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Article

WebGIS and Geospatial Technologies for Landscape Education on Personalized Learning Contexts

María Luisa de Lázaro Torres [1], Rafael de Miguel González [2,*] and Francisco José Morales Yago [1]

[1] Universidad Nacional de Educación a Distancia (UNED); mllazaro@geo.uned.es (M.L.L.T.) fjmorales@geo.uned.es (F.J.M.Y.)
[2,3] Universidad de Zaragoza (UNIZAR); rafaelmg@unizar.es (R.DM.G.)
* Correspondence: rafaelmg@unizar.es; Tel.: +34- 876554845

Abstract: The value of landscape, as part of collective heritage, can be acquired by GIS due to the multilayer approach of the spatial configuration. Proficiency in geospatial technologies in order to collect, process, analyze, interpret, visualize and communicate geographic information is being increased by undergraduate and graduate students, but in particular by those who are training to become geography teachers at secondary education. This training can be carried out through personalized learning and distance learning methodology. Personalized GIS education aims to integrate students and enhance their understanding of landscape. Some teaching experiences are shown whereby opportunities offered by WebGIS will be described, through quantitative tools and techniques that will allow this modality of learning and improve its effectiveness. Results of this research show that students, through geospatial technologies, learn landscape as a diversity of elements but also the complexity of physical and human factors involved. Several conclusions will be highlighted: i) the contribution of geospatial training to education for sustainable development; ii) spatial analysis as a mean of skills acquisition about measures for landscape conservation; iii) expanding and applying acquired knowledge to other geographic spaces and different landscapes.

Keywords: WebGIS; Landscape; heritage; personalized learning; the cloud; distance learning

1. Introduction

The increased use of Internet has made the use of online interactive digital maps based on open data possible instead of conventional cartography on paper. In the late nineties "GIS is seen as an enabling technology for improving the understanding of spatial problems by means of engaging students in empirical analysis" [1]. And, after twenty years, learning about urban world with spatial data visualizing shapes and making metrics online allow Lynch concepts transposition [2], among many other things.

All of these challenges have to be faced [3]: i) innovative curriculum: contents, cognitive processes, assessment, outcomes, competences, etc. versus encyclopedic geography; ii) updated topics: geography for life and spatial challenges in 21st century: environment, sustainability, climate change, population pressure and migrations, food and water supplies, transportation, city growth and housing in urban and metropolitan areas, energy supplies; iii) pedagogies: textbooks versus IBL, PBL, student simulating scientific tasks of geographers, learning by doing geography.

Thus, geospatial technologies are very helpful for all these aims, as they allow obtaining-processing-presenting geographic information. Many authors demonstrate that geospatial technologies using geoinformation contribute significantly to the development of students' geospatial thinking [4-5].

WebGIS is a geospatial technology using geoinformation on a Geographic Information System online which allows to collect, process, analyze, interpret, visualize and communicate data, to add and remove layers and the client-server interaction [6]. Therefore, geodata, images in different layers, gather a data collection on a map for a further analysis [7] and integrate other data from participatory methods using a computer or a device (e.g. ESRI Survey123). This is easily integrated on a Web map

on platforms hosting GIS on the cloud. These geospatial technologies using geoinformation make it possible to understand landscape transformations and so, environmental monitoring and assessment. This geospatial approach has been previously used in GIS training by several European projects such as GeoSkills [8], "digital-earth.eu" or even by the European Environment Agency initiative called "Eye On Earth".

Besides those references, the present paper underlines the importance of pedagogical methods to achieve a personalized learning, in particular focused on distance learning. The steps that we will fulfil throughout this paper in order to achieve these objectives are: explanation personalized learning context (Section 2), underlining the importance of technologies (Section 3), developing the research about how WebGIS enhances personalized learning on landscape contents, followed by conclusions and results.

2. Personalised learning context

The educational context should reflect and respond to three questions: what to learn, how to learn, and who will learn in order to carry out the construction of a training strategy which integrates the most appropriate resources and tools for each student according to their own background. This approach on personalized learning or personalized education is a pedagogical conception that tries to achieve the best possible integral human development for every student. Thus, efficiency and effectiveness are important elements as learning objectives in order to improve learning outcomes and to reduce university and school leavers. Its application is a challenge, especially in distance learning. Active methodologies, personal and cooperative work are essential to this methodological renewal.

Nevertheless, this is not new. Methodological background, such as the pedagogical model used by Pierre Faure for personalized education [9] was based on two pillars, one is the integral vision of the human being, and the other, the constructivist method. The latter encourages the personal work of the student in a guided way, and a subsequent grouping or group interaction based on previous knowledge obtained through personal work. The constructivist method proposes the integral development of the person by forming responsible citizens, from their own work at school. Students discover their learning challenges, they engage in learning and in researching, they increase their competences in learning to learn. These enhances a responsible citizenship, acting with knowledge and integrating lifelong learning in a natural way.

We can therefore consider that the essence of personalized learning makes the student take the initiative of his own work: establishing his own learning objectives, managing the content to learn according to their own background and interests. The possibility of communicating with others is also a relevant question, putting into practice his social skills supporting lifelong learning. Thus, the student-centered learning is "pushed" not only by the teacher's orientation but also by community and network.

Some specific teaching strategies such as the inquiry method [10-12], the flipped classroom or flipped teaching [6, 13], self-organized learning (Self-Organized Learning Environment called as SOLE project [14]), self-learning and lifelong learning [15] are examples of student-centered learning guided by teachers using personalized learning. In all cases, key questions of the subject to be studied or investigated are very important in order to achieve learning objectives using a varied range of materials. The student should choose within useful resources for the subject. There is a great flexibility in personal work: without distances, without schedules, using group and teacher interaction.

The main problem is the great number of students in the classrooms in all the educational levels which undoubtedly makes the application of personalized learning method difficult. However, technologies and geo technologies (GeoICT) make it possible to introduce custom processes without undue stress. In fact, after a review on the literature related to the personalized learning environments PLE (Personalized Learning Environment), it concludes that it is imperative to improve the quality and quantity of technology used to aid the learning process [16]. The personalization of learning has nowadays an increasing weight in society, using ICT as the international reports on Higher Education

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and the literature dedicated to learning forms say. But the only use of ICT doesn't guarantee an integral human development for every student.

The sequence of learning entails the continuous and creative intervention of the teacher by encouraging and guiding the use of different didactic strategies and resources. The main problem is the high monetary cost, if we consider that there should be small groups of students and the demand for a methodological renewal only possible with initial and in-service teacher training.

3. Technology enhances personalized learning

Technology allows students to access a wider variety and quantity of instructional resources and each student can choose which material or resources he uses for a better learning. Different ways and different speeds of learning can be faced by ICT according to the students' interests and experience. The huge amount of information available on the Web make it necessary to assess the quality of the online material, using the Internet tools in order to select the most appropriate. The same content can be used on different supports (video, text, graph, maps among others) and they can host tasks, correct them, analyze and monitor the entire learning process using learning platforms. Technology makes the objective of promoting a personalized learning possible with the teachers' orientation which must be adapted to each student. Some authors call it adaptive learning [17-18]: the adaptability in the process, the training plan and in self-learning to respond to the needs of students. In this way of learning, the medium is adapted using tools such as video, related to flipped teaching to favour this type of teaching "à la carte", and also virtual learning environments, such as the Moodle platform, so that the student can learn. These platforms allow the teacher to add and delete contents according to the needs of the students, selecting the materials needed for each group of students, proposing key questions to promote learning, dividing students into interest groups for participation in forums and inviting students to create their own blog. They are an essential element of asynchronous interaction and personalized feedback, for example, through the same forums and messages of support. Educational Adaptive Hypermedia Systems (EAHS) make the adaptation to students possible. Some distance universities such as the Spanish *Universidad Nacional de Educación a Distancia* (UNED), use many different channels to promote adaptive systems.

The growth of open learning environments, such as the Massive Open Online Courses (MOOC), allows to create an own itinerary of learning between the variety of resources that these courses present adding opportunities for personalized and collaborative learning.

Personal learning environments are classified as follows (Figure 1): courses -such as the above mentioned open mass courses online (MOOC)-, conferences, scientific working groups, online symposia, podcast and media casts, among many others. Adaptive teaching use personalized learning.

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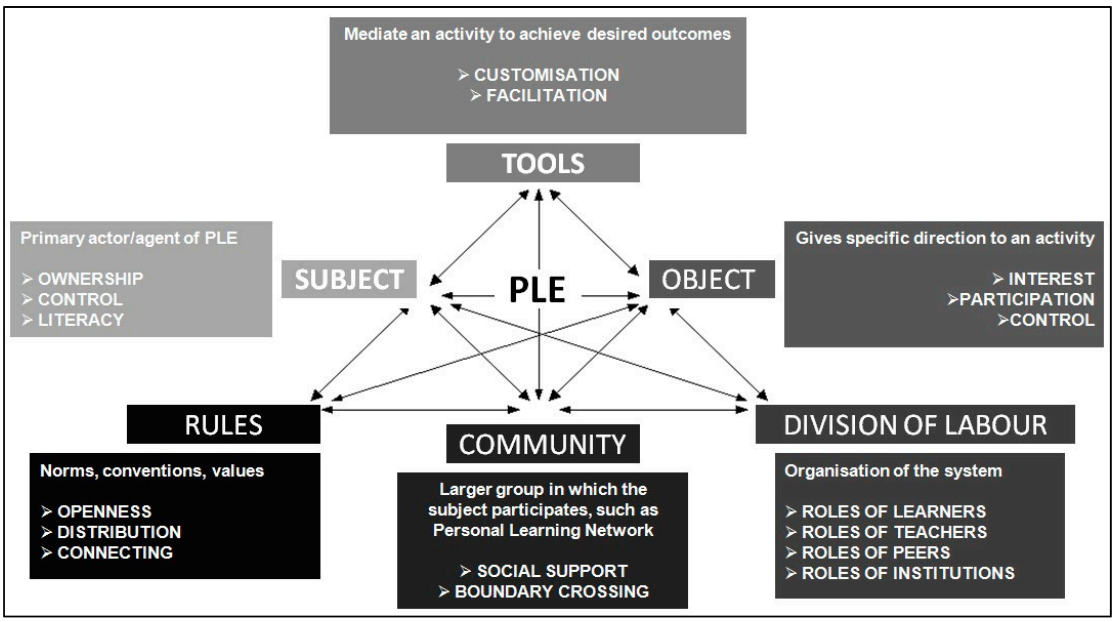

Figure 1. Elements of a Personalized Learning System (PLE) [19] (p. 30).

The system needs to be adapted to the educational context, with all the elements listed so far. Methods and technology as a means of applying personalized learning are emphasized by many European projects such as the School on the Cloud project. Partners gathered experiences to be analyzed from the point of view of personalized learning, using a series of indicators that are gathered in table 1. We can see how difficult it is to achieve personalized learning with the results of this analysis. Most of the experiences do not meet the objectives or the methodology of personalized learning [20]. It is not an easy task to apply personalized learning, despite the support that methodology and technology offer.

We can conclude with Martínez [21] that researchers are making rapid progress by realizing the dream of personalized learning with object architecture and adaptive learning technology. However, an understanding of the whole person, of how people want or intend to learn, rather than simply building, processing and storing knowledge is still missing, in most online solutions.

4. Personalized learning, landscape knowledge, and environmental monitoring and assessment

Landscape, as an expression of the territory, is the main object of study of Geography. The landscape is the result of the interrelation of physical and human elements. The European Landscape Convention (2000) [22] reflects how important this is.

The visualization of landscape, through digital images, allows to observe the most characteristic elements and can help to establish homogeneous units according to them: -physical environment (relief, vegetation, presence of water or climate) but also anthropic action (population, economic activities and infrastructures). Images of previous times show elements of natural and cultural heritage that still survive or have been lost. Therefore, it is possible to understand the future of the landscapes represented, their quality and the conservation measures needed. Of course, field work is very important to complete landscape monitoring and environmental assessment [23], but this is not always possible. Thus, geo-technologies arise as an important tool for a landscape approach in learning.

The importance of the existing landscape as heritage in Spain is a unanimous fact not only based on the protected natural areas which comprise more than 20% of the Spanish land, but also the declared world heritage by UNESCO, 47 sites declared: "Spain has a preferential situation in terms of assets declared world heritage, specifically the third world power behind Italy and China. This privileged position is a clear indicator of the need to manage this wealth in an educational way. Our greatest interest lies in the safeguarding of the heritage, its approach to the population, its care, transmission, dissemination and enjoyment" [24]. These previous reasons encourage to promote

heritage education and landscape education in a holistic approach to citizenship education. There are two Spanish documents to define these aims, the National Education and Heritage Plan (2013), and the Heritage Education Observatory in Spain [25] coordinated by the State and the Autonomous Communities. Heritage education is understood as an essential discipline to connect natural and cultural heritage with the acquisition of social and civic key competences and powerful knowledge in geography, history, biology, environment, etc. and of course, landscape heritage. The school education system reflects this concern in national curriculum, forcing universities to prepare future teachers and citizens with a basic kit of tools for landscape and environmental assessment.

Learning and understanding about landscape is not a new aim, four different and clear actions [26] could be considered not far away from the adapted Bloom taxonomy [27]:

- Perceiving and observing (territory), some key questions help these tasks.
- Using: acquiring, exploring, organizing, analyzing and interpreting outdoor and other geospatial technologies used. 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 collected geographical information (geoinformation). Structuring spatial relations such as identification, comparison, measurement, connections, directions or hierarchy, among others.
- Applying: acting on correct and wise use of geographical knowledge (e.g. building new interactive maps with student's own data and obtaining new research conclusions).

The inquiry method is widely applied to spatial analysis to achieve landscape monitoring and environmental assessment. This section is focused on learning landscape by using geoinformation in three ways: i), WebGIS, which we have defined previously as a geographic information system on the cloud; ii) a peer review tool, Aropä, a learning environment which allows the organization of the correction of dissertations, essays or other, by double blind peers, using evaluation rubrics [28]; and iii) electronic portfolios, which are significant elements for personalized learning objectives.

4.1. Learning landscape using WebGIS

The existence of WebGIS comes out from three recent developments under the geospatial technologies revolution [29]: i), the widespread use of GPS (Global Positioning System); ii), the access to open data (geodata) and quality images; iii), and the proliferation of cloud applications. Thus, geodata can be added more easily than some years ago to create interactive maps on the cloud. Geodata can be displayed on different devices for visualization, measurement, and analysis of features of the Earth. This opens new possibilities for teaching and learning Geography, for spatial analysis of the information contained in a WebGIS [30], for spatial case studies in a particular area.

By using WebGIS, students can visualize geographical contents on a spatial base, interacting with other users and contributing to add new contents. For example, innovative teaching projects at the Complutense University (PIMCD) [31-33] allowed the GEODIDAC research group to work on landscape education, combining flipped teaching, collaborative methods and Cloud-based GIScience learning [6].

The technical advantages of web mapping created from images of agricultural landscapes and geographical itineraries [34], among many others, became evident when these georeferenced images -including comments and metadata- were turned into a conventional web page very easily and quickly. This is just the opposite to the previous system: creation of web maps using html which meant a great investment of time, a location not always precise, the inability to integrate other layers of information that enriched the context of the images, and a lack of collaborative work in real time.

4.1.1. WebGIS on University projects

The facilities of ArcGIS Online (AGOL) TM, Esri® WebGIS platform have made a new approach on geography and landscapes education possible. The user creates different collaborative web maps by themes that show different landscapes [35] or itineraries in zones of heritage or landscape interest, for example Spanish National Parks [36], enabling questions and possible teaching activities. The

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student teacher's work, future teachers of Geography for secondary education at several Spanish Universities, showed their satisfaction by constructing their own cartography and applying them to their own classrooms during traineeship period.

About ten complex mapping projects have created new WebGIS materials for the classroom. They have been key to shift teaching methodologies of many of the teachers participating in them. The flipped teaching method has been a great help in the creation of web maps, following these main steps: students gather data and materials autonomously (for example an image of an agricultural landscape, then they interpret it with the help of the teacher). Later in class they create their map with the geoinformation previously gathered. Teacher mentor, overviews and helps students in the technical difficulties. The last step is to create a collaborative web map with the contents and geodata gathered jointly with the content of the WebGIS, which already covers the subject to study, for example, the vineyard landscapes of Spain.

We can conclude that WebGIS reinforces learning that satisfies students and even in-service geography teachers, who have collaborated asynchronously from different places. These same teaching strategies have been used in topics that are easily outdated on geography school textbooks, such as geopolitics, population, economy geodata, etc.

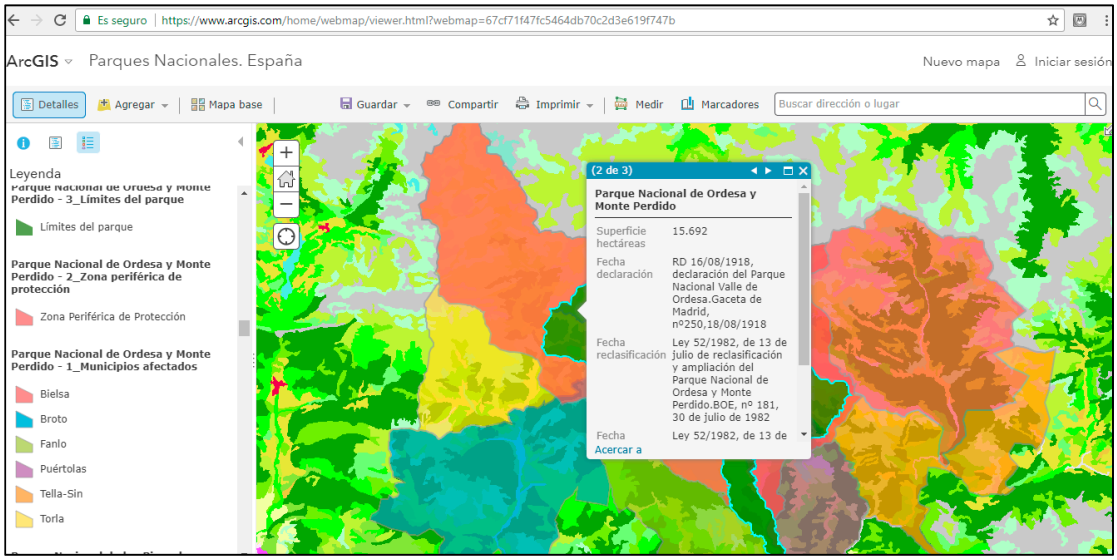

Figure 2. WebGIS about Ordesa National Park (Pyrenees, Spain) land uses and conservation measures assessment. Elaborated by J. Velilla on AGOL.

4.1.2. Digital Atlas for Schools

The Digital Atlas for Schools, in Spanish *Atlas Digital Escolar* (accessible at atlasdigitalescolar.es), is a set of maps drawn from the previous WebGIS experiences of the mixed team, composed by geography educators at colleges and teachers of geography from K-12 levels. This geospatial tool has clear pedagogical advantages in learning methods [37]: increased motivation, improved perception and better spatial thinking, collaborative work, meaningful learning by doing, spatial analysis, project-based learning, geospatial accuracy etc. at all educational levels, but mainly at secondary schools. The Atlas is the result of a contract between University of Zaragoza and ESRI Spain. Thanks to the dissemination and the recognition of several institutions (Spanish Royal Geographic Society, Eurogeo, IGU Commission of Geographical Education) it has reached about 60.000 users in two years since it was launched, according the data provided by Esri Gallery. Most of the Spanish -and even some Latin American- Universities use Digital Atlas for Schools as the main tool for geography teacher training programs.

The Digital Atlas for Schools uses ESRI technology and is visualized through ArcGIS Online, in a storytelling format. This platform allows to create customized maps that reflect the results of an

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investigation and adapt them to the educational needs. It is also organized in the form of a Web Mapping, making the integration with all the geoinformation resources possible: map notes, WMS or WMTS layers (raster), tracks on gpx, csv data bases, shp files for vectorial mapping.

Information obtained from statistical or cartographic open sources such as EUROSTAT, International Monetary Fund (IMF) or World Bank (WB) Excel tables and Spatial Data Infrastructures (SDI) services, among others, can be easily integrated into a web map on AGOL. WebGIS platform allows to address geospatial challenges and problems of Europe and the world. Thus, for the preparation of the Atlas, open data are used, previously published by the statistical institutions responsible for every data which guarantees its quality. For example, a better knowledge of Spain comes from the open data of the Spatial Data Infrastructures of Spain maintained by the National Geographic Institute (IGN) and the Spanish Statistic Institute (INE). Possibilities for creating and updating the created maps would be increased from a combined use of ArcGIS Online and ArcGIS Desktop.

Figure 3. Digital Atlas for Schools front page.

The Atlas is structured in seven sections (more than one hundred maps and almost four hundred geoinformation layers): 1. How it works 2. Cartographic tools; 3. Physical geography & environment (landscapes); 4. Population & urban geography; 5. Economic geography & globalization; 6. Spatial imbalances & regional planning; 7. School projects with AGOL.

The atlas is a web mapping application with text, videos, maps and class resources. The toolbar includes zoom; legend; information about layers; the option of changing the base map, make measures, share and print. There is a popup window that shows map details and gives further information about the map [38]: targeted students, on topics covered, enumerated layers and information presented on the map web. There are two available links: the first one, leads to what has been described as ArcLesson. It has examples of questions that can be directed at students to deepen their knowledge of issues presented, a very useful instructional resource which can be download; and a second link to the web map that contains the built-in application for teachers or students registered to access the map information, activate the layer, modify or create a new map from this ADE map only possible by login on the own AGOL account.

The main objectives to be achieved with the Digital School Atlas are:

- Facilitating the acquisition of knowledge based on the Geography curriculum.
- Encouraging critical geospatial thinking [39] providing a tool for spatial analysis.
- Understanding the concepts and reflected contents on any map, rather than memorizing it. It invites browsing to reach the same learning outcomes proposed on the current curriculum.
- Leveraging open and quality geodata available on the portals maintained by the official bodies responsible for the same data.

- Promoting learning standards and evaluation criteria that are useful for learning throughout life centered reasoning and spatial, and acquiring digital skills.
- Learning how to properly integrate geolocation tools in pictures, maps and other geo-data to help gain a better understanding of the Earth, through its analysis and by drawing the right conclusions for actions to be taken.
- Forming a citizenship whose responsibility is to apply acquired knowledge. Study cases and school experiences will be proposed with this aim in mind.
- Serving as a laboratory instrument for geography education research in at least two ways: geospatial thinking and geo-progressions [40].

4.2. The Aropä learning environment and a landscape aproach

To assess the natural heritage impact is not an easy task for students. The efficiency of land management, is possible by consulting and studying the current legislation related to the uses of land in natural spaces. In this context and, as a complementary means of learning, students from Environmental Sciences Degree at UNED: Planning of the Territory II, must carry out an assessment of one of the National Parks of Spain. An essay or dissertation is planned consulting current legislation, researching on the main problems and correcting other two student's dissertations or essays as blind peers.

The statement of instruction proposed to the students was: Write an essay on the topic "Difficulties and problems of the land use management of a National Park", which will be corrected by two of your colleagues (blind peers). Some guidelines were given [41] on the format, the structure of the document to be elaborated and the contents such as a personalized title. A synthesis of the analysis of the documentation related to the park, from geospatial products, the enumeration of the physical elements and indicators of the most relevant physical environment and problems of management of the Park were also provided. An argumentation whether the planning proposals in the Park needs to be implemented or not was included, and how in order to develop a sustainable spatial strategy for the area was asked. After the date of delivery of the work, the system assigns two essays about different Parks to be corrected by the student. The keywords established by the teacher, which were the names of the Parks, allow a labeling of the essays allowing the system to award two parks different from the one already done and uploaded to the Aropä platform.

Students review the essays or dissertations using the rubrics established by the teacher in relation to the aspects of the work requested: guidelines on the format, adequacy of the chosen title, key information on the management of the Park, enumeration of three relevant physical elements of the Park, coherent explanatory discourse (clarity of ideas and argumentation, correct content, the theme is well centered), correct application of the concepts learned in the subject, inclusion of a personal contribution, suggesting new questions and reflections on the subject that opens bridges to later debates, correct spelling and grammatical expressions, use of an impersonal style or the third person. An item on satisfaction in reading other student's dissertations has been added.

The student is invited to fill in a section of observations and the teacher gives some advice on how to correct a dissertation in a constructive way, collaborating in the improvement of the text and not in the disqualification of it. There are no absolute truths, everything has a temporal and spatial context. The value of new questions and reflections on the subject that have been raised will open bridges to subsequent debates and valuable personal contributions.

In this way, the student has approached three different Spanish National Parks, one more in depth, elaborated by himself, and two other different Parks through the correction made to his colleagues' dissertations. With it, students evaluate critically possible solutions according to the given criteria. They receive feedback on the form and content of the essay or dissertation already done [42-43]. It is a system that favors discussion among students in an orderly way.

The scores obtained have not differed by more than 2 points in 90% of cases, as estimated by the tool's creators [44], and the scores established do not differ substantially from those of the tutor /teacher. Therefore, the previous work of the teacher to elaborate the rubrics means that the tool allows to attend to a great number of students with outcomes in the very reliable qualifications.

It would be interesting to widen blind peer review to a larger number of papers, such as five papers, which would undoubtedly enrich the feedback given to the students, the analysis and assessment of different landscapes, and greater reliability in the evaluation.

Aropä learning environment helps to establish evaluation rubrics that respond to learning objectives and contents, allowing teachers to organize double-blind double-corrections online and offer the accurate results of them, permitting personalized learning using distance methodology.

4.3. The use of the portfolio and landscape study

The portfolio is a work tool that presents interesting aspects such as the possibility of performing a cumulative, sequenced and ordered work [45-46], as well as the assimilation of content [47-48]. In this way, students will be able to participate in the process of reflection [49]. It also incorporates learning not merely descriptive, but reasoned in such a way that it can be maintained over time and allows a reasoned application in future learning and research processes by the students involved [50]. In the context of personalized education, an educational action is employed focused on each student being able to acquire knowledge and develop personal and civic virtues. The study of the landscape through the incorporation of the portfolio supposes the opportunity to incorporate in an orderly and sequenced way the accomplishment of tasks and spaces of study [51].

For the implementation of a conventional portfolio or an e-portfolio, if we use the digital format, dedicated to landscape analysis, the student must learn to select accurate and meaningful information, analyze it and draw the appropriate conclusions. In the case of an urbanized landscape, it should represent the location of the general population in its population environment: neighborhoods, districts, suburbs, analyzing the morphology of these settlements and obtaining conclusions about the incidence in the construction or transformation of the landscape. Significant indicators such as population analysis may also be used, for example the degree of involvement on the landscape based on the level of education or professions in each neighborhood or district; The analysis of the regime of tenure of the dwellings (in property, rent or assignment); The study of the number of persons occupying the dwelling and the age of the dwellings, level of personal autonomy (total, partial or absolute) or form of resolution in case of any dependency (public, private or concerted centers). All of these questions are based in the embodiment of the economic, cultural or social spaces in which the population is based.

Another important section will consist of a map of facilities and services, including cultural and educational centers (libraries, universities or centers of popular culture); Health services (outpatient clinics, dispensaries, hospitals with geriatric services, among others); Facilities for leisure, day centers (indicating ownership: public, private or concerted), commercial services (pharmacies, banks, shops and other companies), residences for seniors installed in the urban area (indicating ownership: public, private or concerted and the economic cost of the square), map of collective transport and its adaptation to the elderly, current state of the existence of architectural barriers, current state of urban furniture indicating the state of conservation of public toilets, banks in landscaped areas, or endowment indexes for over 65 years in the different districts of the city as well as the accessibility to the services in the different districts of the city.

Geography is the science of the scientific analysis of the landscape, so before arriving at the conclusions and proposals for improvement, a section dedicated to the population footprint in the urban landscape could not be missing in this proposal. Renovation of buildings in the neighborhoods, rehabilitation of buildings, intervention of public administrations in the preservation of residential and urban heritage, ending with the elaboration of a map of the studied neighborhood where the main urban actions for renovation and rehabilitation are reflected in the last decades, being able to perform for the qualitative analysis a survey on the level of citizen satisfaction by neighborhoods and proposals of improvement for a greater quality of life of the elderly people. On this research line, mental maps can also be very helpful [52].

Finally, regarding natural and cultural landscapes, the number of possibilities to incorporate the portfolio will be extraordinary such as aspects of territorial planning to the knowledge of existing

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resources or an educational work that will consist in raising awareness about the preservation and defense of these unique spaces [53].

The results obtained from the e-portfolio application to the classroom are summarized using the Likert scale in Table 1. The assessment by the users of the portfolio qualifies it as an effective learning tool, as it allows a good orientation in the monitoring of the contents, helps and orders the subject and the autonomous learning makes to obtain better results in the evaluation. All of them are facilitating elements to surpass the subject with success.

Table 1. Valuation of portfolios by users. Prepared by F.J. Morales, 2017.

Issues to be valued about the use of portfolios	Complete disagree 1	Partly disagree 2	Not sure 3	Partly agree 4	Fully agree 5
Facilitates the progress of learning	0	3	12	11	4
Allows an orderly rhythm in the subject	0	2	9	13	5
Constitute an effective learning tool	1	0	4	19	6
Promotes autonomous learning	0	1	8	13	9
Encourages interaction with teachers	1	4	11	5	9
Allows a positive evaluation	0	1	7	14	8
Directs the monitoring of the contents	0	0	5	11	14
Facilitate personalized education	2	6	10	5	7

5. Results

We can perform a meta-analysis on the experiences provided by indicators related to the organization used (how), the software used (tools), the learning context or object (what), and finally, the subjects or actors involved in the case of study (who): teachers and experts in learning and in the field, and a network of peer reviewers, to be able to make an assessment of them (table 2).

Table 2. Assessment of proposed activities based on the indicators considered by Zwartjes et al., (2016) [54] within the framework of personalized thinking.

Type	Indicator	WebGIS	Aropä	e-Portfolio
How	Diagnostic entry test to start a real personalized learning trajectory			
	Diagnostic tests during the personalized learning trajectory	X	X	X
	Assessment at the end (via test and/or portfolio)	X	X	X
	m-learning or u-learning instead of e-learning			
	Take different learning styles into account	X		X
Tools	Social network or other form of contact with co-learners included	X	X	
	Interactivity	X	X	X
	Accessibility and usability of learning materials for everyone	X	X	X
	Monitoring via the system		X	X
	Motivation (entertainment) tools	X		
	Formal education --> core-curriculum	X	X	X

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What	Possibility (not obligatory) to include non-formal and informal learning	X	X	X
	Valuing all dimensions of the learner			X
	Valuing previous knowledge, competences, life and work skills, also informal			
	Taking the cognitive background of the target group into consideration	X	X	X
	Flexibility in the system (flexible content)	X	X	X
Who	Ownership of personalized learning	X	X	X
	Instructor / tutor, experts and teachers to guide and support the learning	X	X	X
	Contact with peer group/ cooperative learning	X	X	

6. Discussion

Personalized learning conducted by teachers is a useful way of learning specially on distance learning. It must be based on geoinformation instructional resources and enriched by collaborative learning, thus increasing interaction among students. The use of geoinformation tools such as WebGIS in different ways [55], combined with the use of other technologies such as Aropä and e-portfolio also very useful for a landscape approach. All of them have also been used by different authors cited along the text. The next academic year, the research group will use WebGIS, Aropä and e-portfolio for landscape approach, as they have many advantages, especially when it is not possible to do fieldwork, as it happens on distance learning.

7. Conclusions

Some challenges have been shown in distance teaching, such as: achieving a personalized learning method, and the understanding and valuation of the landscape, the main object of geography. It has been considered necessary to clarify at the beginning what is understood by personalized teaching and how technology can help in applying it to university classes. Several examples have been set out when showing that it is possible to approach landscape study using geoinformation in the framework of personalized learning.

In this way, the student and the teacher apply a methodology of distance learning in which the teacher will become a discrete mentor of student learning through the teaching guides of the different subjects. The center of this learning is the student, who makes his own decisions regarding the range of materials and suggestions that the teacher provides.

Access to the virtual campus and other learning environments such as Aropä, the monitoring of forums, videoconferences, and particularly the use of geoinformation such as WebGIS or the delivery of electronic portfolios are complementary basic elements that contribute to the improvement of educational quality. Student participation and interaction with teachers improve teaching practice and the teaching-learning process, as evidenced by the positive evaluations of students on these tools. The results indicate that these techniques have contributed to an improvement in the orderly follow-up of work, the contribution to meaningful learning and the autonomy generated in a student body that has the peculiarity of working in an educational system based on distance learning. It is also a very useful tool in the process of evaluating the learnings and competences acquired by the students.

All this makes us think if geoinformation development companies and educators should not be more united, with constant classes-geoinformation feedback.

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Author Contributions:

M.L.L.T. Coordinate the team and conducting research on personalized learning, WebGIS and Aropä.

R.DM.G. Coordinate Digital School Atlas and review all article consistence and English language.

F. J.M.Y. Research on personalized learning using e-portfolio.

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