

# DIDACTICS FOR STATISTICAL DEVELOPMENT IN PRIMARY EDUCATION

Luis Maya-Jaramillo<sup>1</sup>, & Ana Caballero-Carrasco<sup>2</sup>

<sup>1</sup>PhD Student, Universidad de Extremadura (Spain)

<sup>2</sup>Departamento de Didáctica de las Ciencias Experimentales y Matemáticas,  
Universidad de Extremadura (Spain)

## Abstract

Didactics is a concept which leaves space for the learner's thinking not to be interrupted, and that unnoticed takes a good direction (Tierno Galván, 1986). With this in mind, this panel presents two instances in which didactics have contributed to the statistical development of fifth and sixth year primary school pupils. On the one hand, the methodological and didactic orientations of an implemented statistical proposal are detailed; in this block, didactic principles to be taken into account for statistical improvement in primary education are indicated. On the other hand, data on the results obtained after the didactic proposal are presented; data on the graphic reading developed and the mathematical language used in the communications will be presented. This panel provides significant data derived from a more complete investigation in which 312 primary school pupils participated, and where a quasi-experimental study with a control group was carried out.

**Keywords:** *Didactic statistics, statistical literacy, primary education, mathematical teaching.*

---

## 1. Introduction

Statistics in today's society are of great importance. On a daily basis, their presence in the media and other spaces leads citizens to implement comprehension strategies in order to extract the information proposed. The graphs that appear in newspapers or television programmes serve as verbal and numerical photographs of reality, a reality that needs to be interpreted (Kosslyn, 1985). The educational proposals around the world of statistics try to lead to an improvement in statistical literacy, with comprehension and graphic reading being key to this literacy. The present study is part of a wider area of research, where different variables related to statistical communication are analysed. In this paper we present the main didactic lines developed in the didactic proposal "Little Brokers" for statistical improvement in primary education and the results obtained in graph reading and mathematical language.

We understand graphic reading to be the ability of readers to interpret the meaning of graphics created by others or by themselves (Fiel, Curcio and Bright, 2001; Curcio, 1989). We consider four levels of graphic reading, the passage from one level to another being a complex process. The first level is data reading, which translates into a literal reading of the data on the graph. Next, level two is reading between data, where connections are established between the data. Reading behind the data is the third level, where the reading is advanced. Reading beyond the data goes beyond critical appraisal, and the processing and conclusions drawn lead us to point to an important reading and understanding of the statistical information.

Analysing the graphic reading level of primary school students and developing training plans thereon is important since, as indicated by different studies (Guimaraes, 2002; Pagan, Leite, Magina and Cazorla, 2008; Evangelista, 2013 or Cruz, 2013), there are aspects that can be enhanced. These studies indicate that, generally, at this educational stage students are in the first levels of reading when they work with graphics. This research coincides with other studies related to the didactic and methodological proposals that are carried out in the classroom (Díaz Levicoy et col, 2015; 2016; 2016; 2018; 2020). Furthermore, the studies agree that there are other conditioning factors in the development and outcome of graphic reading, such as teacher training and approach (Alsina, 2020; 2021) or the type of graphic chosen.

Regarding mathematical language, it should be highlighted that communications based in graphical data require elements specific to statistics. A correct development of the particular mathematical language will help with the accuracy of the communication. The concepts worked on in class take on meaning when they are used in a communication to explain and argue the interpretation of the graph presented. In the present study, this variable is assessed through the statistical-mathematical language and terminology used by the students. This language coincides with that proposed in the Fifth and Sixth Grade primary school curriculum: terms such as mean, mode, variables, or trend, among others. The assessment of these terms is based on a quantitative approach.

## 2. Design, objectives, and methods

This research was carried out using a quasi-experimental pretest/posttest design with a non-equivalent control group with a sample of 312 primary school pupils. In the experimental group, the didactic proposal "Little Brokers" was developed.

The elements of this didactic proposal are varied, highlighting the change in the educational purpose of the statistics block. The first aspect is the methodological one, based on PBL (Project Based Learning) through ten sequenced sessions organised with the aim of improving statistical communication. Throughout these sessions, we worked on statistics using oral and written expressive resources, which represents an important variation to the traditional methodological proposals of constructing graphs and statistical-descriptive calculations.

Conversely, the theme of the proposal was financial. The economic and financial topic appears subtly in the curriculum in the subject of social studies. The graphs that are traditionally worked on in primary school are decontextualised, despite the fact that dealing with graphs with real data brings importance and significance to didactics (Rodríguez-Muñiz, Alsina, 2020) and despite the curricular indications in this sense.

The most important component of the "Little Brokers" approach is the inclusion of uncertainty and variability in the classroom. Generally, mathematical didactics is associated with concrete, closed and exact answers. In my opinion, valuing the subjective component has been key to the performance of the proposal. The presentation of a graph can go hand in hand with the analysis and communication of the maximum or minimum values presented. The communication of ideas is very open and connections can be made between values, sharing and communicating a part of the graph, even predicting the trend of the scores reflected in the graph. The materials worked on led to this type of interpretation. Specifying the curriculum proposal in communicative educational actions, Alsina (2000) indicates that the manuals offer a potential curriculum proposal, halfway between the official regulations and the dispositions, ideas and beliefs that teachers develop through the hidden curriculum.

Before starting the didactic proposal presented, the data obtained in the study sample indicated that it was necessary to intervene. Of the total population, only six students used a mathematical term in their communications. In addition, the level of Graphic Reading was 1.27, a level close to the first level of classification, which was identified as Data Reading.

## 3. Discussion and conclusions

The results show that the "Little Brokers" proposal produces a statistically significant improvement in Reading Graphs and in the development of accurate communications derived from a significant advancement in the use of Mathematical Language.

There are no research results related to writing in maths. Financial education has not been worked on in this line.

### References

- Alsina, A.; Vázquez, C.; Muñoz-Rodríguez, L. & Rodríguez-Muñiz, L.J. (2020). ¿Cómo promover la alfabetización estadística y probabilística en contexto? Estrategias y recursos a partir de la COVID-19 para Educación Primaria. *Épsilon, Revista de Educación Matemática*, 104, 99-128.
- Alsina, C. (2000). Mañana será otro día: un reto matemático llamado futuro. En Goño, J. (Ed) *El currículum matemático en los inicios del siglo XXI. Grao, Biblioteca de Uno*, 152, 13-21.
- Cruz, A. (2013). Erros e dificuldades de alunos de 1º ciclo na representacao de daos estadísticos. Trabalho de Máster, Lisboa.

- Curcio, F. R. (1989). Developing graph comprehension. *Journal for Research in Mathematics Education*, 18(5).
- Díaz Levicoy, D.; Osorio, M.; Arteaga, P. & Rodríguez-Alveal, F. (2018). Gráficos estadísticos en libros de texto de matemática de educación primaria en Perú. *Bolema*, 32 (61) <https://doi.org/10.1590/1980-4415v32n61a10>
- Díaz-Levicoy, D., Batanero, C., Arteaga, P., Gea, M. (2016). Gráficos estadísticos en libros de texto de educación primaria: un estudio comparativo entre España y Chile. *Bolema*, 30 (55), 713-737. <https://doi.org/10.1590/1980-4415v30n55a20>
- Díaz-Levicoy, D., Batanero, C., Arteaga, P. y Gea, M. (2015). Análisis de gráficos estadísticos en libros de texto de educación primaria española. *Unión* 44.
- Evangelista, B. (2014). Aprendendo a representar escalas em gráficos: um estudo de intervencao. Tesis Doctoral, Universidad Federal Pernambuco.
- Friel, S. N., Curcio, F. R. & Bright, G. W. (2001). Making sense of graphs: critical factors influencing comprehension and instructional implications. En *Journal for Research in Mathematics Education*, 32(2), 124-158.
- Guimarães, G. (2002). Interpretando e construindo gráficos de barras. Tesis doctoral. Pernambuco, Universidade Federal de Pernambuco.
- Kosslyn, S (1985). Graphics and human information processing: A review of five books. *Journal of the American Statistical Association*, vol. 80, núm. 391, pp. 499-512. En Inzusa, S. (2015). Niveles de interpretación que muestran estudiantes sobre gráficas para comunicar información de contextos económicos y sociodemográficos. *Revista mexicana de investigación educativa*, vol.20, nº 65, p 529-555. ISSN: 1405-6666.
- Pagan, A.; Leite, P.; Magina, S.; Cazorla, I. (2008). A leitura e interpretacao de gráficos e tabelas no Ensino Fundamental e Medio. *II SIPEMAT*.