International Online Journal of Education and Teaching (IOJET), Vol. 13 , No. 4, 2026 (pp. 394-407)

RESEARCH ARTICLE WWW:IoJet.org

Geography Education in Portugal: Paths to Artificial Intelligence Research

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Keywords:

Geography education; Portugal; academic Geography; Artificial Intelligence

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Received : 16.04.2026

Revised : 30.07.2026

Accepted : 03.08.2026

Abstract

Lately, Geography education has achieved in a big success in Portugal. That has also been observed by the crescent number of doctoral theses conducted on the related subjects. The objective of this study is to investigate those theses underlining the key topics and identify the issues that need to be better developed in the next years, especially regarding the Artificial Intelligence. In this qualitative study, document analysis method was utilised and the data were collected via the database of doctoral theses on Geography education in Portugal. The key topics of the search were identified as Geography Teacher Education; Education for Sustainable Development and Environmental Education in Geography; Citizenship Education in Geography; Technologies in Geography Teaching; Pedagogy and Curriculum in Geography, and Theory of Geography and Geography Education. In the study, 23 theses were accessed and the obtained data were analysed using the content analysis method. The results have shown that there are still some topics not worked on in doctoral theses in Geography Education in Portugal, such as Artificial Intelligence, Hazards Education, Misconceptions in Geography Education, Powerful Knowledge in Geography Education, and others. For the near future, Artificial Intelligence is the challenge topic to be developed. A reflection on this matter must be done.

How to cite this article: Martinha C (2026). Geography Education in Portugal: Paths to Artificial Intelligence Research. International Online Journal of Education and Teaching, Vol. 13, No. 4, 2026, 394-407

Introduction

Research on Geography education is important for the development of the curriculum in teaching Geography subject in a country. Several authors have written about Geography curriculum (Bladh, 2020; Brooks, 2006; Catling, 2013; Chang and Kidman, 2019; Firth and Winter, 2007; Foskett, 1999; Gerber, 2001; Lambert, 2011; Lambert and Hopkin, 2014; Lee, *et. al.*, 2021; Maude, 2014; Rawding, 2013; Standish, 2009; Walkington, *et. al.*, 2018; Winter, 2018). These studies show some tensions between global and local recommendations for Geography curricula. In Portugal, we also received these different recommendations, and the curriculum tries to adapt to them (Esteves, 2021). Santos and Souto (2018) offer a reflection on this matter, underlining the relevance of the international charts of IGU-CGE in these discussions.

When we discuss the curriculum in Geography these days, it is also relevant to refer to "powerful

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knowledge", and several authors are writing about it (for example, Béneker, 2018; Maude, 2020; Roberts, 2023). In Portugal, this topic is still starting to be developed (Cachinho, 2019; Martinha and Sarmento, 2022). When we think about "Geography Education" and the research on this area, it's relevant to analyze journal articles, research projects (especially international ones), documents from IGU-CGE, and other national documents (curricula, textbooks, documents from teachers' associations). However, the analysis of the doctoral theses made in a country about Geography Education is very relevant to understand the level of development of this research area in that country. Because of this, we describe in this article the development and the content of all doctoral theses made in Portugal in the area of Geography Education. With this analysis, we aim to contribute to the development of knowledge in Geography Education in Portugal and also contribute to international knowledge about this research area. Considering the next paragraph, which is part of the *International Declaration on Research in Geography Education* (IGU-CGE, 2015):

> "*The Commission aims to develop an international culture in geography education in which research investigations at a variety of scales are planned and conducted. The IGU-CGE commends the dissemination of research findings through formal and informal means, enabling cross-fertilisation and accumulation over time and space. Particularly, it notes the role of its own journal, International Research in Geographical and Environmental Education, and its regional and worldwide conferences in contributing to this dissemination process*" (IGU-CGE, *International Declaration on Research in Geography Education,* 2015:2).

Geography education is a research field that connects "Geography" and "Education". As Geçit (2010) shows, the process of Geography Education development as a specific research area occurred in several countries. Portugal only saw the development of this research field after 2000. Despite the developments in the field started before 2000, the first doctoral thesis on the matter was defended in a Portuguese university just happened in 2002, as we describe below.

Internationally, the development of Geography Education as a research field was, according to Geçit (2010:971-972), strongly made by geography magazines in the USA. Studies from Bednarz (2000), Gerber (2001) and Kent (2000; 2006) were important on this matter. Moreover, Bednarz refers that "*it has been possible for many years to obtain a PhD in geography education at several universities in the United States*" (Bednarz, 2000:128).

In 2013, about Germany, Haubrich explains that:

> "*the 1960s, Geography Education in Germany was the domain of Geography teachers in grammar schools. (…) There were no doctorates and no professors or chairs of Geography Didactics at the university level* [but] *the current situation* [is] *about 50 full professors and 80 teachers and researchers of geographical education in our German universities*" (Haubrich, 2013:90).

Lambert (2010) question if a specialist in GER (Geography Education Research) exists, defending that "*GER is concerned with two big ideas, geography and education, and how these are related*" (Lambert, 2010:85). However, in this line, Puttick (2022) defends that "*complex global challenges, rapid shifts in the mediation and distribution of information, rising inequalities and a toxic milieu of low-quality public reasoning make geography education more important than ever*" (Puttick, 2022:898). He conceptualizes that the idea of Geography Education includes three fields: geography education learning and scholarship, geography education research, and geographies of education (Puttick, 2022:899).

Recently, a summary of the development of Geography Education in international documents was done by Miguel González (2021) and also Aksoy, *et. al.* (2021). Aksoy, *et. al.* analyzed articles from the WoS database generated by Clarivate Analytics covering the dates between 1975 and March 2020 about Geography Education and concluded that 559 of 64,874,978 studies registered in the WoS database between 1975 and 2020 were studies related to Geography Education, 106 of these articles were published between 2016 and 2020 what shows a

recent increase if this research field (Aksoy, *et. al.*, 2021:540).

Going specifically to the point of doctoral theses on Geography Education, Catling and Butt (2016:277) explain that IGU-CGE (the Commission 2012-2016) developed an online link for researchers of all countries to insert information about master's and doctoral theses made on Geography Education in different countries to allow the Commission to have a database on this matter. In their article, Catling and Butt underline, however, that "*fulltime doctoral research students, who are qualified and experienced teachers, remain few in number*" (Catling and Butt, 2016:279).

When we look at studies that specifically analyzed doctoral theses in Geography Education, we underline the study developed by Çifçi (2017), where he analyzed theses on Geography Education in Turkey between 2006 and 2017. Previously, Geçit (2010), also for Turkey, analyzed articles and Ph.D. theses in Geographical Education. She concluded that the main topics developed were learning activities, evaluation, and program development.

The development of Geography Education in Portugal as a research field is connected with the development of Geography at universities. Pimenta and Garcia (2021) explain this process of the development of Geography at Portuguese universities, where they refer that the first doctoral thesis in Geography in Portugal dates from 1922 (Pimenta and Garcia, 2021:116). In another study, Costa, *et. al.* (2013) analyzed the doctoral theses defended in Portugal in the field of Geography. Fedrizzi and Santos (2018) also developed a content analysis of post-graduation theses in Tourism, Leisure and Culture made at Coimbra University in Portugal.

About Geography Education, Esteves (2012) analyzed master and doctoral theses on Geography Education in Portugal (until 2012) and concluded that these doctoral theses focused mainly on Geography Education for Citizenship. Recently, Martinha (2021a) analyzed the content of master reports on Geography Teaching defended in Portugal, and the most developed themes in these reports were "strategies and didactical resources", "methods of teaching/learning", "technologies of geographical information and spatial thinking" and "citizenship and human rights".

When we focus on the doctoral theses analysis in Portugal, it is relevant to underline Fernandes and Gaspar (2014), Pintassilgo and Beato (2015), Carvalho (2019), and Silva and Dinis (2021). They made content analysis of the doctoral theses in Sciences of Education defended in Portugal.

Claudino (2010) explains that the research on Geography Didactics began in Portugal when the Portuguese universities started to offer Geography initial teacher training in 1987 and is connected with this. He says that, at that time, several teachers involved in Geography's initial teacher training were teachers from high schools and, because of that, they were not developing a career in research. Claudino says that, as a result, Geography Didactics had a hard academic insertion and is still not fully recognized as a research field in Geography or Sciences of Education. He also explains that this situation made the development of research projects in this field harder (Claudino, 2010:130).

This description of the development of Geography Education research in Portugal shows that this development occurred mainly in the last twenty years and was done mainly by Portuguese universities. Despite the fact that the first doctoral thesis on Geography Education in Portugal was done at London University by Maria Ferreira (Ferreira, 1992), after that, the country was able to develop research in this area in national universities. It is also important to note that Ferreira was the supervisor of three doctoral theses developed in Portuguese universities that we analyzed (Miranda, 2009; Alexandre, 2013; Oliveira, 2014), having a relevant role in the development and recognition of this research area in Portugal. Ferreira also represented Portugal in IGU-CGE for several years.

This path of Geography Education research in Portugal allows us to defend that this research area needs to keep its development with structured research groups and research projects funded by the national agency for research funding (some analyzed doctoral theses were already funded by it) and international projects (especially with European Union countries and in collaboration with other countries that use the Portuguese language).

This study seeks the answer to the research question "How can Geography education of Portugal be better developed, especially, regarding the Artificial Intelligence.

2. Method

Research design

In the study, document analysis, qualitative research design, was utilized. The document analysis method is preferred because this method is a form of qualitative research, which is also a systemic procedure for reviewing and evaluating printed or electronic documents (Bowen, 2009; Gross, 2018).

Sampling and data collection

In the study, the database of doctoral theses on Geography education in Portugal was searched using the keywords of Geography Teacher Education; Education for Sustainable Development and Environmental Education in Geography; Citizenship Education in Geography; Technologies in Geography Teaching; Pedagogy and Curriculum in Geography, and Theory of Geography and Geography Education (Costa et al, 2013).

Despite the low number of the theses on Geography education in their list, we knew that there were more theses made in the field of Educational Sciences that were not in that database and other dated after 2013. So, using the RCAAP (Open Access of Portuguese Scientific Repositories) - https://www.rcaap.pt/ we searched all doctoral theses related to Geography education using appropriate keywords, such as Geography Teacher Education; Education for Sustainable Development and Environmental Education in Geography; Citizenship Education in Geography; Technologies in Geography Teaching; Pedagogy and Curriculum in Geography, and Theory of Geography and Geography Education. In total, twenty-three (23) theses on Geography Education dated from 2002 to 2022 were accessed.

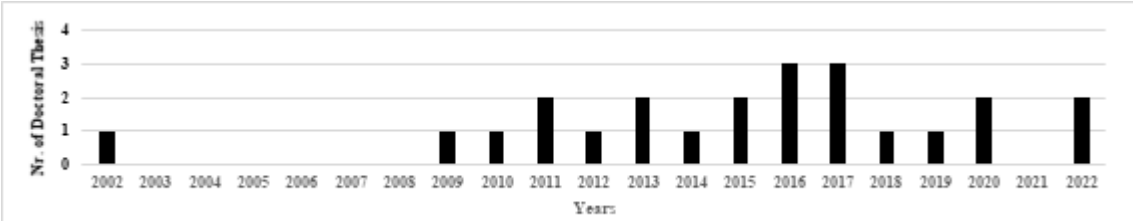
Analysis of the data

In the content analysis process, the theses were analyzed in regard to their content, time, universities and the theme. Consequently, six categories were identified following the content analysis method (Krippendorff, 2004). These categories were as follows:

1. Geography Teacher Education;
2. Education for Sustainable Development and Environmental Education in Geography;
3. Citizenship Education in Geography;
4. Technologies in Geography Teaching;
5. Pedagogy and Curriculum in Geography;
6. Theory of Geography and Geography Education.

Findings

Analyzing graph 1 it is possible to identify that the first doctoral thesis in Geography Education defended in a Portuguese university is from 2002 (Nunes, 2002). Then, we had six years with no doctoral theses in Geography Education in Portuguese universities. However, since 2009, almost all the years have had defences of doctoral theses in Geography Education in Portuguese universities (except for 2021). This situation clearly shows the growth of the importance of this research field in Portugal and its consolidation. The years with the highest number of doctoral theses are 2016 and 2017, with three theses each, followed by 2011, 2013, 2015, 2020, and 2022, with two theses each.



Graph 1: The number of 5Doctoral Theses in Geography Education defended in Portuguese universities by year.

Data: RCAAP (Open Access of Portuguese Scientific Repositories) - https://www.rcaap.pt/

These theses were conducted 35% by men and 65% by women. About their scientific field, 52% are doctoral theses in Geography, and 48% are doctoral theses in the field of Educational Sciences.

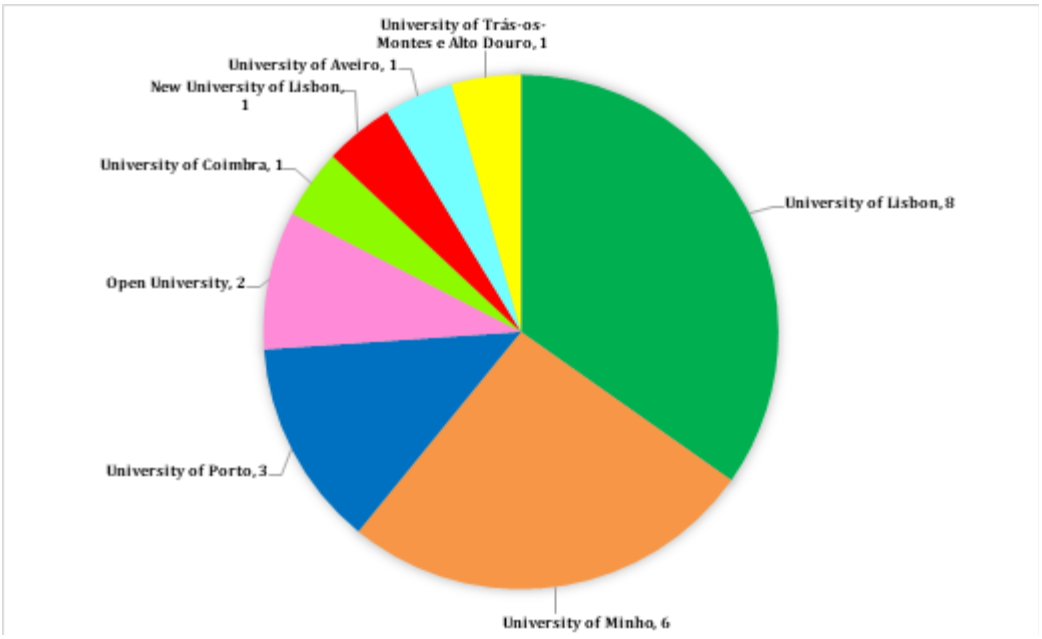
The twelve theses in the Geography field include one in "Geography and Territorial Planning". The specialties of these theses are Geography Teaching (7 theses); Human Geography (1 thesis); Landscape Studies (1 thesis); Physical Geography (1 thesis); Planning and Organization of the Territory (1 thesis), and without specialty (1 thesis).

The eleven theses in Sciences of Education include one in "Multimedia in Education". The specialties of these theses are no specialty (4 theses); "Personal, Social and Community Training (2 theses); Environmental Education and for Sustainability (2 theses); Curricular Development (1 thesis); Pedagogical Supervision (1 thesis) and Educative Technology (1 thesis).

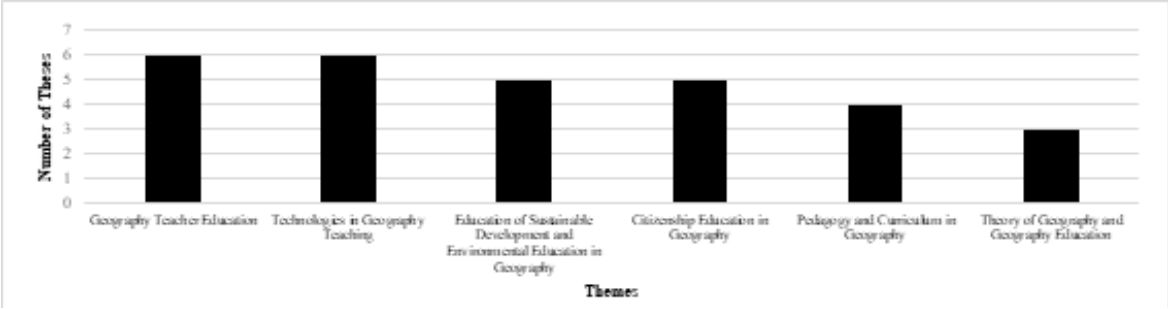
When we look at the institutions of these theses, all of them were defended in universities and not in polytechnic institutes of higher education (graph 2).

Graph 2 shows the distribution of theses by universities, and according to it, we can understand that the University with a higher number of doctoral theses in Geography Education is the University of Lisbon that has eight theses defended at the Institute of Geography and Spatial Planning and at the Faculty of Arts. At the University of Minho, the researchers defended six theses at the Institute of Education and at the Social Sciences Institute. At the University of Porto, the researchers defended three theses at the Faculty of Sciences of Education and Psychology and at the Faculty of Arts. At Open University, the researchers defended two theses, and the Universities of Coimbra, New University of Lisbon, University of Aveiro, and University of Trás-os-Montes e Alto Douro each had a single doctoral thesis in Geography Education.

These twenty-three theses had a total number of twenty-nine supervisors. Some theses had more than one supervisor and some supervisors supervised more than one thesis. The supervisors with more than one doctoral thesis in Geography Education are Sérgio Claudino (University of Lisbon) with four theses in Geography Education supervised; Manuela Malheiro Ferreira (Open University) with three theses supervised; Carlinda Leite (University of Porto) and Herculano Cachinho (University of Lisbon) with two theses supervised each.



Graph 2: Portuguese Universities where the Doctoral Theses in Geography Education were defended.
Data: RCAAP (Open Access of Portuguese Scientific Repositories) - https://www.rcaap.pt/



Graph 3: – Doctoral Theses in Geography Education in Portugal, by themes.
Own Source.

These are specific themes that these theses developed in Geography Education. Some of these theses have more than one theme. The themes with the higher number of theses in Geography Education in Portugal are the theme "Geography Teacher Education", with six theses working on it (Alexandre, 2013; Oliveira, 2014; Lussinga, 2016; Miranda, 2017; Braga, 2018; Nascimento, 2019) and "Technologies in Geography Teaching" (Soares, 2013; Carlos, 2015; Preto, 2015; Maciel, 2016; Gonçalves, 2017; Azevedo, 2022). The theme "Geography Teacher Education" has four theses in the field of Sciences of Education and two theses in the area of Geography, and the theme "Technologies in Geography Teaching" has four theses in the field of Sciences of Education and two theses in the field of Geography.

With five theses each, we have two different themes: "Education of Sustainable Development and Environmental Education in Geography" (Gomes, 2012; Preto, 2015; Moro, 2016; Bernardes, 2017; Costa, 2020) and "Citizenship Education in Geography" (Miranda, 2009; Esteves, 2010; Costa, 2011; Alexandre, 2013; Braga, 2018). The themes "Education of Sustainable Development and Environmental Education in Geography" and "Citizenship Education in Geography" have three theses in the area of Geography and two theses in the field of Sciences of Education each.

The theme "Pedagogy and Curriculum in Geography" has four doctoral theses (Nunes, 2002; Martins, 2011; Costa, 2011; Coscurão, 2022). Three of these theses are in Geography, and one is in the Sciences of Education.

Finally, the theme "Theory of Geography and Geography Education" has three theses (Nunes, 2002; Carlos, 2015; Ferreira, 2020). Two of these theses are in the field of Geography, and one is in the Sciences of Education.

We underline that the University of Lisbon does not have a main research theme. It has different themes with two theses, and there is no theme more strongly worked on compared with others. A completely different situation is present at the University of Minho, where the majority of the theses are related to the theme "Education of Sustainable Development and Environmental Education in Geography". At the University of Porto, the main theme is "Pedagogy and Curriculum in Geography". At the Open University is "Citizenship Education in Geography" and at the New University of Lisbon is "Theory of Geography and Geography Education". All the other universities have as their most relevant research theme "Technologies in Geography Teaching".

Here, it is important to note that the University of Lisbon is not only the university with the highest number of theses on Geography Education in Portugal but also the university with the most diverse themes worked on in these theses. Because of this, we can say that the University of Lisbon is the main "school" in Geography Education research in Portugal. Moreover, we must underline that only the University of Lisbon – Institute of Geography and Spatial Planning can give a doctoral diploma with a specialty in "Geography Teaching" (in the academic field of Geography) in Portugal. The second university with the higher number of Ph.D. theses in Geography Education is the University of Minho and the majority of these theses were made in the area of the Science of Education and one in the area of Geography. Mainly

they are connected with the area of Education for Sustainable Development and Environment. The other universities do not have a number of theses enough to be considered as "reference" in the area in Portugal.

Conclusions and Discussion

With our analysis of the doctoral theses on Geography Education in Portugal, we concluded that the development of this research area in our country mainly occurred after 2002 (the date of the first doctoral thesis on Geography Education made in a Portuguese university). Before that, only one doctoral thesis was done on this issue at the University of London (Ferreira, 1992), and just some master theses and some sporadic researches were done until 2002 by Portuguese researchers on Geography Education.

So, 2002 is the turning point of this situation, and when more structured research in Geography Education in Portugal started. The last twenty years correspond to a period of development of this research area in Portugal.

The themes most approached in the analyzed theses are Geography Teacher Education and the Technologies in Geography Teaching. The main research university on this matter is the University of Lisbon.

It is also very important that Portugal has a national database of theses and other academic works - the RCAAP (Open Access of Portuguese Scientific Repositories) - that helped us very much to do our analysis and is a good example for other countries to follow.

With this research, we want to stimulate the Commission on Geographical Education of UGI to continue to construct a database of master's and doctoral theses on Geography Education around the world. We truly believe this database can help researchers in several countries, new doctoral candidates and the development and recognition of Geography Education.

The analysis of these theses shows that there are still some topics not worked on in doctoral theses in Geography Education in Portugal, such as Hazards Education, Misconceptions in Geography Education, Powerful Knowledge in Geography Education, and others.

Most of the analysed theses refer to the Portuguese reality, but it is relevant to underline that there is one thesis about Geography Education in Angola and five theses about Geography Education in Brazil (sometimes comparing with Portuguese reality). This fact shows the importance of Portuguese universities and their research in other countries that use the Portuguese language.

Stoltman, in 2012, analysed the scientific presentations at the 2012 IGU-CGE and concluded that the "interests of geography educators continue to prevail in the categories such as pedagogy and teacher preparation. Interest in geospatial technologies is increasing, as are the topics of spatial thinking and sustainable development" (Stoltman, 2012:17). This observation of Stoltman fits with Portuguese reality of the development of Geography Education research.

According to Donert (2007:29-30), who analyzed the teaching and the research in Geography departments in 2007, the topic "Geography Didactics" is present in the teaching activities of 65% of these departments and is in 35% of the research activities. The theme "Teacher Training" is present in the teaching activities of 74% of these departments, and it is in 42% of the research activities. The Portuguese reality confirms this. Despite several universities and polytechnic institutes teach Geography Didactics and make Geography teacher training (in primary and secondary education), few of them develop research on it, as we can conclude from our doctoral theses analysis.

Considering that the first thesis about Geography Education made in Portugal was done 2002 (Nunes, 2002), since this date, more than twenty theses have been developed in Portuguese universities connected with Geography Education. This is a very important proof that this research area is increasing in Portugal despite the hard academic definition (it is hard to be accepted as part of "Geography" and as part of "Sciences of Education").

But we would like to underline the very important contribution of Maria Manuela Malheiro Ferreira, who in 1992 made her Ph.D. thesis at the Institute of Education of the University of London (under the supervision of Professor Norman Graves) about Geography Teaching in Portugal. This made her the pioneer of the research area in Portugal.

Of course, during these decades several master's theses were done in Portugal about Geography Education. However, doctoral theses are the key point to the development of a research area in a university and in a country. Doctoral theses in Geography Education in Portugal are divided between Geography and Sciences of Education. This division is explained by scientific and institutional divisions in the universities, the active work developed by the specific professors for this development, and the strategic programs of the universities.

After this research, we identified some challenges to be developed in the next years in this research field in Portugal, such as diversifying the themes of the doctoral theses; developing the discussion in Portugal if Geography Education should be in Geography or Sciences of Education, and the growth of the number of publications in indexed journals about this research field.

When we approach GER (Geographical Education Research), it is relevant to underline that Lambert says that GER "*is a field of highly specialized scholarly inquiry and as such can never be expected to grow and mature into anything other than an important niche interest"* (Lambert, 2015:25). On this matter, in last years, several authors made reflections about the relevance of research in geographical education (for example, Assis and Júnior, 2018; Heidari, *et. al.*, 2022; Lambert, 2010; Piotrowska, *et. al.*, 2019; Stoltman, 2012).

Looking to the near future, Martinha (2021b:227) identified five main research topics to develop in the next decade in Geographical Education. The topics identified are:

- Geographical Education as an element of Political Education and Education for Sustainable Peace;
- Disciplinary Powerful Knowledge in Geography;
- Technologies of Geographic Information and Spatial Thinking;
- Hazards Education and Education for Sustainable Development;
- Education for Global Understanding and teaching of the Global Citizen.

These topics are to develop internationally, and we consider that the topics more relevant to be worked on in Portugal shortly are: "Disciplinary Powerful Knowledge in Geography" and "Hazards Education and Education for Sustainable Development" because they are the topics least worked on the doctoral theses that we analyzed.

After this evolution in the PhD theses in Geography Education, we can now say that the main challenge for the near-future doctoral candidates is to present a thesis about IA in Geography Education because it is a key topic in the present and near future in Geography Education in our country and also around the world (Álvarez-Otero and Gómez-Trigueros, 2026; Rakuasa, 2023; Şanli (2025). Artificial Intelligence brings new challenges to Geography Education that must be explored and research on Geographical Education must respond to this challenge. Because of this, we defend that in the near future, doctoral theses must be done about this issue in Geography Education.

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