Co-funded by the European Union

Teaching Spanish Population Distribution with LEGO bricks®

Pablo A. Haya Coll

Universidad Autónoma de Madrid

pablo.haya@uam.es

Abstract

An educational activity is presented, designed for primary school students, which focuses on understanding the population distribution across the provinces of Spain through the use of LEGO® pieces. In a classroom setting without electronic devices, students are provided with a political map of Spain, LEGO® pieces, and data on the population of each province. After performing calculations to allocate pieces to each province, the students build a visual map of the population, thereby facilitating the interpretation and analysis of population density. The activity culminates in a guided discussion and a reflection on the impact of population distribution on aspects such as the economy and politics.

The main objective of the activity is to enhance geographical understanding and develop skills in data interpretation and critical thinking. Through interdisciplinary learning that combines geography, mathematics, and social sciences, students learn to translate numerical data into visual representations and collaborate in the analysis of population densities. This approach not only strengthens knowledge of population distribution and its implications, but also promotes problem-solving and communication skills, preparing students to apply this knowledge in real-world contexts.

Introduction

This activity aims to teach Spanish geography to primary school students by combining data visualization techniques with hands-on and collaborative activities. Geography

often requires the interpretation of statistical data and spatial patterns (DeMers, 2008; Goodchild & Janelle, 2004; Haining, 2003). By combining these elements with manipulative learning (Mathews, DeChano-Cook, & Bloom, 2023; Lambert & Morgan, 2010) and collaborative learning (Fournier, 2002), students not only learn to interpret data but also to apply mathematical concepts practically (Boaler, 2022).

Manipulative activities allow students to experience and explore geographical concepts in a more concrete and meaningful way (Carbonneau, Marley & Selig, 2013). Manipulative learning fosters a deeper understanding, as students can see and touch the data, which facilitates the internalisation of abstract concepts (Sarama & Clements, 2009).

Collaboration is equally fundamental. Working in groups allows students to exchange ideas, solve problems together, and develop social skills. Through interaction with their peers, they can build a more comprehensive and diverse knowledge, as well as learn to communicate and justify their ideas effectively (Kus, Filiz, & Altun, 2014).

The proposed educational activity not only enriches the learning of geography but also promotes essential skills such as critical thinking, problem-solving, and teamwork. By integrating data visualization and mathematics, it provides students with an initial introduction to understanding and tackling more complex challenges, grounded in a solid foundation of geographical knowledge and analytical skills (Baker & Witham Bednarz, 2003).

Activity Design

This educational activity is intended for fourth-year primary school students. It takes place in a face-to-face classroom setting without the need for electronic devices. A tangible and manipulative methodology is used to teach students about the population distribution across the provinces of Spain through the use of LEGO® pieces, thereby combining the learning of geography, mathematics, and data analysis (see Figure 1).

Figure 1. Three-dimensional visualisation of the population distribution in Spain using LEGO® pieces as the outcome of the activity.

The activity begins with an introduction to the geography of Spain, its division into provinces, and the objective of the activity: to visualise the distribution of the Spanish population in a comprehensible and enjoyable way.

Each group of students is provided with a political map of Spain with clearly marked provincial boundaries, LEGO® pieces, and a data sheet containing the population of each province.

The students perform calculations to determine the number of LEGO® pieces that represent the population of each province. For example, if a province has 500,000 inhabitants and each piece represents 100,000 people, the province would receive 5 pieces. With these calculations, students stack LEGO® pieces on each province, providing a clear visual representation of population density.

After constructing the map, a guided discussion takes place about the observed results. Questions are posed to encourage critical thinking and analysis, such as which provinces have the most pieces and what this means in terms of population, where the population is most concentrated, and if there is anything that surprises the students. The differences in population density between coastal and inland regions are explored.

Finally, the activity concludes with a reflection in which students can write or discuss what they have learned. The reflection focuses on how the distribution of the population can impact various aspects of life in Spain, such as the economy, politics, and society. This activity not only reinforces geographical knowledge but also promotes understanding of how demographic data affects the reality of the country.

Activity Implementation

The activity was carried out during a school day at CEIP Pedro Duque in the Community of Madrid. It was repeated across three different fourth-grade classes, dedicating one hour to each class. In each class, groups of four to five students were formed, selected by the teacher. A total of 72 students participated. Figure 2 shows several examples of the activity in different workgroups.

Figure 2. Photos of the activity being carried out in various groups

Results

The main objective of the proposed activity is to enhance students' geographical understanding, develop data interpretation skills, and foster critical thinking and collaboration. It focuses on interdisciplinary learning by integrating geography,

mathematics, social sciences, and STEM (Science, Technology, Engineering, and Mathematics) to provide a comprehensive educational experience. By undertaking this activity, students will learn the names, locations, and relative sizes of the provinces of Spain, which will help them better understand the population distribution of the country. This will be achieved through the identification of Spanish provinces, understanding political boundaries, and recognising patterns of population distribution, both urban and rural.

Through the activity, students will develop data interpretation skills, learning to interpret population statistics and translate numerical data into visual representations. This is achieved by data analysis techniques and the application of mathematical concepts such as proportions and ratios to represent the population in a tangible way using LEGO® pieces. Additionally, critical thinking is promoted by analysing and comparing population densities, encouraging discussions on the social, economic, and political implications of population distribution.

Collaborative learning is highlighted by promoting teamwork as students construct population maps and develop communication skills through group discussions and presentations. The kinesthetic experience is also integrated, providing a tactile learning approach that engages students who learn best through hands-on activities.

In terms of social sciences, the implications of population distribution are analysed in relation to the allocation of resources and infrastructure, highlighting regional economic disparities. The activity also explores demographic changes over time and how these impact society, fostering a deeper understanding of national and regional differences.

In summary, the activity not only teaches specific content related to geography and population studies, but also fosters essential skills such as data literacy, collaborative problem-solving, and critical thinking. This interdisciplinary approach ensures that students gain a comprehensive understanding of population distribution and its broader implications, preparing them to apply this knowledge in real-world contexts.

Conclusions

The educational activity facilitates the understanding of Spain's population distribution through a manipulative methodology that combines geography, mathematics, and data analysis. By using LEGO® pieces to represent the population of each province, students not only learn about the locations and relative sizes of the provinces but also develop skills in data interpretation by translating numerical statistics into visual representations. This tangible approach helps make abstract concepts more accessible and understandable for children.

In addition to strengthening geographical and mathematical knowledge, the activity fosters critical thinking and collaboration. Through the guided discussion and comparative analysis of population densities, students reflect on the social, economic, and political implications of population distribution. This allows them to consider how population concentration affects various aspects of life in Spain, such as infrastructure and regional economy.

Finally, the activity promotes interdisciplinary and collaborative learning by integrating social sciences and STEM into a single project. By working in teams and participating in group discussions, students develop communication and problem-solving skills. The hands-on experience with LEGO® also supports those who learn best through kinesthetic methods, ensuring a deeper and more lasting understanding of the concepts studied.

Funding

The materials for the implementation of this activity have been funded by the Erasmus+ CoTEDI project, which is financed by the European Union under the key action 2023-1-NL01-KA220-SCH-000152037 – OID E10207981.

Acknowledgements

We would like to thank the management team and the fourth-grade teachers at CEIP Pedro Duque for their involvement and support in carrying out this activity.

References

Baker, T. R., & Witham Bednarz, S. (2003). Lessons learned from reviewing research in GIS education. Journal of geography, 102(6), pp. 231-233. DOI: 10.1080/00221340308978554

Boaler, J. (2022). Mathematical mindsets: Unleashing students' potential through creative mathematics, inspiring messages and innovative teaching. John Wiley & Sons.

Butt, G. (2019). Geography education research in the UK: Retrospect and Prospect: The UK case, within the global context. Springer Nature.

Carbonneau, K. J., Marley, S. C., & Selig, J. P. (2013). A meta-analysis of the efficacy of teaching mathematics with concrete manipulatives. Journal of educational psychology, 105(2), 380 - 400. DOI: 10.1037/a0031084.

DeMers, M. N. (2008). Fundamentals of geographic information systems. John Wiley & Sons.

Fournier, E. J. (2002). World regional geography and problem-based learning: using collaborative learning groups in an introductory-level world geography course. The Journal of General Education, 51(4), pp. 293-305. Disponible en: https://www.jstor.org/stable/27797930.

Goodchild, M. F., & Janelle, D. G. (Eds.). (2004). Spatially integrated social science. Oxford University Press.

Haining, R. P. (2003 Spatial data analysis: theory and practice. Cambridge university press.

Kus, M., Filiz, E., & Altun, S. (2014). Teacher and student thoughts on effectiveness of cooperative learning in geography teaching. Educational Research and Reviews, 9(11), 312. DOI: 10.5897/ERR2013.1651.

Lambert, D., & Morgan, J. (2010). Teaching geography 11-18: A conceptual approach. McGraw-Hill Education (UK).

Mathews, A. J., DeChano-Cook, L. M., & Bloom, C. (2023). Enhancing middle school learning about geography and topographic maps using hands-on play and geospatial

technologies. Journal of geography, 122(5), pp. 115-125. DOI: 10.1080/00221341.2023.2226156.

Sarama, J., & Clements, D. H. (2009). “Concrete” computer manipulatives in mathematics education. Child Development Perspectives, 3(3), pp. 145-150. DOI: 10.1111/j.1750-8606.2009.00095.x.

CoTEDI – Activity Sheet

Activity title	**Teaching Spanish Population Distribution with LEGO bricks**
Author	Pablo Haya Coll
Name of Educational Center	CEIP Pedro Duque
Status of the activity	Done
Start date	14 June 2024
End date	14 June 2024
Target groups	
Age range of students	9-10
Grade level	Primary
Number of students involved	72 children
Educational context	Classroom
Diversity	Both gender
Required resources	
WiFi connection is required	No
Devices	No devices are required
Tangible materials	- Legobricks - Political map of Spain with clearly marked provincial boundaries (one per each group) - Datasheet with the population of each Spanish province
Activity description	
Activity Description	Students will learn about the population distribution across Spain's provinces by visualizing data with LEGO bricks on a political map. This hands-on activity combines geography, mathematics, and data analysis. Specifically, the activity aims to: 1. **Enhance Geographic Literacy:**

- Help students learn the names, locations, and relative sizes of Spain's provinces.
- Develop an understanding of how population is distributed across a country.

2. **Develop Data Interpretation Skills:**
   - Enable students to interpret population data and understand its significance.
   - Teach students how to translate numerical data into visual representations.
3. **Promote Critical Thinking:**
   - Encourage students to analyse and compare population densities.
   - Foster discussions about the social, economic, and political implications of population distribution.
4. **Integrate STEM Concepts:**
   - Apply mathematical skills in calculating proportions and population densities.
   - Utilize basic data analysis techniques to draw conclusions from the visualized data.
5. **Foster Collaborative Learning:**
   - Promote teamwork as students work together to build the population map.
   - Develop communication skills through group discussions and presentations.
6. **Engage Kinesthetic Learners:**
   - Provide a tactile learning experience that engages students who learn best through hands-on activities.

	By achieving these goals, the activity not only teaches specific content related to geography and population studies but also cultivates broader skills such as critical thinking, data literacy, and collaborative problem-solving.
Total time needed	3 hours (1 hour per session)
Subject(s)	This interdisciplinary approach ensures that students gain a comprehensive understanding of population distribution and its broader implications. ○ **Geography:** Understanding the political and physical layout of Spain, learning the names and locations of provinces, and exploring regional population distributions. ○ **Mathematics:** Applying mathematical concepts to calculate proportions, understand ratios, and perform basic data analysis. ○ **Social Studies:** Discussing the social, economic, and political implications of population distribution and how it affects resource allocation and infrastructure. ○ **STEM (Science, Technology, Engineering, Mathematics):** Integrating data interpretation and visualization skills and encouraging critical thinking and problem-solving. ○ **Civic Education:** Exploring demographic trends and their impact on society, fostering an understanding of national and regional differences.
Specific topic addressed	**Geography:** ○ Identification and location of Spanish provinces. ○ Understanding political boundaries within Spain. ○ Population distribution patterns. ○ Urban vs. rural population densities. **Mathematics:**

	○ Calculating population proportions for each province. ○ Using ratios to represent population data with LEGO bricks. ○ Visualizing population data using physical models. ○ Interpreting numerical data through hands-on activities. **Social Studies:** ○ Analysing population data and trends. ○ Understanding demographic changes over time. ○ Discussing how population distribution affects resources and infrastructure. ○ Examining regional economic disparities related to population density. **Data analysis and visualization:** ○ Interpreting and analysing population statistics. ○ Applying mathematical concepts to real-world data. ○ Using LEGO bricks to create a visual representation of demographic data. ○ Developing skills in translating abstract data into concrete models.
Plugged / Unplugged	Unplugged
Type of Activity	Tangible material
Collaborative Activity	This activity is designed to be a collaborative learning experience, involving group work to enhance engagement, communication, and teamwork skills.
Level of creativity	Low
Level of technology	Low
Computational skills worked	Data analysis, Pattern recognition
Activity protocol and guidelines	
Activity Protocol and Guidelines	1. **Introduction:**

- Provide a brief overview of Spain's geography and its division into provinces.
- Explain the objective of the activity and how it helps visualize population distribution.

2. **Distribute Materials:**
   - Give each group or student the LEGO bricks, the map of Spain, and the population data.
3. **Calculation:**
   - Students calculate the number of LEGO bricks each province should receive using the datasheet. For instance, if a province has a population of 500,000 and each brick represents 100,000 people, the province will get 5 bricks.
4. **Building the Map:**
   - Students place the corresponding number of LEGO bricks on each province, stacking the bricks to represent population density visually.
   - Ensure each province is correctly labelled on the map.
5. **Discussion:**
   - Once the map is complete, discuss the results. Ask questions such as:
     - Which provinces have the most bricks? What does this indicate about their population?
     - Where is the population higher, along the coast or inland?
     - Are there any surprising results?
     - How does population density vary across Spain?
6. **Reflection:**
   - Have students reflect on what they learned from the activity. They can write a short paragraph or discuss in pairs about how

	population distribution can impact social, economic, and political aspects of life in Spain.
Teacher Training	No previous experience was required
eTwinning Platform Implementation	No
Inclusion	
Adaptation for Special Needs	No
Inclusive Adaptation	No
Additional details	

By considering these following additional details, the activity can be enriched to provide a learning experience extending the scope of learning beyond basic concepts.

Extension Ideas:

- **Historical Comparison**: Compare current population data with historical data to observe population trends and changes over time.
- **Regional Analysis**: Explore specific regions within Spain and compare their population densities and demographic characteristics.
- **Global Perspective**: Extend the activity by comparing population distributions in Spain with other countries or regions around the world.

Integration with Other Subjects:

- Collaborate with mathematics teachers to reinforce mathematical skills related to proportions and ratios.
- Connect with social studies or history teachers to discuss the historical and cultural implications of population distribution.