 7 to 130. The CAR and Philippines sites had 7 communities. The Mozambique site had 130 communities. The remaining sites had 11-

32 communities with populations ranging in size from a few hundred to a few thousand people (Table 2).

**Table 2.** Demographics of Intervention Sites.

| Country | Evaluation Site | Target population | Target communities | Demographic stage | Desired no. children |
|---|---|---|---|---|---|
| Philippines | Coral Triangle | 22,500 | 7 | Middle | 2.5 |
| Nepal | Eastern Himalayas | 18,300 | 32 | Early-Middle | 2.5 |
| India | Eastern Himalayas | 50,000 | 25 | Early-Middle | 2.5 |
| Madagascar | Spiny Forest | 20,000 | 23 | Early | 7 |
| Mozambique | Coastal East Africa | 125,000 | 130 | Early | 7 |
| Kenya | Coastal East Africa | 21,000 | 11 | Early-Middle | 4 |
| CAR | Congo Basin | 12,000 | 7 | Early | 8 |
| Cameroon | Congo Basin | 12,000 | 20 | Early | 6 |
| ***Totals/Mean*** | | ***280,800*** | ***230*** | | *4.9375* |

Consonant with their remote locations, the development and demographic stage of the regions are low. However, there is some notable heterogeneity. For example, populations of Roxas District in the Philippines have clearly progressed through much of the early demographic and development stages. Fishing communities are integrated into local government policies and health care, desired family size is below three births per woman, and mortality has fallen dramatically. Conversely, the people inhabiting the Dzanga-Sangha forest of the CAR and the Spiny Forest of Madagascar remain at the earliest stages of these key transitions. Desired family size is very high, life expectancy remains below 40 years of age, infant mortality in some cases exceeds 50 percent, and communities survive largely without any reliable government presence. In some instances, different development stages were evident within the same PHE site. For instance, the Ba'Aka forest people of the CAR, who had recently settled on the forest edge, and the Boni people, living as hunters and gatherers and incipient agriculturalists on the Kenyan and Somali border, were at the very early stages of the development and demographic transitions, notably lagging behind their Bantu and coastal Muslim neighbors respectively.

Each site received between $30,000 and $139,437 annually (2007 figures) for their program and was in the third, fourth, or fifth year of funding at the time of data collection (Table 3)[1].

**Table 3.** Investment per Intervention Site.

| Country | Priority place | 2007 funding | USAID | Johnson & Johnson | Years of funding | Funding per capita |
|---|---|---|---|---|---|---|
| Philippines | Coral Triangle | $70,000 | $70,000 | n/a | 3 | $3.11 |
| Nepal | Eastern Himalayas | $79,993 | $38,231 | $41,762 | 4 | $4.37 |
| India | Eastern Himalayas | $30,000 | n/a | $30,000 | 4 | $1.66 |
| Madagascar | Spiny Forest | $107,725 | $107,725 | n/a | 4 | $5.39 |
| Mozambique | Coastal East Africa | $46,000 | n/a | $46,000 | 4 | $0.37 |
| Kenya | Coastal East Africa | $139,437 | $85,000 | $54,437 | 4 | $6.64 |
| CAR | Congo Basin | $49,000 | n/a | $49,000 | 4 | $4.08 |

[1] All figures are net of WWF-US overhead, i.e. they are the amounts that WWF-US sent to the field. USAID funds are for October 2006–September 2007. J & J funds are for calendar year 2007. All USAID funds are from the Office of Population and Reproductive Health, Global Bureau, except for Nepal, which was funded by the USAID Nepal Mission.

| | | | | | | |
|---|---|---|---|---|---|---|
| Cameroon | Congo Basin | $45,400 | n/a | $45,400 | 5 | $3.78 |
| ***Total/Mean*** | | ***$567,555*** | ***$300,956*** | ***$266,599*** | ***4*** | ***$2.02*** |

Budgets often varied from year to year. Some of the PHE interventions we evaluated built capacity or infrastructure. Others were aimed at direct outcomes. Among these were direct interventions, such as directly saving individual turtles from fishing, while other interventions were preventive, such as preventing human impacts on turtles by seizing illegal fishing gear.

Similarly, some population and health outcomes were indirect and others direct. In Central Africa, poaching was a primary conservation challenge while in other terrestrial regions, agricultural expansion and fuelwood collection were primary environmental concerns. Marine sites, conversely, were combatting overfishing (Table 4).

**Table 4.** Human Threats to the Environment

| **Country** | **Priority place** | **Main Eco-threat** |
|---|---|---|
| Philippines | Coral Triangle | Illegal & over-fishing |
| Nepal | Eastern Himalayas | Fuelwood collection/cattle |
| India | Eastern Himalayas | Fuelwood collection/cattle |
| Madagascar | Spiny Forest | Agriculture/fuelwood collection |
| Mozambique | Coastal East Africa | Agriculture/illegal fishing |
| Kenya | Coastal East Africa | Fuelwood/illegal & over-fishing |
| CAR | Congo Basin | Poaching |
| Cameroon | Congo Basin | Poaching |

Interventions were prioritized according to the distinct conservation challenges facing each area (Table 5).

**Table 5.** Interventions

| **Area of Program** | **Main environmental intervention** | **Main health intervention(s)** | **Reserve Established** | **Clean Water Provided** | **Livelihood Intervention** | **Food security intervention** |
|---|---|---|---|---|---|---|
| Coral Triangle, Philippines | Sanctuaries/fishing regulations | FP/MCH | Yes | | Yes | Yes |
| Eastern Himalayas, Nepal | Fuel-efficiency | FP/MCH/HIV/Infectious Diseases | | Yes | Yes | |
| Eastern Himalayas, India | Fuel-efficiency | Infectious Diseases | | | Yes | Yes |
| Spiny Forest, Madagascar | Forest protection | FP/MCH/Infectious Diseases | | | | |
| Coastal East Africa, Mozambique | Sanctuaries/fishing regulations | Nutrition | Yes | | | Yes |
| Coastal East Africa, Kenya | Sanctuaries/fishing regulations | FP/MCH/HIV | Yes | Yes | Yes | Yes |
| Congo Basin, CAR | Hunting regulations | FP/MCH/HIV/ Infectious Diseases | | Yes | Yes | Yes |
| Congo Basin, Cameroon | Hunting regulations | FP/MCH/HIV Infectious Diseases | | Yes | | |

How successful were the WWF PHE programs in improving population, health and environmental outcomes in target sites?

## 2.2 Data Collection Methods

The lead author conducted individual and focus-group interviews with 754 individuals: WWF staff, staff from partner health and environment organizations, and local men and women in the program service areas (Table 1). Key informants were interviewed, including village leaders and local NGO and ministry representatives, health workers, and agricultural extension agents. At least three villagers were selected at random for interviews at each program site. A brainstorming and conceptual linking activity was conducted with a selection of local villagers, NGO, and government staff, to record and prioritize PHE synergies and to illustrate the synergistic pathways. Conversely, barriers to beneficial PHE linkages were also identified. Lastly, focus groups were conducted to capture diverse observations among locals regarding potential PHE synergies.

## 3. RESULTS

### 3.1 Population

The projects demonstrated mixed success regarding population outcomes. Capacity building for FP remains as diverse as the levels in the demographic transition in the target areas—from rudimentary or absent at one end of the spectrum to well advanced and sustainable at the other end. Several problems have limited success. First, the poorest sites, such as the Ba'Aka in the CAR, and Madagascar, had relatively low demand for FP. Relatively great demand exists for basic health care and nutrition, to prevent deaths, largely among infants, and to combat easily controllable infectious diseases. In these places, little progress in FP indicators was observed in the first several years of the projects. This result is unsurprising for populations in the early stages of the demographic transition. In these areas, mortality must fall and livelihoods must become more secure in order to generate demand for FP. Working first on mortality and subsistence is almost certainly a more sustainable path to ultimately reducing family size through FP adoption.

Despite these restrictions, the Contraceptive Prevalence Rate (CPR) among women of reproductive age resulted in varying but notable changes (Table 6).

**Table 6.** Changes in Contraceptive Prevalence among Women of Reproductive Age.

| Area of Program | Pre-intervention | At time of evaluation | Percent Change |
|---|---|---|---|
| Kiunga District , Kenya | 7% | 68% | 871 |
| Mad Spiny Forest, Madagascar | 6% | 11% | 83 |
| Roxas District, Philippines | 32% | 33% | 3 |
| Khata Corridor, Nepal | 43% | 50% | 16 |

*Source: WWF PMP 2007 and Tal Nepal Annual Report 2007.*

For example, CPR increased dramatically in the Kiunga district of Kenya, nearly doubled in Madagascar's Spiny Forest, increased by nearly 20 percent from 2006 to 2007 in Nepal's Khata region and increased slightly in Roxas district, Philippines. Adequate data on CPR are unavailable for other sites due to nonexistent or unreliable collection methods. This is unfortunate because CPR—a more immediate proxy for fertility reduction, as opposed to the longer duration needed to properly measure fertility rate change - may be the most appropriate short-term indicator for progress within the population component of PHE projects.

## 3.2 Health

The positive results of the PHE projects on health outcomes were substantial and rapid (Table 7).

**Table 7.** Changes in Health Outcomes.

| **Area of Program** | | **Pre-intervention** | **At time of evaluation** | **Percent Change** |
|---|---|---|---|---|
| Kiunga District , Kenya | Children under 5 immunized | <30% | 100% | >330% |
| | Community Based Distributors (CBDs) trained | 17 | 46 | 171 |
| | No. of persons trained in health service delivery | 47 | 81 | 72 |
| Roxas District, Philippines | No. of persons trained in health service delivery | 29 | 50 | 72 |
| Mad Spiny Forest, Madagascar | No. of persons trained in health service delivery | 91 | 96 | 5 |
| Congo Basin, Cameroon | Pit latrines built | 0 | 800 | NA |
| | Percent of children under 5 with diarrhea | 7% | 1.40% | -80 |

*Source: WWF PMP 2007 and data collected in the field by Carr and Oglethorpe, 2007.*

Infant mortality rates dropped dramatically within months in several sites. Improved water and sanitation efforts, basic health care provision and anti-malarial treatment and mosquito nets reduced infant mortality. Estimates from the WWF director and health partners in Kenya's Kiunga National Reserve suggest that vaccination campaigns resulted in complete coverage for children under five. Prior to these campaigns, coverage was about one-third of this age group. Although there is evidence that similarly impressive results were achieved elsewhere, these results are not supported by standardized data. In India, although seven core villages are the sites of the camps, a total of 25 villages are reached since villagers from nearby communities travel to the health camps. In Cameroon, following the buildup of pit latrines, the number of new childhood diarrhea cases plummeted from 7% to under 2%.

Key to project success—and antecedent to any sustainable outcomes that can be attributable to the project—was the successful development of local health infrastructure and capacity building. Capacity-building results varied according to the number of years the projects were funded, existing infrastructure, and the education level of locals. Where some infrastructure existed and where there was some level of literacy, training developed rapidly. For example, from 2005 to 2007 the number of community-based health volunteers trained in Kenya expanded from an initial group of 47 to more than 80. In the Philippines, trained health volunteers swelled from 29 to 50 during the same period. Conversely, the CAR has had difficulty training local volunteers (Table 7), due at least in part to low literacy levels: Among the Ba'Aka, one of several local groups, it is rare to find even one literate person among many clans. This makes it very difficult to establish the need for health volunteers in the first place and further hampers the effective communication of skills and knowledge necessary for the position. Nevertheless, two Ba'Aka play important roles in the CAR PHE project and are fundamental reasons the Ba'Aka attend the clinic. Two exceptions here are India and Madagascar. The locals in India's Terai are largely literate and enjoy at least elementary education. Yet, despite excellent relations between WWF and locals and their desire and ability to become more involved with improving health in their communities, local capacity remained

undeveloped. Conversely, in Madagascar, despite low literacy and education among locals and less flexible USAID funding, nearly 100 people were trained.

### 3.3 Environment

In the Philippines, Kenya and Mozambique, "no-take" marine sanctuaries were established. In the older sanctuaries, locals reported that in the less than two years since the marine conservation zones were implemented, fish volume had at least doubled while fish diversity also increased (Table 8).

**Table 8.** Change in Environmental Outcomes.

| | **Indicator** | **Pre-intervention** | **At Time of Evaluation** | **Percent Change** |
|---|---|---|---|---|
| Kiunga District , Kenya | No. of turtle nests reported | 98 | 123 | 25 |
| | Percent of turtles nests reported by community | 50% | 72% | 22 |
| | Percent of registered fishermen in the KMNR using sustainable fishing gear* | 89% | 100% | 11 |
| Mad Spiny Forest, Madagascar | Percent of households using fuel-saving stoves | approx. 0** | 10% | NA |
| | Tree nurseries | 3 | 7% | 133 |
| | Trees planted | 2,160 | 106,250 | 4,819 |
| Roxas District, Philippines | No. of boat patrols conducted for illegal fishing | 0 | 70 | NA |
| | No. of apprehensions & cases filed in court for illegal fishing activities | 0 | 8 | NA |
| | KG fish caught per man-hour (CPUE) | 0.7 to 2.4 | 1 to 3 | NA |
| Eastern Himalayas, India | Percent households using gas | 20% | 45% | 125% |
| | Fuelwood collection decrease among households | NA | NA | 65% |

In Kenya, a 22 percent increase (from 50 to 72 percent) of marine turtle nests were reported by communities in Kiunga Reserve. These sanctuaries had immediate impacts not only on conservation outcomes but also on fisher family well-being and nutrition. In Mozambique, the increase in marine richness within the sanctuaries had the spillover effect of enhancing fish catches outside of the sanctuaries. Human population outcomes were also influenced by the increased fish catches. Perhaps contrary to conservation outcomes in the short term, the impact has been through an in-migration rate exceeding 5 percent yearly following the establishment of the sanctuary, according to local informants.

On the terrestrial side, in Madagascar's Spiny Forest, the project catalyzed the increase in tree nurseries from 3 to 7 and the number of tree plantings from 2,160 to 106,250, accompanied by government recognition of almost 98,000 ha. of new areas under community forestry management. In an effort to preserve these forests and increase food security, locals were trained in composting and in the creation of "curvas de nivel" (trench and dyke) agriculture. Both practices promise to reduce soil erosion and capture soil nutrients and water for reuse. Early adopters were demonstrably enthusiastic about increased yields observed in their first harvest year with the new techniques; several neighboring villages subsequently adopted the

approach. Lastly, in India, households in the project area changed their energy use from locally collected firewood to liquefied petroleum gas, from less than 20 percent of households using this cleaner energy source before the intervention to almost 50 percent. This change resulted in an estimated 60 to 70 percent reduction in fuelwood collection.

### 3.4 PHE Synergies?

Although we were unable to apply a standardized experimental design, results suggest that WWF's population and health work generated goodwill for environmental conservation outcomes. Indirectly, community commitment was fostered through an understanding of linkages between health and the environment. In other cases, the exchange is more direct, for example through an increased quantity and quality of working hours enabled by improved health. A potentially positive feedback loop exists where conservation efforts lead to increased resource availability, which leads to better nutrition, achieved in fewer hours of work, which ultimately gives people more time to spend on conservation efforts (Honzak and Lopez-Carr 2012).

## 4. CONCLUSION

Life expectancy in the developing world remains largely predicted by infant mortality. It is among children under age five where mortality is concentrated in the poorest countries. And it is here where FP, livelihood, sustainable and just food production and security investments provide the biggest yield. Results suggest progress in reducing childhood mortality across the PHE sites. Sometimes, as with latrine construction in Cameroon (reducing childhood deaths from gastrointestinal infections) and with malaria prevention efforts in Kenya, death is averted with trust, teaching, knowledge and the volition to change. However, without doubt, when planned with appropriate cultural sensitivity and local buy-in, even modest financing can make a dramatic impact. It appears that the distribution of malaria nets and antimalarial pills in most of the sites has notably lowered malaria rates. Although numerical data are not readily available for each country, interviews corroborate noticeable reductions in infections—in some cases, dramatically. This is especially salient where, for example in Kiunga Reserve, several methods are used in tandem to combat malaria, including using malaria nets, taking antimalarial drugs, covering wells and clearing stagnant water sources. Similarly, antibacterial drugs, vitamins and other basic medicines, although provided only sporadically in some instances (for example with monthly health camps), have apparently had important positive effects on childhood survival. Lastly, sanitation campaigns, including the construction of latrines and the development of clean water sources, have helped to lower several diseases, most notably childhood gastrointestinal infections, which are a leading cause of infant death.

A common denominator of success across sites was effective collaboration with health partners. Building capacity among locals and health partners is necessary for effective outcomes and their sustainability. Where partnerships are more developed, stakeholders yield benefits from the relationship as well. For example, in the Philippines and Kenya, the involvement of both NGOs (nongovernment organizations) and GOs (government organizations), particularly the MoH (Ministry of Health) with health and conservation NGOs, enabled the team to accomplish more than anyone could achieve, especially where NGOs filled geographic vacuums, especially conservation NGOs, where government institutes have little to no presence.

An important, perhaps underappreciated, aspect of a successful PHE program is the selection of an appropriate geographical target for integrated PHE interventions. With the exception of Mozambique, all PHE programs target between 5,000 and 50,000 people in 5 to

30 villages in priority biodiversity sites or landscapes where there are strong human-environment interactions. At the modest funding available to these efforts, larger scale projects may have diluted their impact had they expanded their geographic scope. Further related to scale, in addition to the internal synergistic effect of the PHE programs, external synergy has also been accomplished through leveraging PHE resources to acquire further funding.

The WWF PHE programs were run at $.37 to $6.64 per capita annually, thus seemingly challenging two dominant paradigms operating in development assistance. The first relates to the demographic transition and, more specifically, the urban transition. During the coming decades, all the world's several billion net additional people will live in the world's poorest cities. Yet this belies the fact that in many conservation priority areas the demographic transition has scarcely commenced. What will be the impact of progress, or lack of, through the demographic transition? This cost efficiency also challenges the notion that has dominated development assistance in recent years that agencies should invest their efforts in urban areas to achieve the greatest yield. Although certainly more people can be accessed at less cost per person in urban areas, the qualitatively distinct human-environment milieu of high-priority ecological priority demands a revisiting of this assumption.

The results of those WWF PHE programs also strongly point toward the importance of investing in livelihoods in tandem with PHE interventions. Invoking livelihoods is key for selling PHE: People think in terms of their livelihoods first and see their relationship with the environment through a livelihood lens. Involving livelihoods is also key for implementing PHE programs: People struggling to make ends meet do not enjoy the leisure time to practice conservation as a hobby; it must be integrated seamlessly into how people survive and thrive. Livelihoods are also important for stimulating demand for FP. Although human populations increase in the short term where environmental conservation and livelihood programs attract migrants, over the longer term, a successful PHE message could help to limit in-migration where it threatens livelihoods. Such a message could also support an increasing demand for FP as people wish to improve education for their children, and thereby increase investments in fewer children.

The PHE approach strives to combine the strengths of PE and HE solutions to maximize conservation efforts for some of the most biologically sensitive parts of the world. By recognizing potential linkages among these three dimensions, and simultaneously addressing them, practitioners of this approach hope to realize increased synergy and efficiency in conservation, health, and development outcomes. The underlying philosophy is that environmental conservation and human development need not be oppositional; rather, they can be complementary. The ethical contradiction of protecting animals but not people is a thorn that may be removed by earnest PHE and livelihood interventions. In order to compellingly demonstrate these synergies across different places, each with distinct human and environmental landscapes, challenges, interventions, and desired outcomes, future research can build upon lessons learned from case studies towards scaling up to test potential PHE synergies in replicable standardized before and after controlled experimental designs.

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# SOCIAL AND GEOGRAPHICAL RESEARCH IN THE REPUBLIC OF KAZAKHSTAN WITH THE USE OF GIS TECHNOLOGIES

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## Abstract

The article deals with the dynamics of the main indicators of socio-geographical processes of the Republic of Kazakhstan from 1999 to 2014. The article is based on statistical data from 1999 to 2014 with an emphasis on 1999, 2009 (the first and second censuses of independent Kazakhstan) and 2004, 2014. The territorial analysis of the socio-geographical processes includes such indicators as population size, infant mortality, and life expectancy, the level of health care, education level, and provision of the housing of the population. The main conclusions are: 1. Kazakhstan is characterized by the increase in population due to natural growth and a positive balance of migration; 2. The aging of the population, which led to the increase in the unfavorable side of the indicator of the demographic load and the balance of labor resources; 3. Low life expectancy in comparison with the developed countries; high infant mortality rate. At the same time, Kazakhstan has almost 100% literacy rate of the population and high coverage of the population by education.

***Keywords***: *Social and geographical indicators, social policy, GIS, regional studies, the Republic of Kazakhstan.*

## 1. INTRODUCTION

Since declaring the independence of the Republic of Kazakhstan in 1991, the improvement of the quality and standard of living of the population has been the most important task of the state's social policy.

The Republic of Kazakhstan made significant progress in the implementation of the eight Millennium Development Goals. In 2004, our country realized task 1 of the 1st Millennium Development Goal - to decrease twice the share of people whose income is below the subsistence level. Task 2 of the 1st Millennium Development Goal - to reduce by half through the period of 1990-2015 the proportion of people who suffer from hunger - was accomplished. In 2002-2005 task 3 of the 2nd Millennium Development Goal - to provide the access to primary education - was realized (The Millennium Development Goals in Kazakhstan, 2010).

On September 25, 2015 the state - members of the United Nations adopted the agenda for sustainable development till 2030. It contains 17 goals aimed at putting an end to poverty, preserving the planet's resources and providing a high standard of living quality of the population of the entire planet. Putting an end to poverty must be inseparably linked to the implementation of the policies that promote economic growth, and designed to meet a number of social needs in the field of education, health care, social protection and employment opportunities, while addressing the challenges posed by climate change, and the environmental protection (The official website of the United Nations Organization).

In the Republic of Kazakhstan many state programs at the national and regional level, aimed at improving the quality of life were adopted. So, in «Strategic Plan of Development of Kazakhstan till 2020," one of the strategic goals of the country until 2020 is to reduce the proportion of people with incomes below the subsistence level up to 8% (Strategic Plan of Development of Kazakhstan till 2020, 2010).

In the Strategy "Kazakhstan - 2050": a new policy of the established state" it is noted that the questions of social well-being, prosperity, improvement of the welfare of the citizens of Kazakhstan and issues of social support of the population are at the forefront of public policy. At the same time, as it is noted by the President of Kazakhstan Nursultan Nazarbayev, "The most important task of the coming decade is to improve the quality and standard of living of all citizens of Kazakhstan, strengthen social stability and security" (Strategy "Kazakhstan - 2050": a new policy established state", 2010).

In the "Concept of transition of Kazakhstan to sustainable development for 2007-2024», the main priorities are to increase life expectancy, to improve welfare, education and the environment (Concept of Transition of Kazakhstan to sustainable development for 2007-2024, 2006).

Thus, both in the world and in Kazakhstan, the issues of socio-geographical research are very actual. Among the works of foreign authors, which deal with a wide range of issues related to socio-geographical research, the papers by P. Vidal de la Blache, A. Demanzhon (Vidal de la Blache, 1903, Demanzhon 1946-1948) played an important role.

In the Russian science, the first geographical works on population and settlements were written by K.I.Arsenvev, P.P. Semenov-Tyan Shan (Arsenyev, 1841, Semenov-Tyan Shan, 1884).

A significant contribution to the development of the geography of the Soviet population was made by: V.V. Pokshishevsky (general issues, migration) (Pokshishevsky, 1971), G. Saushkin (the study of rural settlements, relationships of man and nature) (Saushkin, 1964), B.S. Khorev (the problems of urban resettlement) (Khorev, 1975), S.A. Kovalev (general issues, geography of rural resettlement, the study of conditions and ways of life) (Kovalev, 1963).

Socio-geographic processes and, in particular, certain demographic and social indicators were reviewed and investigated by the Kazakhstani scientists-geographers: Sh.M. Nadyrov, G.N. Nyussupova, A.Z. Abilov, E.ZH. Imashev (Nadyrov, 2008, Nyussupova, 2010, Abilov, 2013, Imashev, 2011).

Monitoring of the socio-geographical indicators is an essential tool for strategic management of socio-economic development of a particular region and the country as a whole. The choice of strategic priorities of the socio-economic development must be based on the spatial development components, i.e., taking into account their economic and geographical position, the distance to the places of concentration of natural, technical and technological, labor and other resources. Monitoring of the socio-geographical indicators requires appropriate mathematical-cartographic, information-analytical and technological support on the platform of geographic information systems (GIS). The GIS feature consists in the fact that the collection and creation of databases, storage, processing, transformation and

accumulation of information on the socio-demographic and socio-economic state of the region are based on them. The problems related to the strategic management of regions are solved with the help of GIS. Using GIS technology ArcGIS 10 software, the authors created a geographic database of socio-geographical indicators and thematic digital maps on its basis.

## 2. DATA AND METHODS

When writing the article, the official data of the Committee on Statistics of the Republic of Kazakhstan were served as the information base (The official website of the Committee on Statistics of the Republic of Kazakhstan).

The article is based on statistical data from 1999 to 2014, with an emphasis on 1999, 2004, 2009 and 2014, i.e. the changes for every 5 years are reviewed. In 1999, the first census of sovereign Kazakhstan was held, and then in 2009 when there was the second census since declaring the independence.

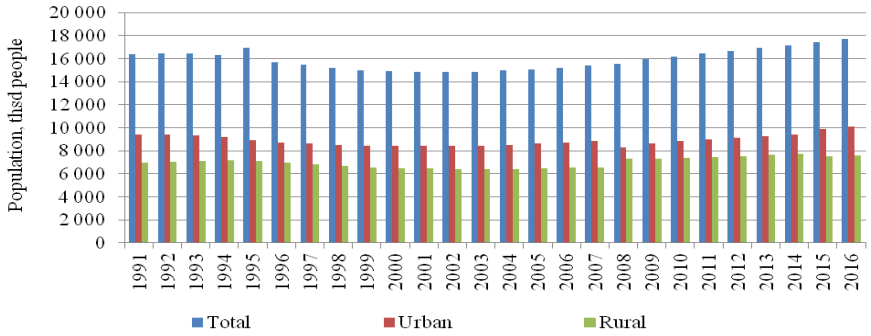
Regional analysis of the socio-geographical processes includes such factors as population, infant mortality rate, life expectancy, the level of health care, the level of education, the housing security for the period of 1999 - 2014 in the Republic of Kazakhstan as a whole, as well as in regions.

The study was based on the methodology of national and foreign geography science. In the paper, both traditional and modern methods of research: a systematic, descriptive, comparative geographical analysis, methods of mathematical statistics, mapping, and methods of GIS technologies and GIS were used. While data processing, software packages ArcGIS, Excel spreadsheets were used.

## 3. ANALYSIS AND RESULTS

During 1991-2000, Kazakhstan’s population underwent numerous changes. It was during this period that all the negative consequences of the events that took place in the first half of the twentieth century began to affect. An unfavorable demographic situation was noted, which was reflected in the annual decrease in the population size because of the decrease in birth rate, the increase of sickness rate and mortality rate, and the significant migration outflow of the population. The formation of the population is under two factors - natural growth and balance of migration (Nyussupova, et al., 2013).

The population of the Republic of Kazakhstan at the beginning of 1991 was 16,358.2 thousand people, and by the beginning of 2000, it decreased to 14,901.6 thousand people. The significant decrease of the population in the 1990s was related to the departure of the representatives of Slavic and other nationalities for permanent residence in their historic homeland, and the decrease in birth rate. In 2002, the size of the population began to increase and by March 2016, it was 17 713.7 thousand people. The natural growth is the main source of the population increase was Kazakhstan (Figure 1).




*Source: Committee on Statistics of the Republic of Kazakhstan*

**Figure 1.** Dynamics of population of Kazakhstan in 1991-2016 years

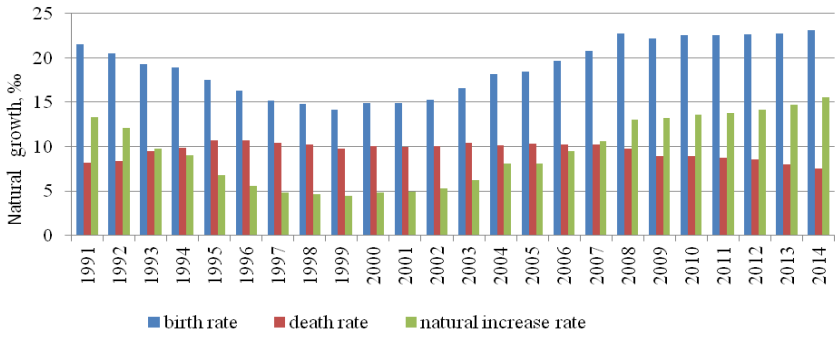
In 2015, the population in Kazakhstan was 17,544.1 thousand people, including urban dwellers - 9967.5 thousand people, or 56.8%, rural - 7576.5 thousand people, or 43.2%. The largest population number is concentrated in the following regions: South Kazakhstan region - 2814.8 thousand people (16%), Almaty region - 1934.7 thousand people (11.0%) and Almaty city - 1672.9 thousand people (9.5%). The smallest population number is in the North-Kazakhstan region - 570.6 thousand people (3.3%), Atyrau region -588.0 thousand people (3.4%) and Mangistau region - 616.8 thousand people (3.5%). For 1999-2014, the population of the republic increased by 2205.6 people. In Karaganda, Kostanay, East Kazakhstan, North Kazakhstan and Pavlodar regions for these years there was the outflow of population and the population in these areas decreased from 139.8 thousand people to 41 thousand people. The largest population growth was in the South Kazakhstan region, its population increased by 839.3 thousand people (Table 1).

**Table 1.** Population in the regions of the Republic of Kazakhstan in 1999, 2004, 2009, 2014 and 2015 years (thsd. people)

| Regions | Years | | | | |
|---|---|---|---|---|---|
| | 1999 | 2004 | 2009 | 2014 | 2015 |
| Republic of Kazakhstan | 14 955,1 | 748,9 | 15 982,3 | 17160,7 | 17544,1 |
| Akmola | 829,2 | 671,8 | 738,8 | 735,5 | 740,4 |
| Aktobe | 682,5 | 1571,1 | 756,7 | 808,9 | 828,6 |
| Almaty | 1556,5 | 457,2 | 1804,0 | 1984,5 | 1934,7 |
| Atyrau | 439,3 | 603,8 | 509,1 | 567,8 | 588,0 |
| West Kazakhstan | 617,3 | 985,5 | 598,3 | 623,9 | 633,4 |
| Zhambyl | 988,8 | 1330,9 | 1020,7 | 1084,4 | 1104,8 |
| Karaganda | 1411,4 | 913,4 | 1341,2 | 1369,6 | 1381,5 |
| Kostanay | 1020,5 | 607,4 | 886,3 | 880,7 | 882,5 |
| Kyzylorda | 595,5 | 349,6 | 677,7 | 739,7 | 759,1 |
| Mangistau | 314,0 | 2150,2 | 482,6 | 587,4 | 616,8 |
| South Kazakhstan | 1975,5 | 745,2 | 2462,7 | 2733,2 | 2814,8 |
| Pavlodar | 808,3 | 674,4 | 742,2 | 752,7 | 757,1 |
| North Kazakhstan | 727,0 | 1 455,4 | 597,5 | 575,7 | 570,6 |
| East Kazakhstan | 1532,9 | 510,5 | 1396,8 | 1394,0 | 1395,5 |
| Astana city | 326,9 | 1175,2 | 605,2 | 814,4 | 862,7 |
| Almaty city | 1128,9 | 748,9 | 1361,8 | 1507,5 | 1672,9 |

*Source: Committee on Statistics of the Republic of Kazakhstan*

The reason for population decrease in Kazakhstan resulted from a significant migration outflow of the population, which was significantly more than the low natural growth. In 2002, the natural growth of the population of the republic was more than the negative balance of external migration, and since 2004 the population of Kazakhstan has begun to grow because of natural and mechanical growth. The natural growth of the population in 1991 was 13.3%, and then it was followed by a decline in the indicator to 4.7 % in 1999. The decrease in the birth rate during the 1990s in Kazakhstan gave rise to two opposing points of view: 1) the main reason was the economic and political crisis in the country during this period; 2) the decrease in birth rate in the coming years is the continuation of the objective evolution process. Since 1999, the indicators of natural growth of the population have had a positive upward trend, from 1999 to 2014, this indicator increased by 3.4 times from 4.4 % to 15/5%. The total rate of natural growth in Kazakhstan for the period of 1999-2014 was on average: in 1999 - 4.7 %, in 2004 - 8.0 %, in 2009 -13.2 %, and in 2014 – 15.6 % (Figure 2).




*Source: Committee on Statistics of the Republic of Kazakhstan*

**Figure 2.** Changes in the natural growth of the population in the Republic of Kazakhstan for 1991-2014 years

In 1999, the lowest indicators of the natural growth were characteristic of Akmola, Karaganda, Kostanay, Pavlodar, North Kazakhstan, East Kazakhstan regions. In 2004, compared with 1999, the average natural growth in the republic increased by almost twice from 4.4 % to 8.0 %. The largest growth was observed in Almaty city and Pavlodar region. Thus, the natural growth in Almaty increased by 9.8 times, from 0.4 % to 8.8 %. In Pavlodar region it increased by 6.6 times, from 0.4 % to 6.4 %. In 2009, the highest indicators of natural growth were in South Kazakhstan (23.5 %), Mangistau (23.3%), Kyzylorda (20.7 %), Atyrau (19.9%) and Zhambyl regions (19.3 %) and Astana (19.1%). While the lowest indicators of the natural growth were registered in North Kazakhstan (1.4%), Kostanay (2.4%), East Kazakhstan (5.1%) and Akmola (59%) regions. In 2014, the natural growth indicator in the country was 15.5%. The lowest indicators of natural growth in the country were observed in North Kazakhstan and Kostanay regions (respectively 2.4% and 3.9%). The high indicators of natural growth were recorded in Mangistau (27.4%), South Kazakhstan (24.3%) regions, Astana city (24.6 %) (Table 2).

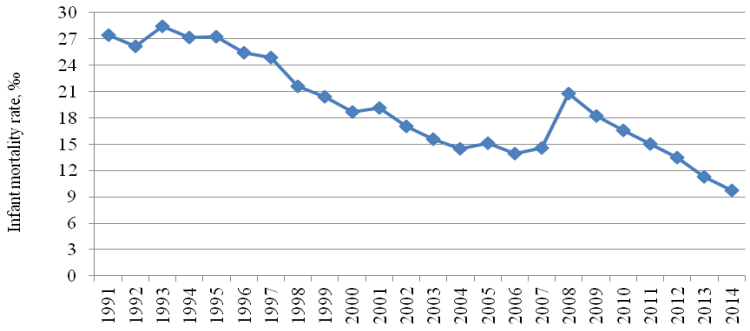
The natural growth of population in Kazakhstan reflects the improvement of material living conditions, health care, and nutrition, working and living conditions of people and so on.

**Table 2**. Dynamics of indicators of natural growth of the population in the regions of Republic of Kazakhstan in 1999, 2004, 2009 and 2014 years (per 1000 people)

| Regions | Natural growth rate, ‰ | | | |
|---|---|---|---|---|
| | Years | | | |
| | 1999 | 2004 | 2009 | 2014 |
| Republic of Kazakhstan | 4,4 | 8,0 | 13,2 | 15,5 |
| Akmola | 0,3 | 1,8 | 5,9 | 7,3 |
| Aktobe | 4,1 | 8,3 | 13,7 | 17,2 |
| Almaty | 5,5 | 8,3 | 15,7 | 19,2 |
| Atyrau | 9,4 | 12,8 | 19,9 | 22,4 |
| West Kazakhstan | 0,9 | 5,8 | 9,5 | 11,9 |
| Zhambyl | 7,3 | 12,3 | 19,3 | 20,3 |
| Karaganda | 0,3 | 1,4 | 6,0 | 8,3 |
| Kostanay | -0,7 | 0,1 | 2,4 | 3,9 |
| Kyzylorda | 13,9 | 15,7 | 20,7 | 21,3 |
| Mangistau | 11,4 | 18,9 | 23,3 | 27,4 |
| South Kazakhstan | 15,8 | 19,7 | 23,5 | 24,3 |
| Pavlodar | 0,4 | 2,6 | 6,1 | 7,4 |
| North Kazakhstan | -1,2 | -1,0 | 1,4 | 2,4 |
| East Kazakhstan | -1,2 | 0,6 | 5,17 | 6,7 |
| Astana city | 2,4 | 8,8 | 19,1 | 24,6 |
| Almaty city | 0,9 | 8,8 | 10,4 | 11,6 |

*Source: Committee on Statistics of the Republic of Kazakhstan*

One of the main demographic indicators that make up the mortality rate is the infant mortality rate (mortality rate of children under one year). Infant mortality rate is the important characteristic of the general state of health and living standards of the population. In the Republic of Kazakhstan, in 1991 the infant mortality rate was 27.4 %, according to the census in 1999 it was 20.4 %. These figures are among the highest ones in the world. In 2004, the infant mortality rate was 14.5 % and in 2014 it was 9.7 %. Thus, for the period of 1991-2014 the infant mortality rate in the country decreased from 27.4 % to 9.7 %, i.e. 3 times (Figure 3).




*Source: Committee on Statistics of the Republic of Kazakhstan*

**Figure 3.** The infant mortality rate in the Republic of Kazakhstan in 1991-2014 years

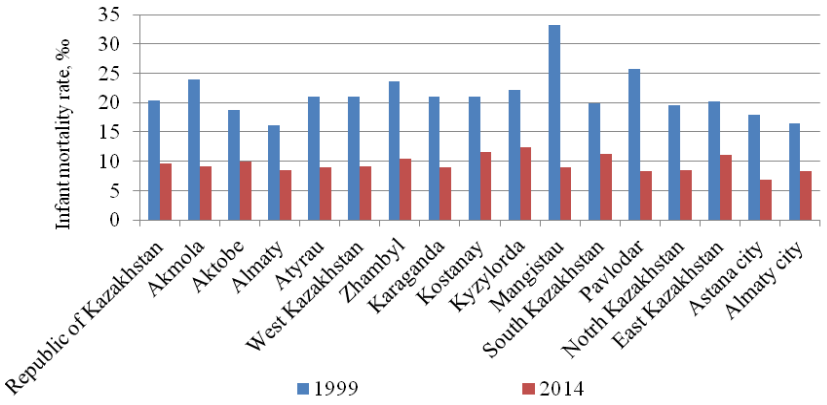
For 1991-2014, the infant mortality rate in Kazakhstan had a stable downward trend. The slight increase in the indicator in 2008 is due to the transition to a new system of registration of newborn death in accordance with WHO recommendations. In 2014, 3,868 infants who

died before reaching the age of 1 year were recorded in the republic i.e. while the infant mortality rate in 2014 was 2.8 times less than in 1991 (9.7 % and 27.4 %, respectively).

Among the causes of infant mortality rate, the state of health in the perinatal period (47%) takes the first place, the second - innate malformations (22%), the third - diseases of the respiratory system (14%) and the fourth - accidents and injuries (8%).

The decrease in the level of the health of women of reproductive age, shortcomings in the work of primary care, in the work of family medical clinics whose task is to improve the health of women of childbearing age, delay in pregnant women registration result in high infant mortality rate.

In the republic in 1999, the highest infant mortality rate was registered in Mangistau (33.2%), Pavlodar (25.7%), Akmola (24%) and Zhambyl (23.6%) regions, the lowest infant mortality rate was observed in Almaty (16.2%), Aktobe (18.8%) regions and in Almaty city (16.5%) and Astana (17.9%). According to the data of 2004, in Kazakhstan as a whole, infant mortality rate decreased up to 14.2%. The high indicators were registered in Kyzylorda (19.5%) and Mangistau (17.9%) regions. Almaty region (11.8%) and Karaganda region (11.9%) region were noted as the regions with the lowest infant mortality rate in 2004. The highest indicators of infant mortality rate in 2009 were in Kyzylorda (24.6%) and East Kazakhstan (22.9%) regions, low indicators were in Almaty region (13.4%) and Astana city (13.6%). In 2014, the highest indicators were in Kyzylorda (12.3%), Kostanay (11.6%), and South Kazakhstan (11.3%) regions. Relatively low indicators were in Pavlodar (8.3%), North Kazakhstan and Almaty (8.5%) regions (Figure 4).




*Source: Committee on Statistics of the Republic of Kazakhstan*

**Figure 4**. The infant mortality rate in the regions of Republic of Kazakhstan in 1999 and 2014

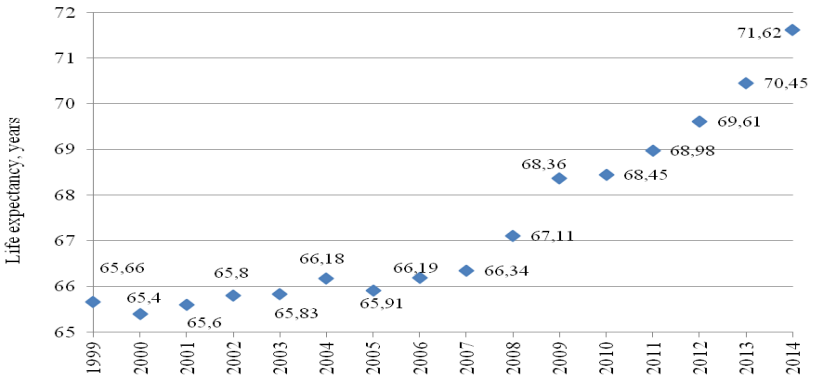
In order to reduce infant and child mortality rate in the Republic of Kazakhstan, the appropriate legislative base was created. The health of a newborn determines the characteristics of the child's further development and their adaptive capacity, sickness rate and the probability of fatal diseases in the following periods of their life. The decrease in the infant mortality rate can be achieved by strengthening and improving the quality of medical care, putting into practice effective programs of WHO and UNICEF, professional development of doctors and nurses, and the application of new perinatal technologies.

The other demographic indicator is life expectancy indicator at the time of birth. It indicates the number of years a newborn will live if the mortality rate, established at the time of his birth, will remain the same throughout his life. Life expectancy is one of the primary quality indicators of health care system in the evaluation criteria of the World Health Organization (WHO). This indicator has a direct correlation with the indicator of total expenditure on health care. The research shows that life expectancy and health of the population depend by 51.2% on lifestyle, by 20.4% - on human biological data, including

heredity, by 19.9% - on the environment and only by 8.5% - on the quality of the public health care, life expectancy of women is almost 10 years more than men's (Abdieva, 2003).

According to the WHO, on a global scale, the top five countries with the highest life expectancy indicators in 2015 are: Japan (83.7 years), Switzerland (83.1 years), Singapore (83.0 years), Australia (82.8 years), and Kazakhstan takes 111 place in the list with indicator of 70.5 years.

According to the Committee on Statistics of the Republic of Kazakhstan in 2014, life expectancy at the time of birth in Kazakhstan increased by almost 6 years compared to 1999 and was 71.62 years, while in 1999, the figure was 65.66 years. The lowest life expectancy indicator in the country in the period of 1999-2014 was observed in 2000, when it dropped to 64.4 years (Figure 5).



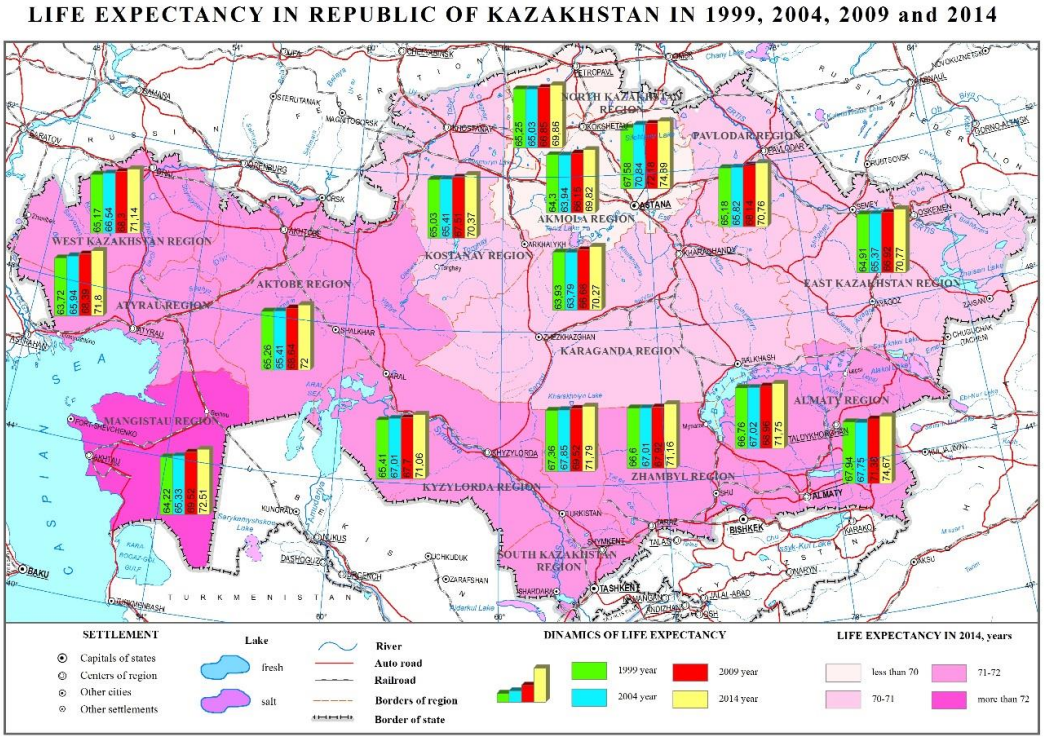

*Source: Committee on Statistics of the Republic of Kazakhstan*

**Figure 5**. Life expectancy in the Republic of Kazakhstan in 1999-2014 years

At the same time, life expectancy of the population is increasing in Kazakhstan in dynamics. According to the Committee on Statistics of the Republic of Kazakhstan, in 2014 the average life expectancy indicator in Kazakhstan was 64.8 years for men and 74.3 years for women. In 1999, life expectancy indicator for men on average was 58.5 years and for women 69.9 years. During the period of 1991-2014, in the context of gender there were not any changes in the life expectancy indicators. On average, men live 10 years less than women. The greatest gender difference in life expectancy indicator of 11.9 years was observed in the republic in 2007. The reasons for the low life expectancy of men are professions related with risk to life (miners, drivers and others). The realization of the State Program "Salamatty Kazakhstan" has made a specific contribution to the increase of life expectancy in the country, which is aimed at improving the health of Kazakhstani people, providing sustainable socio demographic development of the country, improving the quality of medical care and treatment of basic socially significant diseases (Nyussupova, Kalimurzina, 2014).

In 1999, high indicators of life expectancy were in Almaty and Astana (67.4 and 67.9 years, respectively). South Kazakhstan region with life expectancy indicator of 67.3 years was on the third place. The lowest indicator of average life expectancy was observed in Atyrau and Karaganda regions, with 63.72 and 63.93 years. In 2004, the national average life expectancy indicator was 66.18 years; the maximum indicator was -70.84 years in Astana city, which was more than the average indicator by 4.66 years and more than the minimum indicator in Karaganda region (63.79 years) by 7 years. The biggest differences in this indicator were showed in 2009, the life expectancy of the population was the same in Mangistau, South Kazakhstan regions with 69.52 years, but Almaty city and Astana city always remained the leaders. In these cities, the life expectancy indicator for 10 years grew by almost 5 years, with 72.18 and 71.38 years respectively. Low indicators were in Akmola

(66.15 years), Karaganda (66.66 years) and East Kazakhstan regions (66.92 years). In 2014, there were not significant changes in the life expectancy indicators. The same regions remained the leaders, Aktobe region joined them. The average life expectancy indicator in these regions was 71-74 years. The low indicators were in those regions as they were in 2009 (Figure 6).




*Source: Developed by the authors based on data from Committee of statistics of Republic of Kazakhstan*

**Figure 6.** Life expectancy in the Republic of Kazakhstan in 1999, 2004, 2009 and 2014 years

To determine the fact that the life expectancy depends on environmental factors, namely on the amount of harmful pollutant emissions into the atmosphere, the correlation of these parameters per capita was made in Kazakhstan (Figure 7).

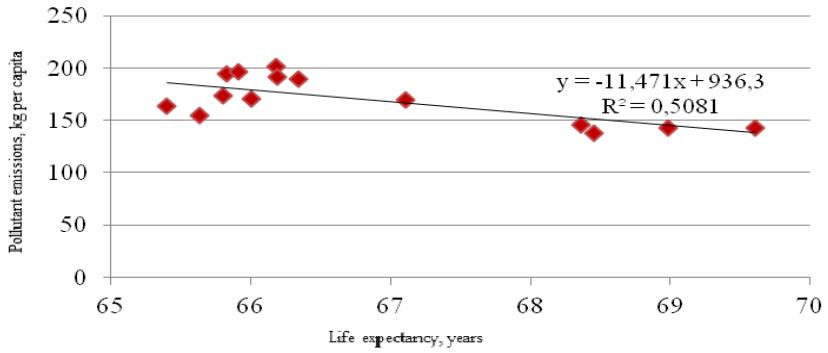



**Figure 7**. Correlation between life expectancy and the volume of substances emissions into the atmosphere in the Republic of Kazakhstan

The analysis shows that the amount of harmful emissions into the atmosphere inversely correlated to life expectancy. The correlation coefficient r = - 0.7 shows that the life expectancy indicator in the country is increasing with the decrease of the amount of harmful emissions into the atmosphere.

Life expectancy of the population of Kazakhstan is strictly correlated with income of the population (Figure 8). Life expectancy in the country is increasing with the increase of their incomes.

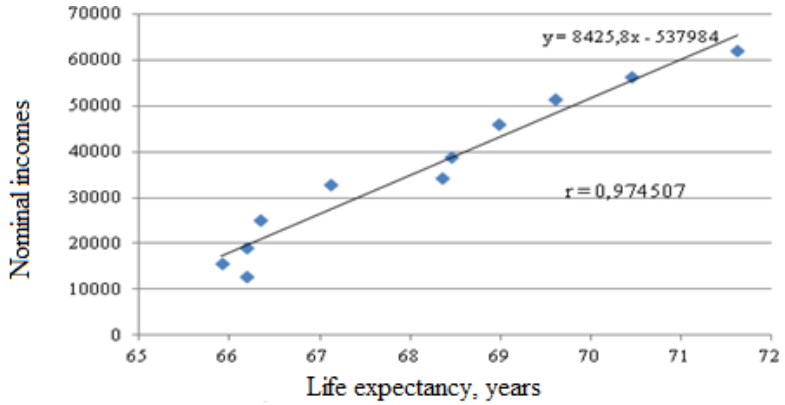



**Figure 8.** The correlation between life expectancy and the nominal income of population in the Republic of Kazakhstan

In general, the increase in life expectancy in Kazakhstan is the result of economic development and the development of medicine, improvement of the hygienic culture of the population and educational standards. The increase in life expectancy is a necessary condition for the increase in labor productivity and efficiency, economic progress and education in the country.

Demographic processes play an important role in the assessment of the level and quality of life of the population. Taking into account the importance of demographic factor, as the factor of sustainable economic growth, the development of socio-demographic policy is actively conducted in Kazakhstan, it aims at solving a set of problems and taking into account all potential external and internal trends of demographic processes. In connection with the increase in birth rate and aging of the population in Kazakhstan, it is observed demographic pressure of pre-working and post-working age population. The different distribution of populations in the three age intervals not only indicate a variation in the ageing path among countries, it also provides important information on what key policy issues may be in future (Lucis et al., 2012)

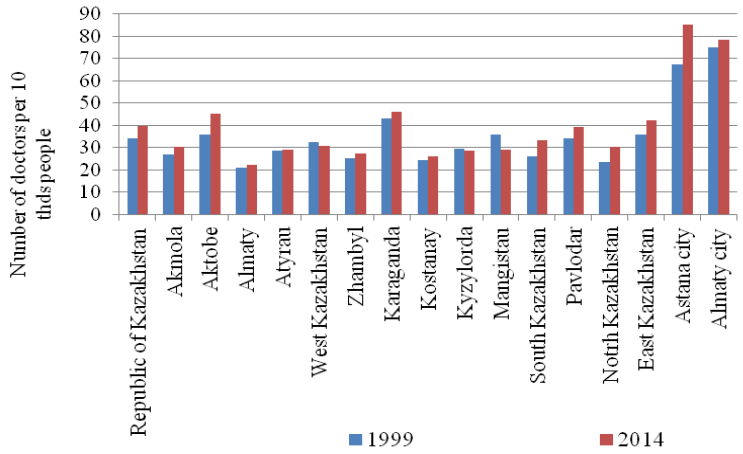
The development of appropriate mechanisms and targeted measures were taken by the government will promote the favorable development of the socio-demographic factors in Kazakhstan. Pursuing the targeted, balanced, comprehensive demographic policy will contribute to long-term economic growth in the Republic of Kazakhstan.

The health care indicators are important in the assessment of the quality of life, they are important in the determination of life expectancy, not only in Kazakhstan but in the world as well.

In 1991, the number of doctors of all specialties in the Republic of Kazakhstan was 67.6 thousand people, and in 2014, it was 68.8 thousand people. It was for the first time when the number of doctors was more than it was in 1991. Since the collapse of the Soviet Union in 1991, there was a significant decrease in the number of doctors due to a number of factors, such as leaving the system by medical professionals, the emigration of Russian-speaking people and other ethnic groups, the reduction of medical staff. By 2000, this figure reached its critical level, and the number of doctors was 20% less compared to the year of the collapse of the USSR. For 1999-2014, the number of doctors increased by 27%. At the same time, in 1991 the smallest number of doctors was in Mangistau region – 1.5 thousand people, the greatest number was in Almaty and it was - 10.1 thousand people. In 2014, this minimum indicator - 1.6 thousand people was observed in Atyrau region, the maximum indicator of

12.1 thousand people was in Almaty. The percentage of doctors working in the private sector was growing. In 1999, 10% of all doctors worked in private sector, by 2010, the share of doctors working in private sector rose up to 16%.

In 2009, the availability of doctors in urban areas was 58.3 doctors per 10 thousand people, while in rural areas there were 14.1 doctors per 10 thousand people, which is almost 4 times less than in urban areas. In 2009, the largest number of doctors in rural areas was registered in Karaganda region (20.1 doctors per 10 thousand people.), and the lowest availability was in North Kazakhstan region (9.6 doctors per 10 thousand people). By the number of doctors per 10 thousand people in Kazakhstan in 2014, Almaty and Astana cities, Karaganda region were the leaders. In these regions, there were 46 to 85 specialists per 10 thousand people. While in the whole country, this indicator was low - 40 doctors per 10 thousand people; the least number of specialists was in Zhambyl, Kostanay, Almaty. In 1991, the average availability of doctors per 10 thousand people in the country was 39.6, in 2014 - 39.5 (Figure 9).



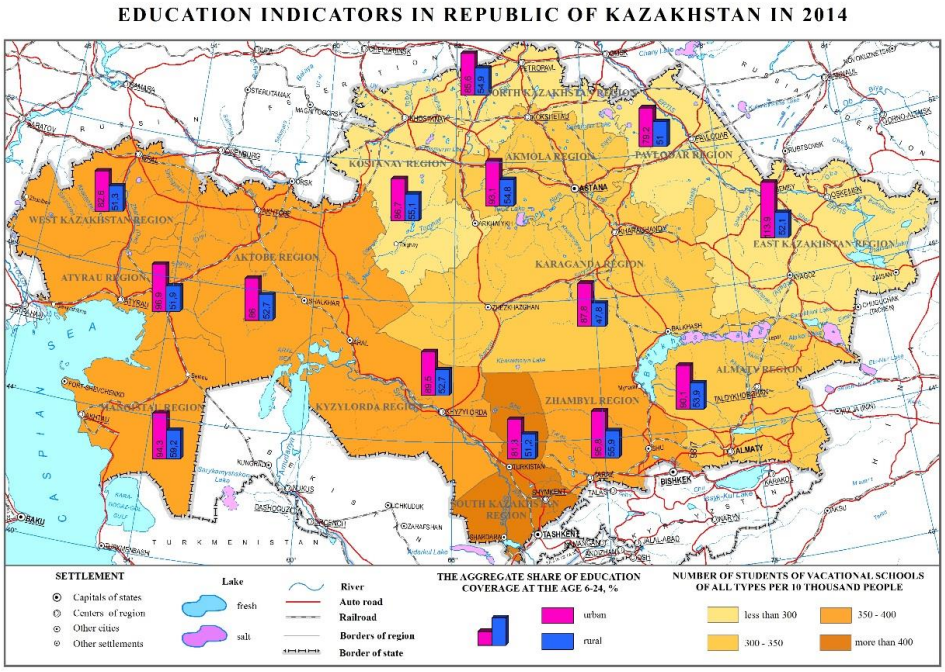

*Source: Committee on Statistics of the Republic of Kazakhstan*

**Figure 9.** Average availability of doctors per 10 thousand people in the regions of the Republic of Kazakhstan in 1999 and 2014 years

In Kazakhstan the principle of universal access to education has been realized at sufficiently high level. The priority of Kazakhstan's education is to ensure its competitiveness in the global context.

In 2014, in Kazakhstan, 72.9% of the population at the age of 6-24 years was covered by education, compared with 1995 this indicator increased by 9%. At the same time, in urban areas coverage by education was 1.6 times higher than in rural areas, and was 90.4% and 54.7%, respectively (Figure 10).

The combined share of education coverage of the population in the country at the age of 6-24 years had a tendency to decrease from 78.7% in 2004 to 72.9% in 2014. At regions, in 1999 education coverage of 68.9% was observed in Aktobe, Mangistau, West Kazakhstan, Karaganda and Atyrau regions. The lowest combined share of education coverage of the population aged 6-24 years was observed in Astana city, Almaty and Zhambyl regions. The maximum indicator was in Almaty-90.4%.




*Source: Developed by the authors based on data from Committee of statistics of Republic of Kazakhstan*

**Figure 10.** Gross coverage of the population at the age of 6-24 years by education in 2014

In urban areas the maximum indicator was observed in Aktobe region – 90.3%, the lowest indicator was in Astana (58.5%). In rural areas in 1999, the highest indicators were in Atyrau region - 63.4%, the lowest indicator was in the Aktobe region -55.9%. In 2004, the average republican indicator was - 78.7%. The maximum indicator of 122.5% was in Almaty. It should be noted that Almaty with the education coverage indicator of 127.3% was the leader in 2009. This high indicator is mainly because of migration flows of young people from all over the country to get an education. In 2009, only 5 regions' indicators were higher than the average republican indicator. The lowest indicator of education coverage of the population aged 6-24 years was in the North-Kazakhstan and Almaty regions. According to the method of calculation of the indicator of education coverage, it can be influenced by the following factors:

- "demographic" - increase (decrease) of population in the age group of 6 to 24 years;
- development of "lifelong learning" in the age groups of 24 years and older.

Table 3 shows the number of students of vocational schools of all types in Kazakhstan per 10 thousand people. If in 2014 the average national number was 365.7 per 10 thousand people, in 2004 it was 460.2 per 10 thousand people. The maximum indicator of 433.3 at the regional level was in Almaty. The minimum indicator of 263.4 per 10 thousand people was in North-Kazakhstan region. In 2004, the leader was Almaty with the indicator of 606.2 per 10 thousand people; the outsider was Astana with the indicator of 375.3 per 10 thousand people. The decrease in the number of students in all kinds of schools was because of the increase in population in 2014 compared to 2004. According to the census of 2009, the republican number was 390.4 per 10 thousand people. The decrease was 16% compared to 2004, and in 2014 the decrease was 6% compared to 2009. The percentage difference between 2004 and 2014 was 21%.

**Table 3.** Number of students in vocational educational institutions per 10 000 population in the regions of the Republic of Kazakhstan in 2004, 2009 and 2014 years

| Regions | The number of students of vocational schools of all types per 10 thousand people | | |
|---|---|---|---|
| | Years | | |
| | 2004 | 2009 | 2014 |
| Republic of Kazakhstan | 460,2 | 390,4 | 365,7 |
| Akmola | 412,2 | 348,8 | 334,4 |
| Aktobe | 512,4 | 398,2 | 371,1 |
| Almaty | 391,5 | 311,0 | 323,7 |
| Atyrau | 534,3 | 428,2 | 394,5 |
| West Kazakhstan | 465,6 | 408,0 | 380,9 |
| Zhambyl | 459,4 | 406,4 | 384,8 |
| Karaganda | 437,0 | 368,5 | 338,7 |
| Kostanay | 389,1 | 323,0 | 290,3 |
| Kyzylorda | 506,9 | 416,9 | 383,8 |
| Mangistau | 568,3 | 419,3 | 391,8 |
| South Kazakhstan | 527,3 | 451,0 | 441,9 |
| Pavlodar | 393,0 | 336,7 | 300,0 |
| North Kazakhstan | 405,6 | 315,4 | 263,4 |
| East Kazakhstan | 397,6 | 339,3 | 291,0 |
| Astana city | 375,3 | 377,7 | 391,4 |
| Almaty city | 606,2 | 530,8 | 433,3 |

*Source: Committee on Statistics of the Republic of Kazakhstan*

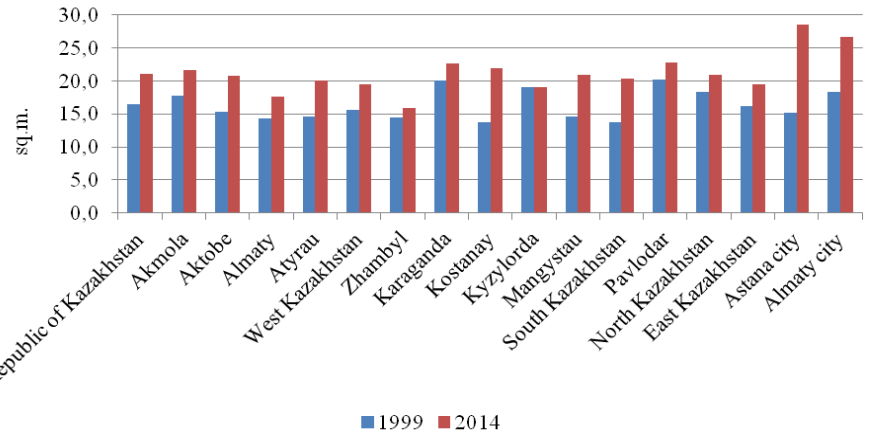
In the Republic of Kazakhstan, according to the results of the 2009 census a little more than 32 thousand people (0.3%) aged 15 and older was illiterate. In 2016, 99.79% of the population were literate. About 29.2 thousand people still remain illiterate. The literacy rate among the male adult population is 99.81% i.e. 12.7 thousand people in Kazakhstan are illiterate. The literacy rate among the female adult population is 99.78% i.e. 16.4 thousand people are illiterate. The literacy rate among the young people is 99.81% and 99.87% for male and female, respectively. The overall literacy rate among young people is 99.84%.

The state of the housing in the country clearly reflects the socio-economic development, the social climate in the society and the standard of living of the population. Housing in Kazakhstan, a country with difficult climatic conditions, is the basis of life for the majority of the population. For the period of 2004-2014, the republic housing increased by 84.2 million sq. meters (25%). The increase of the housing is predominantly due to the increase of urban housing. In the regional context, the largest share of housing was in South Kazakhstan region (14.3%), Almaty city (12.2%) and Almaty region (8.7%). In 2014, housing security in the republic was 21 m2 per 1 person. Since 2010, housing security in rural areas increased from 16.5 m2 to 17.6 m2 per a person, and in urban areas - from 20.2m2 to 23.8 m2, respectively. The average annual growth of housing security for the period of 2004-2014 was 17.7%; while maintaining the rates, Kazakhstan can reach the number of 24-25 m2 per a person by 2020. In 2014, housing security of urban population was by 6 m2 more than in rural areas. The housing improvement indicators tend to rise. During the period of 2004-2014, the fresh water supply of the population increased by 45%, sewer system by 30%, bath and shower and central heating by 5%, gas and hot water supply by 2%.

In the regions of Kazakhstan from 1999 to 2014, the indicator of the housing of the population had a positive trend. In 1999, the highest indicators of housing were in Karaganda and Pavlodar regions - 20 m2 per a person, the lowest indicators were in Kyzylorda and South Kazakhstan regions - 13.8 m2 per a person. In 2014, the highest housing indicator was in Almaty city (27.6 m2 per a person) and Astana city (28.3 m2 per a person). The lowest

housing indicator was in Zhambyl (15.6 m2 per a person) and Almaty region (17.1 m2 per a person).

During this period, in the republic as a whole, the housing increased from 16.4 square meters per a person in 1999 to 20.9 square meters per a person in 2014. There was the increase of housing in all regions of the country. The highest housing indicators in 1999 were in Karaganda and Pavlodar regions, in 2009 - in the Karaganda region and Astana city, and in 2014 - in Almaty city and Astana city (Figure 11).




*Source: Committee on Statistics of the Republic of Kazakhstan*

**Figure 11.** Average housing supply of population in the Republic of Kazakhstan in 1999 and 2014 years

The solution of housing problem depends on the financial state of citizens and their solvency, which is determined by the relation between income and cost of housing. In Kazakhstan, the cost of housing increases on average by 8.3% every year. Due to public housing programs, there are so-called "bottom" prices in the housing market, which is, in fact, the minimum price. In Kazakhstan, this figure, on average, is 170 000 tenges per m2 in economy class buildings (according to the program of regions development, the cost of m2 of housing is from 90 000 tenges to 142 tenges). By the end of December 2015, according to statistics, the cheapest housing in the new housing market was in the cities of Zhezkazgan and Tadlykorgan (90 000 tenges per 1 m2), and the most expensive was in Shymkent (364 402 tenges per m2), Atyrau (353,468 tenges per m2) and Astana (335 476 tenges per m2). On the second hand housing market, the most affordable housing was in Kyzylorda city (115 660 tenges per m2) and Zhezkazgan city (117 384 tenges per m2), and the most expensive square meter was in the cities of Almaty (350 642 tenges), Aktau (342 080 tenges per m2) and Astana (341 389 tenges per m2). In this regard, the mechanisms of property investment based on borrowing funds, which include mortgage loans, housing savings system through JSC "Housing Construction Savings Bank of Kazakhstan", JSC "Kazakhstan Mortgage Company" are particularly important (Shinkeeva, 2016).

The indicator of health care through the availability of doctors and the state of the housing clearly reflect the socio-economic development of the country and the standard of living of the population. The increase of many social indicators is reflected in social programs of the Republic of Kazakhstan. In Kazakhstan, the principle of universal access to education has been realized at the sufficiently high level, there is a fairly high level of adult literacy in the country with the high percentage of education coverage in many regions of the republic.

## 4. CONCLUSION

The assessment of the socio-geographical indicators in the Republic of Kazakhstan has revealed a great contrast of these indicators in the regions. Thus, it showed a negative demographic situation in the northern regions of the country. Low birth rates, life expectancy, a significant outflow of population and high mortality rate are observed in Kostanay, North Kazakhstan and East Kazakhstan regions. The birth and death rates in the Kostanay region are 14.5 % and 10.6 %, respectively, in the North-Kazakhstan region – 14.3% and 11.9 %, in the East Kazakhstan region – 17.0 % and 10.3 %. The national average birth rate in 2014 was equal to 23,1 %, while the mortality rate – 7.5 %. Thus, in the abovementioned regions the birth rate compared with the national average rate is 1.3-1.6 times lower, the mortality rate is 1.4-1.6 times higher. The rate of natural growth in these areas is at the level of 4-7%, which is 2-4 times less than the national average indicator. In these regions, it is necessary to increase the birth rate up to 23 % and to decrease the mortality rates to the level of the national average indicator – 7.5%. The life expectancy of the population in Kostanay, North Kazakhstan, Karaganda, Akmola, East Kazakhstan and Pavlodar regions is 70 years, which is less than the national average indicator by 1.5 years. In these regions, it is necessary to increase life expectancy up to the national average indicator, and in future to increase the life expectancy of the population of the republic up to 73 years by 2025, which is consistent with the adopted national program "Densaulyk" for 2016-2020. Alongside with this, it is necessary to reduce gender differences in mortality up to 5 years, which was equal to 8.8 years in 2014. Life expectancy for men is 67.1 years, for women is 75.9 years.

The high birth rates, natural growth and infant mortality rates are characteristic of South Kazakhstan, Mangistau, Kyzylorda, Zhambyl, Pavlodar, Akmola regions, Almaty and Astana cities. In future, it is necessary to reduce the maternal mortality up to 8 cases per 100 thousand of live births per year, which is important for Almaty city, Astana, Mangistau, Zhambyl, Akmola, South Kazakhstan, Pavlodar regions.

In order to integrate the republic into the global community and become one of the most competitive and developed countries, it is necessary to reduce infant mortality, at least up to 6.9 %. These recommendations are relevant to all regions of Kazakhstan.

The low availability of doctors per 10 thousand people in 2014 was characteristic of Almaty (22 per 10 thousand people), Kostanay (26.1 per 10 thousand people), Kyzylorda (28.6 per 10 thousand people) regions. In a number of regions (Akmola, Atyrau, West Kazakhstan, Mangistau, North Kazakhstan), the indicators of doctors' availability are about 30 doctors per 10 thousand people. For these areas, it is necessary to increase the number of doctors up to the national average figure - 39.5 doctors per 10 thousand people, although this figure is considered to be low. In the developed countries of Europe, this indicator is 45 doctors per 10 thousand people.

In the Republic of Kazakhstan, the principle of universal access to education has been realized at sufficiently high-level. A high level of literacy of the adult population with the highest percentage of education coverage (98.7%) is observed in Almaty and (85.4%) in Astana, while a low percentage of education coverage of the population in North Kazakhstan region is 66.3% and Almaty region is 61.8%.

The state of the republic housing stock clearly reflects the socio-economic development, the social climate in the society and the standard of living of the population. The highest rates of availability of housing in 2014 were in the cities of Almaty and Astana, the lowest levels were in Zhambyl and Almaty regions.

An important key point in improving the quality of life in Kazakhstan is to solve the housing shortage. The priority directions of development of the housing sector should be: modernization of housing infrastructure, the development of mortgage lending for

construction and purchase of housing, the creation of favorable conditions for attracting investments in the housing sector, development and realization of regional programs to provide housing for socially disadvantaged groups. These recommendations are relevant to all regions of Kazakhstan, but at the same time in Zhambyl, Almaty, Kostanay regions, Almaty city and Astana there is an acute housing shortage. In the three above-mentioned regions the housing supply per a person on average was 20 m2, in the cities of Almaty and Astana was 27 m2 per a person in 2014. It is necessary to increase the housing supply of the population in Zhambyl, Almaty, Kostanay regions up to 30 m2, in Almaty and Astana up to 35-40 m2 per a person.

As a result of a spatial analysis of the socio-geographic indicators of Kazakhstan for 1999-2014 years, it was found out that problems such as housing shortage, kindergartens shortage, increased crime rates, low life expectancy compared with the developed countries, and vice versa, a high infant mortality rate are still actual for the majority of its regions. The financial and economic crisis that began in 2007 directly affected the quality of life of the population that caused inflation, mass dismissals of workers, general destabilization. However, there is a positive dynamics of the socio-geographical indicators, since 1999 the rates of natural increase, life expectancy, the number of schools and others have increased.

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# IMAGES OF GENDER AMONG WESTERN AND EASTERN PERSPECTIVE: THE CASE OF BAHRAIN

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## Abstract

The theme of gender is largely discussed in private and public arenas, since it concerns questions connected to the concept of sustainability. It involves political arguments and requests economic solutions, not only humanistic notions. It is also a complex argument to study, with many faces and perspectives, connected to religions and social-economic development of different areas. Today two main visions are facing each other, depending on South-North/Western and Eastern societies. Governmental and Inter-governmental organizations are launching programs and laws in order to gain equality and parity between both sexes in every condition of life, since assuring human rights is a pre-requisite of human development and development in general. In addition, achieving gender equality and empowering all women and girls is essential for achieving sustainable development, one of the post- 2015 sustainable development goals.

***Keywords:*** *Gender, women, equity, Int. Organizations, Bahrain.*

## 1. INTRODUCTION

After quite seventy years from the UN Declaration of Human Rights (1948), one of the most diffused conditions of inequality is that connected to genders differences, since they are diffused, politically or socio-economically, even in countries where all human rights are respected.

Questions of equality and inclusion, other than being political and economic issues, are essentially of geographical importance, since their distribution and modalities and perceptions are variable. A special kind of inequality is that related to the gender, which is unpredicted even at national and local levels, or even at a family level. The principal mean, along with the way of equality, is education, but this is uneven even in developed countries. In independent evaluations of Unesco Advisory Body in 2005 and 2010 respectively, gender imbalance emerged even as a possible bias in the World Heritage system (2015).

Parity is also a basic condition for peace.

The UN General Assembly, in its resolution 3010 (XXVII), proclaimed 1975 the International Women's Year, and the period 1976-1985 the United Nations Decade for Women: Equality, Development and Peace.

At the Nairobi Conference in 1985, United Nations were establishing progress achieved and obstacles encountered at national, regional and international levels, to attain the goal and objectives of development, after the Decade for Women. A Report had been released in Nairobi in 1985 for starting future strategies, named "The Forward-looking Strategies for the Advancement of Women during the Period from 1986 to the Year 2000" (1985).

From 2000 until now, two big UN programs have started, the *MDGs* in 2000 and the *Post 2015- Agenda or Agenda 20-30* in 2015, but, near remarkable progresses, heart-breaking conditions remain even in the most developed countries (UN 2015, a & b). The 17 points of the UN Agenda 20-30 include many proposals for parity. In particular, we remember the Goal 5, "Achieve gender equality and empower all women and girls".

After the consensus obtained on the Nairobi summit, on the progress made in Rio de Janeiro in1992, on the Conference on Human Rights in Vienna in 1993, on Population and Development in Cairo in 1994, and on Social Development in Copenhagen in 1995, with the objective of achieving equality, development and peace, one of the most important conferences was held in Beijing in 1995, the Fourth World Conference on Women, which gave origin to the *Beijing Chart on Women.*

For example, In Italy, numerous females occupy extremely important positions, like the direction of CERN in Geneva, or one woman scientist has been on a space satellite for six months. Nevertheless, deaths of killed women and many killed by their husbands or relatives are registered quite every day. That occurs even if we are under the rules of EU which, through the Council of Europe, has proposed its own chart on women rights in 2014, named "Istanbul Convention", precisely "Council of Europe Convention on Preventing and Combating Violence against Women and Domestic Violence" composed by 81 articles (www.coe.int/en/web/istanbul-convention/home).

### 1.1 The inequality background

The inequality among people and men has a long history, but one fundamentally disparity is always persistent: the inequality between men and women.

Babatunde Osotimehin, Executive Director of the United Nations Population Fund (UNFPA), noted that access to good health care and reproductive rights remains elusive for many women and that not a single country had achieved full gender equality. "We cannot advance by leaving half of the population — our women and girls — behind," he said at UN General Assembly on 22 September 2014 (www.unmultimedia.org/avlibrary).

The gender question is on the stage today, during the modern phenomenon of globalization and mass immigration, which impinge even on female issues. Females are charged with several tasks, the care of children and old parents, often they are the only ones who collect food, water and wood in poor countries, they are the last to reach a good job when they migrate, they usually have the inferior payment, even in the same conditions of men. Several agencies or institutions or international organizations are questioning about the ways to reach the parity in every field of activities or social interests.

All the instruments adopted by international institutions (UN, UN Women/UNICEF, OECD, EU) (www.un.org several years) act towards seven goals for women, in order to join:

- Environmental and energy sustainability;
- Quality for girls at secondary or higher levels of education, including learning outcomes;

- Women economic empowerment;
- End of violence against women and girls;
- Sexual and reproductive health and rights;
- Women leadership, voice and influence;
- Women peace and security.

## 2. THE WAY TOWARD PARITY

When the Decade for Women was launched, there was hope that accelerated economic growth sustained by growing international trade, financial flow and technological developments would allow an increased participation of women in the economic and social development of those countries. These hopes have been belied owing to the persistence and, in some cases, the aggravation of several economic crisis both in developed and in the developing countries, which have created important obstacles that endangers, until now, not only the pursuance of new programmes in support of women, but also the maintenance of those that were already under way.

In front of a general crisis, only the oil producers could have the financial possibilities of realizing a global female social inclusion, but only if the projects are not hindered by religious dogmas.

In several areas women are delayed by an excessive number of births, or by ethical prohibitions from religious organisms, both Christian and Muslim, or by other religions. The general result is that in most countries females remain "the poorest of the poor" (OECD, 2010).

The argument of healthy maternity has been inserted in the UN-MDGs and, at the end of 2014, an informing topic has been approved and included in the new goals of the Post 2015-Agenda.

The gender question becomes today an economic matter, since, involving females in the development process, means to recognize the women skills and education which could integrate the male contribution in works, policies and social questions.

Inequality is exacerbated by economic constraints, major stress and stress-related illnesses, work accidents, harassment and bullying (Woestman, 2012). Surely, Grotti, and Scherer (2016) suggest that important social stratifications are at work other than gender inequality.

### 2.1 Social arguments in a globalized world

The long economic crisis is creating a larger inequality and is impairing the gender levels adjusted during the years of economic boom. During crisis people are compelled to accept what doesn't matter job, independently on salary or work conditions, especially women (Vaughan - Whitehead, 2012, Woestman, 2012).

Today the role of women in society is enhanced by the prerequisite of sustainability, in facts both the UN-MDGs and the new Agenda 2030 are increasingly focusing on the benefits that governments and organizations must assure to women and children, starting from health, until furnishing with equal opportunities in education, jurisdiction, politics, work, social inclusion.

Even OECD promoted a process of justice with its contribution of the Post 2015 Agenda, both criticising the MDGs and preparing a new table of discussion for the UN-Agenda 2030.

Especially, scientifically important is the framework depicted in the preliminary proposal for the Post-2015 program, which reflects the OECD mission of a coherent approach to development, by designing the project *Better Policies for Better Lives* (2011, 2013, 2015), in addressing the shortcomings of the former MDGs, the outcomes of Rio+20, as well as new global challenges for 2030.

Practically, OECD prepared (2012) the Gender Indexes which outline a holistic calculation for development.

The Social Institutions and Gender Index (SIGI) measures gender inequalities in over 100 non- OECD countries, according to five dimensions: discrimination in the family, violence against women, women's access to resources and access to public spaces.

Individual well-being and progress are measuring by OECD according to:

- Quality of life
- Health status
- Work and life balance
- Education and skills
- Social connections
- Civic engagement and governance
- Environmental quality
- Personal security
- Subjective well-being

OECD has proposed new solutions for the period 2015-2030 (Post 2015 Reflections, 2015). Along these proposals it has implemented a *New geography of growth*: "The shift in the world's economic centre of gravity away from OECD countries, towards emerging countries, has implications for the global balance of economic power. Developing and emerging economies have outperformed OECD growth since the start of the millennium, and account for a larger share of world GDP. The new engines of growth and the emergence of south-south linkages also create new opportunities for developing countries", like the new economic climate encourages entrepreneurship among both men and women (Galvani, 2016).

The FAO document (2011) "*State of Food and Agriculture 2010-11 - Closing the gender gap in agriculture"* would generate significant gains for the agriculture sector and society. The document states that, if women had the same access to productive resources as men, they could increase yields on their farms by 20–30 percent. This could raise total agricultural output in developing countries by 2.5–4 percent.

"Women make significant contributions to the rural economy in all developing regions. Their roles differ across regions, yet they consistently have less access than men to the resources and opportunities they need to be more productive. Increasing women's access to land, livestock, education, financial services, extension, technology and rural employment would boost their productivity and generate gains in terms of agricultural production, food security, economic growth and social welfare". (idem, p.3).

Today, not only in the agriculture, but in the services and even in the financial sectors there are new possibilities opened to women, if necessary skills are equally offered to both genders.

Babatunde Osotimehin, Executive Director of the United Nations Population Fund (UNFPA), noted that access to good health care and reproductive rights remained elusive for many women and that not a single country had achieved full gender equality. "We cannot advance by leaving half of the population — our women and girls — behind," (www.un.org/womenwatch/daw/beijing/index.html) he said at UN General Assembly on 22 September 2014.

## 2.2 Larger perspectives

The Gender Equality Commission at the Council of Europe (Doc. 13733 of 17 March 2015) reiterates that "Equality between women and men is an integral part of human rights and a fundamental criterion of democracy". Referring to the EU Recommendation 2053, in

Resolution 2012 (2014), the "Women's rights and prospects for Euro-Mediterranean Co-operation", the Parliamentary Assembly notes that "in the countries on the southern shore of the Mediterranean, equality between men and women is developing unevenly, alongside democratic transition, with significant advances in certain countries and a situation of instability hampering progress in others". The Council of Europe will help in strengthen co-operation with the countries of the region and contribute to the processes of democracy through laws, promoting the Istanbul Convention (CETS n. 210), which states: "Equality between women and men and actions to stop violence against women form an integral part of the Council of Europe's co-operation priorities with the countries of the southern neighborhood. The Committee welcomes the exchanges and relations already established and urges continued co-operation to support and build on the progress already achieved in these countries" (Doc. 137333, 17 March 2015).

The Committee on Equality and Non-Discrimination is focusing on three priorities:

- Preventing racism and intolerance
- Combating racism and intolerance, violence against women
- Fighting against discrimination on the ground of sexual orientation and gender identity.

The Assembly considers that "Co-operation by the Council of Europe with the Southern Mediterranean countries should also continue to assign a major role to gender equality components in the inter-parliamentary context" (Parliamentary Assembly Debate on 30 September 2014, Recommendation 2053).

The *Istanbul Convention* which entered into force on 1st August 2014, already ratified by 18 States parties, created the Gender Equality Commission at the Council of Europe. The Article 13 of the Convention plays on awareness-raising campaigns which should be designed in "close collaboration with national human rights institutions and equality bodies, civil society and non-governmental organizations, especially women's organizations, and needs to be based on accurate data to ensure that they target their messages at the right audience" (AS/EGA (2015) 10, p. 3). Article 14 plays on non- stereotyped gender roles, mutual respect, non-violent conflict resolution in interpersonal relationships and the right to personal integrity.

## 3. THE FEMALE ROLE AND POSITION IN MIDDLE EAST NATIONS

While governments around the world are taking steps to advance gender equality, parity continues to remain a global challenge. Great differences in female gender's results, success, career and respect appear among countries and especially between North and South, so women continue to have unequal access to opportunities in both their private and public-economic lives, including the Middle East and North Africa Region (MENA). To address this challenge, the OECD introduced an OECD *Gender Initiative* in 2010 and adopted the *2013 Recommendation on Gender Equality in Education, Employment and Entrepreneurship*. In addition, in 2014, the OECD *Global Forum on Women Leadership in Public Life* and the OECD Report *Women, Government and Policy Making* in *OECD Countries: Fostering Diversity for Inclusive Growth* called for the establishment of guidelines for gender equality in public life.

If differences exist among North and South, inequalities are even more differentiated in the internal division of these two geographical parts, especially in developing countries. The MENA region is in fact composed by very distinct parts, being African countries not similar to Middle East countries. MENA region includes 20 economies: Algeria, Bahrain, Djibouti, Egypt, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, the Palestinian Authority, Qatar, Saudi Arabia, Somalia, Sudan, Syria, Tunisia, United Arab Emirates, Yemen.

However, one nation has made more progresses along the democratic process, and is resulting noticeable in human rights evolution: Bahrain.

### 3.1 The Bahrain

Bahrain is a small archipelago in the Persian Gulf, East of Saudi Arabia, to which it is connected with a 24 km bridge. It occupies a strategic location in the Persian Gulf, through which much of the Western world's petroleum must transit to reach Open Ocean, so it has an organized network of transports, having also a national air carrier.

It has the smallest population of the Gulf States, 1.343.000 (2014) inhabitants, with a density of 1.643 ab. Km², the third density rate in the world, comparable only to the City States. Urbanization rate exceeds 90%, concentrated on the far northern end of the island and around the capital Manama (www.cia.gov).

In 1916 it became a protectorate of the United Kingdom and remained until 1971, the date of Bahrain's definitive independence. It adopted a Constitution in 1973, and became a kingdom in 2002, abandoning the form of Emirate.

Now it has a mixed legal system of Islamic law, English common law, Egyptian civil, criminal, and commercial codes, customary law.

Bahrain has a high Human Development Index and was recognized by the World Bank as a high income economy; the GDP per capita has been estimated in 2016, in 50.000 US dollars. According to a January 2006 Report by the United Nations Economic and Social Commission for Western Asia, Bahrain has the fastest growing economy in the Arab world. The lowest growth rate has been of 2,2%, during the worst years of the global crisis (www.cia.gov).

Bahrain is open to the external world, so, to demonstrate its Western policy has granted a naval base to the United States and has joined the United Nations. It has established bilateral relations with 190 countries worldwide; maintains a network of 25 embassies, 3 consulates and 4 permanent missions to the Arab League, United Nations and the European Union respectively, and hosts 36 embassies.

The Government has important relations with the United States, having provided a NATO military base, and implemented a Free Trade Agreement (FTA) with the US in August 2006, the first FTA between the US and a Gulf State. Bahrain is one of the founding members of the Gulf Cooperation Council; it adheres to the views of the Arab League on Middle East peace and Palestinian rights by supporting the two states solution.

It results as an advanced country in the horizon of Arabian oil producers. Oil comprises 86% of Bahraini budget revenues. Low oil prices have generated a budget deficit of at least a $4 billion in 2015, or 13% of GDP, despite efforts to diversify its economy and to build communication and transport facilities for multinational firms with business in the Gulf.

The national GDP is divided into: agriculture: 0.3%, industry: 33.8%, services: 65.9% (2016 est.).

Renowned is the production of pearls considered the best in the world.

Other major economic activities are the production of aluminum, finance, and construction. Bahrain continues to seek new natural gas supplies as feedstock to support its expanding petrochemical and aluminum industries (www.cia.gov).

Bahrain has been the first post-oil economy in the Persian Gulf, investing, since late 20th century, in the banking and tourism sectors, hosting many financial institutions in Manama, becoming a fiscal paradise, characterized by the Bahrain World Trade Center and the Bahrain Financial Harbour, where the projected Murjan Tower, a skyscraper, 1022 meters high, with 200 floors, will be the tallest building in the world, over 193 meters (40 floors), more than the Burj Khalifa in Dubai, which is 829 m high on 160 floors.

Prince Nasser, of the Al Khalifa dynasty, is known for his opening to the modern styles, for his love for all the sports. He has set the car racing circuit of the Formula 1 with the Gulf Air Bahrain Grand Prix, and the MENA Motorcycle Rally, the Rugby festival, the polo and golf tournaments, the bike and horses races, and many other events.

### 3.2 The Bahrain social system

Bahrain has implemented a new jurisdictional system and is involved in promoting impartiality among different ethnic groups and religious *credo*, since more than half population is of foreign origin. Even if it is at the beginning of some progressive human rights evolution, it should be mentioned in the Middle-East panorama, for the role it is achieving in reducing the gender gap. Like other oil producers, Bahrain would look beyond the present economy, preparing for the day when energy needs will be satisfied using alternative sources. Urban, transport and buildings investments are today gigantic, like the perspectives on financial investments and bank credits.

Bahraini authorities face the long-term challenge of boosting Bahrain's regional competitiveness—especially regarding the industry, finance, and tourism—and reconciling revenue constraints with popular pressure to maintain generous state subsidies and a large public sector.

On November 11$^{th}$, 2016, a delegation of Bahrain government came to Rome, Italy, in order to sign an agreement with the University La Sapienza. At the Park Hotel Marriott, where the signature ceremony was held, the representatives of Bahrain have organized an international conference and the Fair of Gulf State Cultural Center, aimed at building a social, political, cultural and economic cooperation strategy between Europe and the Gulf of Arabia.

The delegation of the small reign has exposed during both the events, the processes of political, social and cultural innovation undertaken by the government, to enhance the economic-political-social relations between East and West. At the exhibition, and during the conference, it has been strongly emphasized the peaceful coexistence that has been established in the country between the multifaced ethnic groups and different religions, from the Christian-Catholic and the Protestants, until the Buddhist credo, for demonstrating the government's firmness against violent extremisms. This, because the country wants to emphasize its role as a lighthouse of peace between West and East, favored by its symbolic position and archipelago profile, almost at the center of the Gulf. To this end, it has strengthened the judicial system and is pursuing an equality policy that seeks, first, the attainment of equality between men and women. For several decades, this policy has led to a greater number of women in educational institutions and women in government, passing through the high roots of the banking-financial system, the way initiated for the first time in 1970 by Princess Sabeeka. The result is that today in the Central Bank, 44% of the jobs are covered by women. This is a worldwide practice, because even in Japan, the female element seems more suitable for interpersonal contacts that are decisive in delicate transactions, such as investments.

The road to finance is the way to the future in oil countries that are witnessing, along with a reduction in reserves, the widespread introduction of new sources of energy. It is significant that one of the most modern and impressive buildings is powered by wind power. Enlargement to international finance takes place under the auspices of London - ties deriving from the English protectorate.

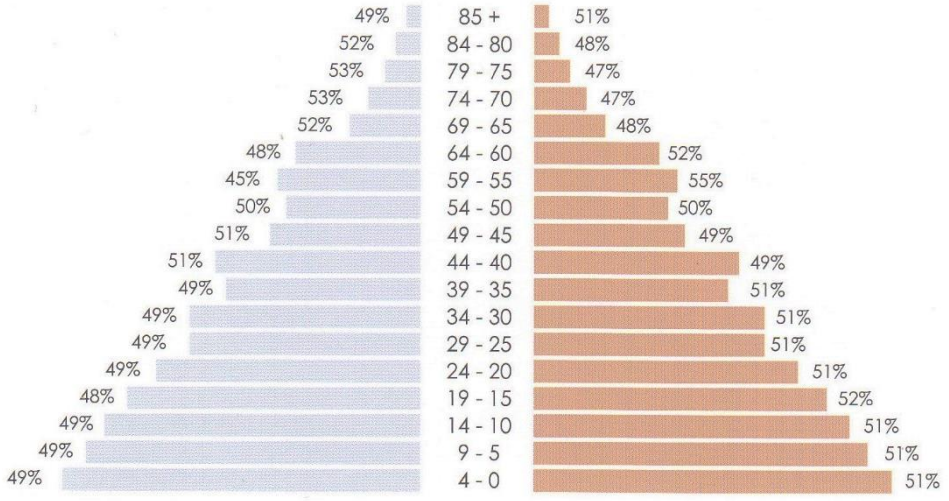
Finance is perhaps the most consistent way for the future of the Gulf States that have an excess of liquidity, which must be safeguarded, since it will only decrease in the future.

## 4. WOMEN ON THE STAGE

Bahrain is regarding a future based on services and for that, considers women the most suitable to social interaction, like it had also been experimented in Japan (Galvani, 2009).

Education is compulsory for children between the ages of 6 and 14, and free for Bahraini citizens in public schools, with free textbooks, but boys and girls are taught in separate schools.

Bahrain has a young population, distributed in a typical pyramid of developing countries, with an increased rate of 2,5%, but the high revenues could reveal great expectations for all the youth (Figure 1), since the unemployment rate is quite low, of 4%.




*Source: Central informatics Organization (2015), Kingdom of Bahrain.*

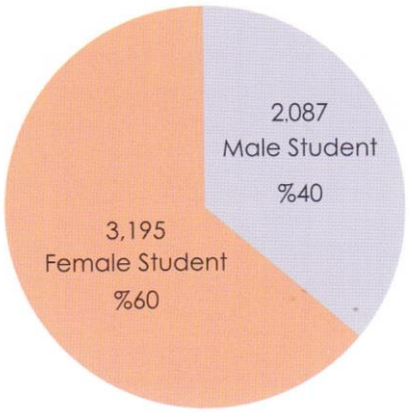
**Figure 1.** Population Pyramid for the Kingdom of Bahrain 2014 (Bahrain Nationals)

At the beginning of the 20th century, Qur'anic schools (*Kuttab*) were the only form of education in Bahrain, but after World War I, Bahrain became open to western influences, opening in 1919 modern public schools. The schools were restricted only to boys until 1928, when the first public school for girls was opened in Muharraq.

The Royal University for Women (RUW), established in 2005, was the first private, purpose-built, international University in Bahrain dedicated solely to educating women.
Women's political rights in Bahrain increased when women were granted the right to vote and stand in national elections for the first time in the 2002 election. Six women were appointed to the Shura Council, which also includes representatives of the Kingdom's indigenous Jewish and Christian communities. The country's first female cabinet minister was appointed as Minister of Health in 2004. When Bahrain was elected to head the United Nations General Assembly in 2006, it appointed lawyer and women's rights activist from the royal family as President of the UN Assembly, only the third woman in history to head the world body. In 2008 one woman was appointed ambassador to the United States making her the first Jewish ambassador of any Arab country, while in 2011, a Christian woman was appointed ambassador to the UK (cia.gov).

Like the famous Mohammad Yunus- who has been the first in Muslim environment to help women and trusting them - the Bahraini policy is promoting the skills that - like it has been recently suggested by OECD - would be the key for future, the so-called “financial literacy”. Even if the educational breach is quite adjusted in developed countries, wide gaps remain everywhere in female and male educational choices, since mathematics and sciences remain an option predominantly chosen by boys, so Bahrain looks toward the future, avoiding the diffused habit of women increasingly becoming everywhere NEETs (Not in Education, Employment,

or Training) because of the rapid technological advances. In fact, the educational situation in Bahrain is satisfactory for girls, as we can see in Figure 2.

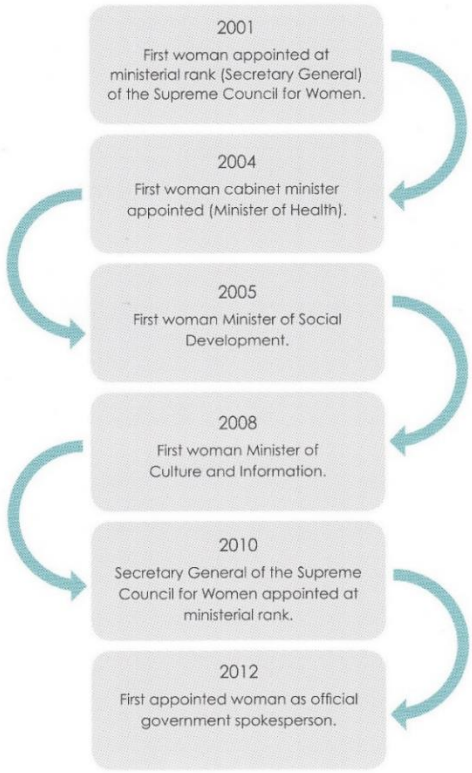



*Source: Ministry of Education (2015). Kingdom of Bahrain.*

**Figure 2.** Numeric and percentile distribution of students graduates from public and private institutions of higher education in Bahrain (2012-2013).

### 4.1 Women at high positions

The Economic Development Board will integrate women's needs into the future policies. Updated statistics are foreseen in order to document the Bahraini women in the field of entrepreneurship in financing and insurance. The new real direction toward gender justness has been started in 2000 by a royal princess, and entered into practices in 2001, so that, today, women have a legal framework of roles, positions, and rights.




*Source: Supreme Council of Women (SCW) Secretariat - Manama, 2015.*

**Figure 3.** Women in Decision Making

Rules regarding female attire are generally relaxed compared to regional neighbors, and Western clothing is common in the country.

The Governmental General Secretariat of the Supreme Council for Women (SCW) has implemented plans and practices in accordance with the bank and financial sector to ensure equal opportunities for women and to enable them to reach high positions. The women integration in the sector started in the 1970s, following the establishment of the Bahrain Monetary Agency (BMA), so the women staff represents today about 44% of the Central Bank of Bahrain (CBB) force, and cadres represent about 33% of the National Bank workforce, including high administrative posts.

Among several initiatives, we note the: *Implementation of a training program for women entrepreneurs in the Women Development Center* (Ryadat) and the creation of the *Supreme Council for Women in Investment Education*. The Bank of Bahrain and Kuwait is activating a *Women Empowerment Committee* in preparing a second row of leaders. A great role is played by multinational banks headquartered in London or in the US, suggesting new steps in changing towards modernity.

Interesting is the study conducted by the Gulf International Bank (GIB) in valuing the challenges which women are facing in accessing leadership positions. The Bahraini Islamic Bank is chaired by a special woman, a royal highness.

## 5. CONCLUSIONS

The most favorized countries, that means today, the countries with oil revenues, could become a model of development and modernization for other less fortunate regions, especially in marginal areas, which don't have the means to implement studies, plans and programs, with the hope that the world will advance in peace, parity and wellbeing. The process could and must change through education and equity among citizens, but especially assuring rights parity for women, since they are the engine of development, thanks to the care of children who are the actors of tomorrow.

UNESCO also recognizes that culture is the essential driver for development and social inclusion (2016).

This, otherwise, also requires a better education for women, who generally are less involved in the formal educational process, or they follow the minor subject of studies, and with difficulties, they follow scientific laboratories. It is demonstrated by OECD that a scientific educational background will assure a general amelioration of economic level of female's social conditions, other than assuring a major degree of dignity.

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