USING COLLABORATIVE WEB-BASED MAPS TO PROMOTE GEOGRAPHY TEACHING AND LEARNING

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Abstract

Many education reforms are being driven by technological advancements, particularly the use of web-based maps. Nonetheless, these unprecedented changes have not been accompanied by teacher education and practice. It fails to bridge the gap between traditional resources and "digital natives" students. Geographic Information Systems (GIS) are utilized by various areas in geography, particularly web mapping applications, which are rapidly developing. GIS is recognized as a powerful technology for Geography teaching and learning, as well as for promoting interdisciplinary learning. It is essential to work with spatial representations and dimensions rather than simply using information and communication technology (ICT). GIS Mapping is an instructive opportunity. The findings of this study stem from the use of Web Mapping in a master class of elementary and secondary teachers' formation. With a long history of incorporating Web Mapping technology into the teaching and learning process, this case study stems from a pedagogical style designed to foster collaborative learning. Students began by writing an individual scientific paper on a sustainability topic, which led to the eventual publication of a book,

and the results were presented in a collective Story Map application. The technique encouraged pupils to learn, boosted creativity, and encouraged the acquisition of skills.

Keywords

GIS, Story Map, Web Map, Geography, Interdisciplinarity

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1. Introduction

Geographic Information Systems (GIS) is an important tool to deal with geographic data. It answers "Where" and "What" by facilitating the process of analysis, storage, visualization, and management of geographic data. It is a fundamental tool to implement spatial analysis more realistically and efficiently. Users must conceptualize "How" to implement GIS configuring the mainstream of GIScience.

At the beginning of 2000 educators highlighted the need to promote Spatial thinking in students and stress the contribution of GIS technologies to achieve this goal. More recently, with the advent of web-based GIS, the power of web and interactive mapping emerged to learn about the earth (Baker et al., 2012; Bearman et al., 2016; Kerski, 2008; Veenendaal et al., 2017).

2. Literature Review

Effectively, nowadays the internet is changing society, and access to telecommunication still growing fast. According to Ribeiro (2022) in March 2021 there were 5,168,780,607 internet users. In Europe 83 percent of individuals are using the Internet, being the mobile phone the most disruptive technology. The authors stress that on 1 September 2021, "statistics showed that every second there is an average of:

- 9,628 Tweets;

- 1,097 Instagram photos uploaded;

- 1,945 Tumblr posts;

- 5,981 Skype calls;

- 126,813 GB of internet traffic;

- 94,931 Google searches;

- 91,347 YouTube videos viewed;

- 3,061,371 Emails sent (which 67% are spam)."

Related to those impressive numbers and technological developments, the concept of smart is widely used in several sectors (transport, planning, cities, and education). It is related to

the use of technological devices, particularly mobile ones. The evolution of digital tools in Geography brings to the scientific research around geotechnologies. The authors cited (Molz, 2012) to identify the main characteristics of Smart Tourism. At the education level one can adapt those characteristics to identify that smart education is related to:

- connectivity through web-based applications
- amplify location capabilities;
- students as co-producers of education content;
- enhancing experiences through immersive technologies (augmented reality);
- connecting and interacting with places;
- improving interdisciplinarity, social and environmental sustainability.

Using web geotechnologies teachers can provide classes more interactive, complete, and efficient with engaged experiences and empowered students. The internet growth and consequent evolution of web geotechnologies create opportunities for citizens and non-specialists GIS users to produce, collaborate and disseminate mapping information. Consequently, two new concepts emerged: Neogeography and Map mashups (Azevedo et al., 2016; Corbett & Legault, 2019; Kalvet et al., 2020; Ribeiro, 2022; Ribeiro et al., 2020; Ribeiro & Sousa, 2017). Geotechnologies can produce geographic representations more dynamic and interactive easily. It is recognized that neogeography is a result of the new generation of web geotechnologies that empowers citizens, enhances public participation and multi-user collaboration (crowdsourcing) (Kerski, 2015; Ribeiro et al., 2017; Ribeiro et al., 2018; Ribeiro et al., 2020). Traditional complex databases to produce maps are now simplified with web capabilities and the capability of many platforms to blend data from multiple sources in a single application is the potential of the Map mashups (Liu & Palen, 2010; Ribeiro, 2022; Ribeiro et al., 2016; Ribeiro et al., 2015). The recent evolution of the internet and the power of multiple devices, particularly mobile, needs a re-adaptation of teaching methods by teachers. Those technologies are part of citizens' everyday life and the education process cannot ignore them (Graham & Dutton, 2019) besides in many countries, such as Portugal, education systems are far from reaching them. Schools must adapt to the increasing technological evolution of the last decades.

3. Methods

This is exploratory research that aims to investigate the contributions of using collaborative web-based maps to promote geography teaching and learning. The findings of this study

stem from the use of Web Mapping in a degree class in basic education formation. With a long history of incorporating Web Mapping technology into the teaching and learning process, this case study stems from a pedagogical style designed to foster collaborative learning. Students began by blending research with web geotechnologies skills. The technique encouraged pupils to learn, boosted creativity, and encouraged the acquisition of transversal skills. I will investigate this by conducting a one-semester experiment and applying a final survey to measure students' perceptions of geotechnologies capabilities in the process of teaching and learn.

4. Case Study

The Portuguese education system has two mandatory cycles: primary school (1st cycle: 1st, 2nd, 3rd, and 4th years; 2nd cycle: 5th and 6th years; 3rd cycle: 7th, 8th, and 9th years) and secondary school three-year cycle (10th, 11th, and 12th school years). Preschool education is optional as also higher education (Figure 1). This research was implemented with 33 students from 1st year of basic education degree during the first semester of the geography discipline at Paula Frassinetti School of Education.

Pre-school

Nursery school

Compulsory Education

Primary | **Lower secondary**

1st cycle | 2nd cycle | 3rd cycle
4 years | 2 years | 3 years
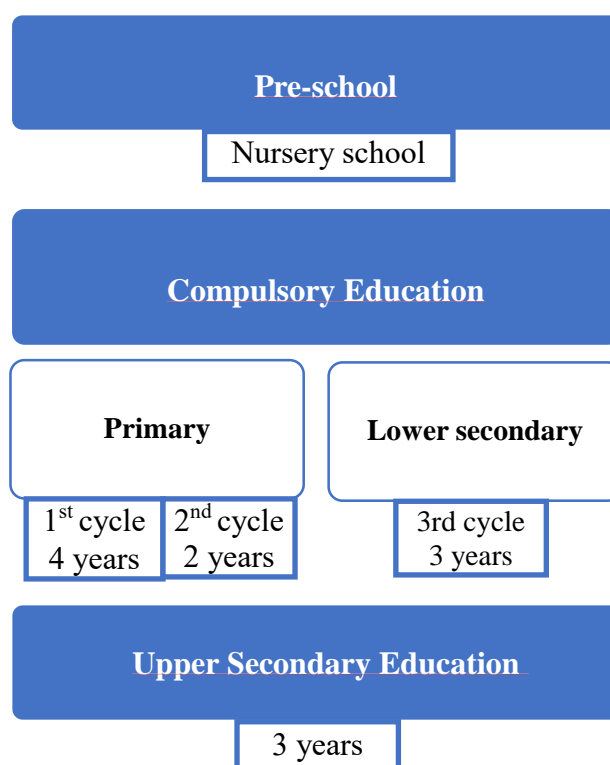
Upper Secondary Education

3 years

Figure 1: *Portuguese Education System*

(Source: Authors' Own Illustration)

The Paula Frassinetti School of Education (ESEPF) belongs to the Institute of the sisters of St Dorothy being created in 1963. They are established in: Europe (Portugal, Italy, Spain, the Azores (Portugal), Malta, England, Switzerland, Albania); North America (U.S.A.), Latin America (Argentina, Brazil, Peru, Bolivia, Mexico), Africa (Angola, Mozambique, Cameroon, S. Tomé e Príncipe), Asia (Taiwan, the Philippines). It is responsible for 11 education centers in Portugal (Ribeiro & Monteiro, 2014). ESEPF is the only higher education establishment in this Institute (Figure 2). It was the first private teacher training college in the north of Portugal and a pioneer in creating a professional statute for early childhood teachers. Currently offers two degrees in basic education and social education and seven master's degrees. This research was done with 33 students (five of them are Erasmus students) in the first year of the degree in basic education, in the Curricular Unit of Geography of 2021/2022.
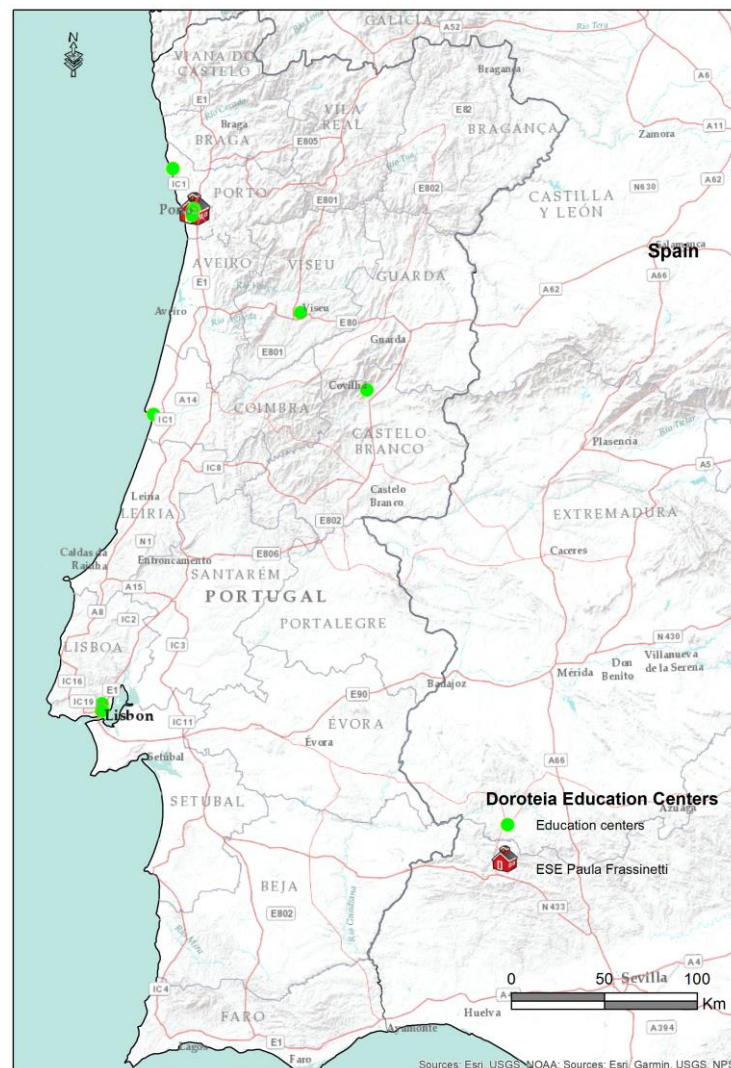

Figure 2: *Location of Portuguese Institute of the Sisters of St. Dorothy Education Centers*

(Source: Authors' Illustration)

Students developed a story map combining map production with immersive and multimedia tools (e.g., pictures, video, and maps). The results were used in the geography practical assessment counting for 60% of the final grade. They had to develop research about a given municipality and highlight the main geographical characteristics of that territory. Students were organized into groups of 2 or three elements each. They had to build a geographical database, produce at least one map on ArcGIS online platform and finally communicate results through a story map. This research was based on a survey applied at the end of the semester (Figure 3).
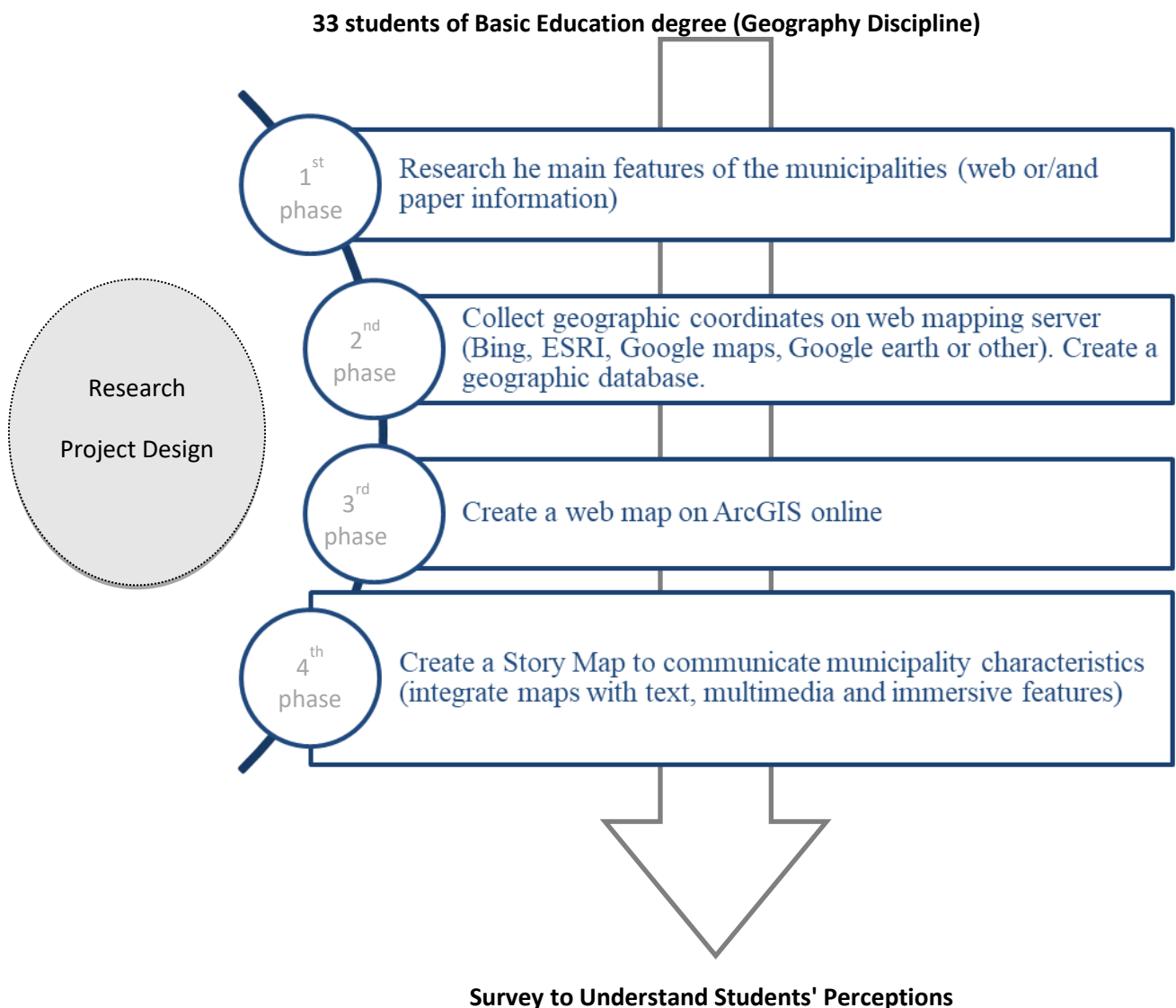
33 students of Basic Education degree (Geography Discipline)

Research Project Design

1ˢᵗ phase — Research he main features of the municipalities (web or/and paper information)

2ⁿᵈ phase — Collect geographic coordinates on web mapping server (Bing, ESRI, Google maps, Google earth or other). Create a geographic database.

3ʳᵈ phase — Create a web map on ArcGIS online

4ᵗʰ phase — Create a Story Map to communicate municipality characteristics (integrate maps with text, multimedia and immersive features)

Survey to Understand Students' Perceptions

Figure 3: *Phases of the Research Project*
(Source: Authors' Own Illustration)

The aim was to understand students' perceptions about the use and potential of story maps. The survey had 8 questions to understand the previous knowledge, the user-friendly platform, interdisciplinarity opportunity, and opinion about their motivation to still use it later. All students answered the survey.

5. Results

ESEPF is integrating technologies since 2012 in geography and history programs. It has been used as an interdisciplinary tool, particularly between Geography, History, and Sciences. Students have their first contact in the first year of the degree in basic education and in the last year of the degree. They still using it in their master's degrees. Several works have been published concerning the use of geotechnologies in teaching and learning (Azevedo et al., 2019; Maia & Monteiro, 2011; Ribeiro et al., 2017; Ribeiro et al., 2016; Ribeiro & Monteiro, 2014; Ribeiro & Sousa, 2017).

When asked about the easiest of using the story map platform and related web mapping production most students revealed a fair difficulty in using it while 21% revealed it was easiest (Figure 4).
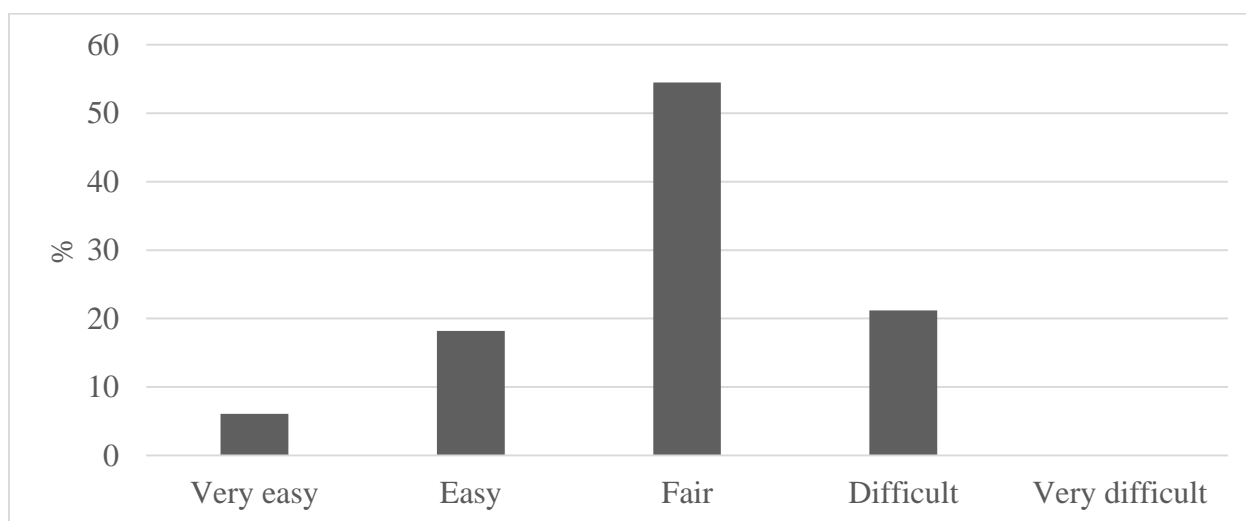

Figure 4: *Students' Opinion (%) About the Easiest of Using Story Map Platform.*
(Source: Authors' Own Illustration)

None of the students have used before the platform and all recognized their teaching and learning opportunities mentioning that they will certainly use it in the future. For example, a student mentioned:

> *The use of the Story Maps application was essential for my teaching and*
> *learning process. Through the application, I had the opportunity to learn*

> *how to prepare/build maps, learn different ways of presenting them, and consequently, manage to use them later, as an educator/teacher, more interactive and dynamic classes for the children/students.*

Effectively, ¾ of the students mentioned some difficulties in using the platform while 18% revealed it was very easy (Figure 5). The story map is the platform to tell a story that relates to the production maps platform ArcGIS online. Students have represented the entities on the map. Those entities were integrated into a geographical database using two fields to geocode the data (Latitude and Longitude), complemented by other entity attributes. This process was done for the first time by the students which can explain the initial difficulties of the students.
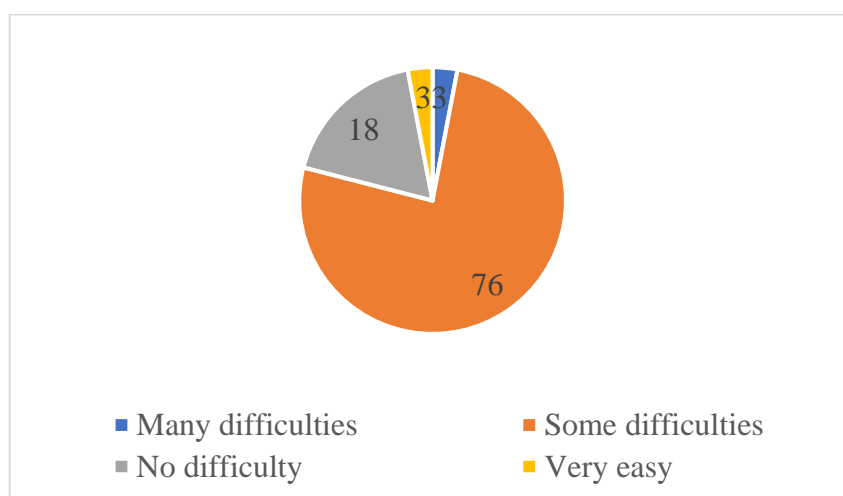

Figure 5: *Difficulty (%) In Using Story Map Platform*
(Source: Authors' Own Illustration)

More than 95% of the students mentioned that they will certainly use the story map in their future practice. They recognize the potential of this web geotechnology to bring students interest in learning. This is due to the dynamic, interactive, and immersive characteristics for study different subjects, as stressed by a student:

> *Story Map is a versatile digital tool to support teaching and learning. The biggest advantage of the App is that it is a powerful interactive cartographic narrative based on a friendly and free online platform. This digital tool can be accessed on multiple devices (desktop, laptop, tablet, iPad, smartphone). The creation and editing process is very user-friendly and requires no programming knowledge. Its weakness lies in the fact that it needs to be connected to the Internet since many schools have poor connections. I think it's interesting and this app can be used in multidisciplinary activities. As*

> *teachers we must be creative to use the app in a geography class, history or study of the environment, adapting the content to be taught according to the level of education of our students.*

The interdisciplinarity potential of the geotechnologies is well expressed for 55% of the students (Figure 6). It reveals that these students understood the potential for teaching geography, history, sciences, maths, or language (Portuguese) in an interdisciplinary way. About 45% stress that the greater potential is for geography teaching.
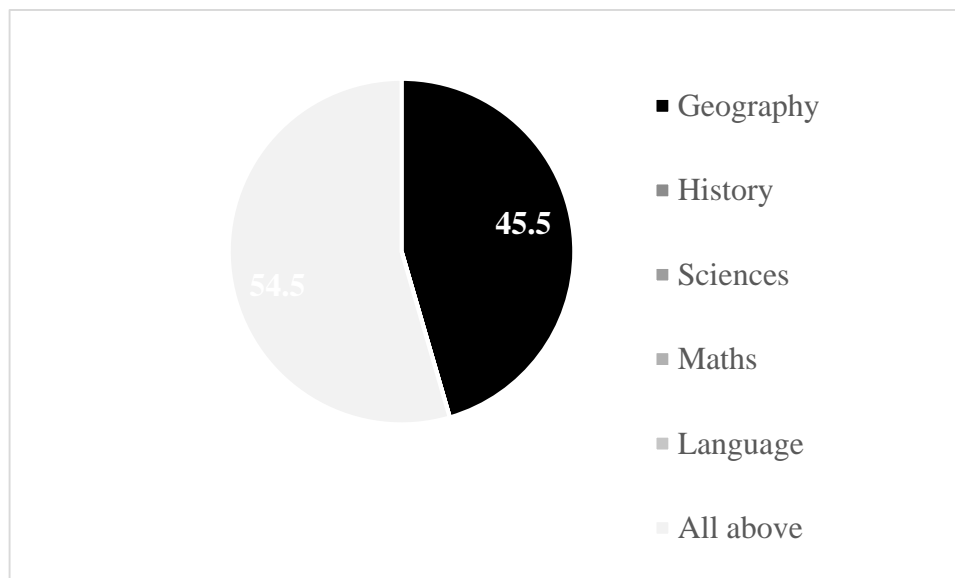

Figure 6: *Students' Perception (%) About Disciplines Where Story Map Can Be A Teaching and Learning Useful Tool*
(Source: Source: Authors' Illustration)

About 85% of respondents also believe those tools are very useful to be used in different cycles (1st, 2nd, and 3rd). Considering the Erasmus students that came from Spain they have a similar perception about the geotechnologies potential as Portuguese students, revealing:

> *It seems to me a good academic tool due to the one that allows students to learn in a very interactive way with the use of maps, lyrics, videos, and many more resources that this offer.*

In line with those comments, another student mentioned:

> *This type of "Story map" presentation is extraordinary, as it allows more focus on a particular story/narrative, as well as the fact of using the power of maps and their interaction. The use of this whole set of good practices makes the experience of learning much richer, more appealing, and beneficial, whether in the classroom or professional context. There is no*

> *doubt that as a future teacher, I gained another type of skill/learning that I will surely put into practice.*

Finally, another similar opinion says:

> *The story map is a complex platform. Once you understand how it works, becomes easy to work with. However, it is an excellent platform to develop geographical works and presentations. I didn't know about this method/tool, and I think that a large majority of teenagers are stuck with PowerPoint, so I had no idea that the story map existed and that it could be so useful. This method is great to use in work support, in presentations because it has immense potential, as are the examples of maps. I also consider that it is an excellent support for teachers' classes. I enjoyed working with the story map and will start using it more from now on.*

5. Conclusion

The Paula Frassinetti School of Education has a long tradition of integrating web geotechnologies in the teaching and learning processes both in degree and master's education. It is an articulated process with a Geography, History, and Sciences curriculum. The student's contact with those technologies starts in the first year of the degree. This research brings those students' perceptions of geographic learning. As observed, none of them used those tools before referring to their unfamiliarity. This is not surprisingly due to the lack of knowledge of basic and secondary teachers in Portuguese education systems. Only recently the Portuguese education system include concepts such as Geographic Information Technologies, Remote sensing, Satellite Images, or GPS.

Despite that, all students recognize the potential of geotechnologies in the teaching and learning process. They also revealed interest in using it, as future teachers, in their classes since it creates more dynamic, immersive, and motivating classes. At the same time, it was stressed those tools are useful to promote interdisciplinarity, namely with history and sciences. Also, some students mention some difficulties in working with those geotechnologies in the beginning. However, it was recognized that rapidly they gain skills to dominate all the integrated tools to produce maps and communicate geographic data.

This exploratory study is in line with the Europe objective of enhancing smart education and introducing digitalization. Digital geographic tools/platforms can be a great contribution to achieving those goals and enhancing the teaching and learning process.

Positive results obtained with this research should inspire researchers to implement similar projects in other education systems and at different locations (rural, urban, or rural-urban transition) and in private or public schools. The research involved a few limitations. First, the survey is a result of a small sample size which was not larger enough to do a statistical analysis. Second, the project was developed in the geography discipline and other subjects should be studied, namely in the interdisciplinarity context. Finally, it would be very interesting to understand elementary or secondary students' perceptions.

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