

A VIEW ON THE TEACHING OF PROBABILITY AND STATISTICS IN ELEMENTARY SCHOOL IN THE CITY OF JOINVILLE, SOUTHERN BRAZIL

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This paper aims to analyze how probability and statistics contents are taught in elementary schools in Joinville, southern Brazil. We sought to identify the teachers' practices, resources, and supporting guidelines. We also aimed to understand the teachers' perception of their roles and the skills expected from the students. A questionnaire was applied, and exploratory data analysis and content analysis were used as methods. The results show that teachers often work with descriptive statistics contents, prioritizing activities involving playful aspects, and apply written assignments for evaluation. Teachers agree on the importance of probability and statistics in the education of children as citizens, consider themselves mediators in this process, and believe that working with daily problems and stimulating reflection and curiosity is essential.

INTRODUCTION

The knowledge of statistics is increasingly more present and necessary to understand our daily lives and broaden our worldview as citizens in a critical and affirmative manner. For Samá and da Silva (2020), the inclusion of probability and statistics in basic education has become essential because of the social demand to understand all the pieces of information around us.

In Brazil, statistics has been part of the basic education school curriculum for a while. In 1997, guided by the National Curricular Parameters (PCN, from Brazilian Portuguese Parâmetros Curriculares Nacionais), the goal was to develop the students' inquiring spirit through the collection, organization, reading, and interpretation of information (Poffo et al., 2020). In 2014, the National Pact for Proper Age Literacy (PNAIC, from Brazilian Portuguese Pacto Nacional pela Alfabetização na Idade Certa) dedicated part of the early-education teacher training program to statistical education, to provide the teacher with elements for the planning of teaching practices (Ministério da Educação, 2014; Samá & da Silva, 2020). The recent National Common Core Curriculum (BNCC, from Brazilian Portuguese Base Nacional Comum Curricular) (Ministério da Educação, 2018) includes probability and statistics as one of the five subject units of the mathematics curriculum (Poffo et al., 2020), proposing an approach of concepts, facts, and proceedings found in many problem-situations of the everyday life and of sciences and technology (Ministério da Educação, 2018).

According to the BNCC, during the early years of education, children are expected to develop skills involving reading, interpretation, and construction of tables and graphs. Regarding probability, the goal is to promote the understanding that not all phenomena are deterministic, and that randomness is a part of our daily lives (Samá & da Silva, 2020). The BNCC recommends conducting research involving variables, initially categorical and later numerical, with subsequent representation, analysis, and communication. These concepts and activities are expanded over the years, permeating the entire student trajectory going all the way up to high school (Giordano et al., 2019).

Despite its importance and presence in the school curriculum, teaching probability and statistics can be a challenge for early-years teachers (Samá & da Silva, 2020). Still, some research reveals that, in the early years, statistics tends to be restricted to descriptive statistics, with the descriptive analysis of tables and graphs (Votto & Silva, 2019).

Those reasons lead us to consider the commitment to insert statistics content into basic education an important one. Seeking to contribute in this matter, this article presents the results of a research work that investigated a scenario of teaching probability and statistics in the early years of elementary school in the city of Joinville, located in the southern region of Brazil. We sought to identify teaching practices, employed resources, and supporting guidelines. We also aimed to understand the teachers' perceptions of their roles regarding the expected students' skills in probability and statistics. In our view, strategies and methodologies to contribute to the effective insertion of statistics in the early years of elementary school must be developed. However, before that happens, understanding the current scenario to identify weaknesses and potentialities is essential.

METHOD

This research is a cross-section, mixed-approach study. The sampling was non-probabilistic for convenience, and the sample is composed of elementary school teachers from Joinville’s municipal public schools. Municipal public schools concentrated 85% of elementary school students in 2019 (Secretaria de Pesquisa e Planejamento Urbano, 2020). A questionnaire was applied with ten questions, both multiple-choice and essay, divided into two parts. The first part collected information about the teachers’ employment and professional training. The second part gathered information regarding actions and practices towards the teaching of statistics. Data collection took place at the end of 2019. The questionnaire was sent by e-mail and had the support of the municipal administration at this stage.

Data analysis was exploratory, based on descriptive statistics and graph construction. Content analysis was applied to the open answers, aided by the Reinert method, which performs a cluster analysis with text segments, allowing their categorization and classification to identify the underlying themes, reducing subjectivity (Souza et al., 2018). The R software (R Core Team, 2021) and IRAMUTEQ (<http://www.iramuteq.org/>) were employed for the analyses.

RESULTS

The sample was composed 71 teachers, who answered the questionnaire. The first four questions referred to their profiles. The analysis of those four questions allowed us to conclude that most teachers work 40 hours a week, have been teaching for more than 10 years, and have academic education at a specialization level. We tried to identify the contents of probability and statistics that they teach. Figure 1(a) shows the main results. A higher frequency of descriptive statistics content is noticed, such as reading tables, drawing simple graphs, and collecting, sorting, and representing data. Figure 1(b) summarizes the answers regarding the employed teaching resources. An effort to develop activities involving playful aspects, such as games and storytelling, is noticeable. The diversity and richness of resources pointed out by teachers in the “others” category also stands out, including mathematical challenges, manipulable objects, and the use of concrete material.

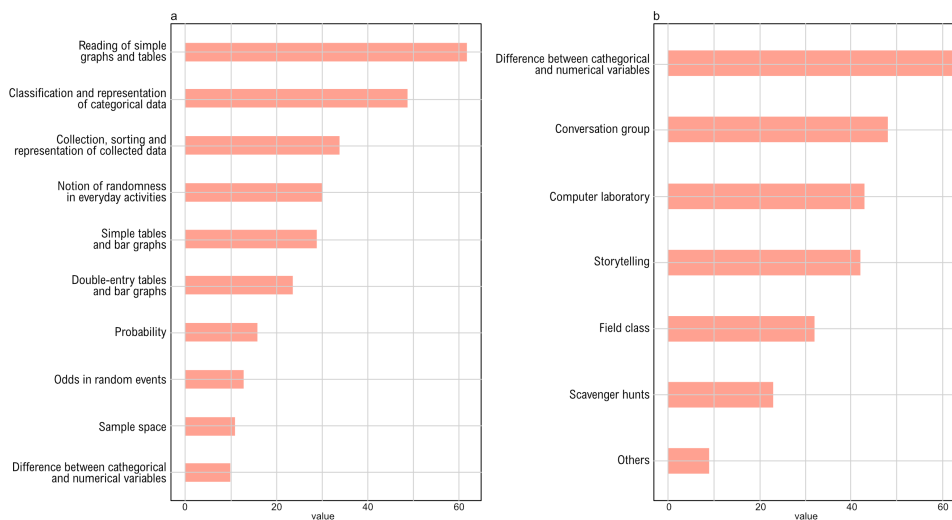


Figure 1. Bar graph with (a) probability and statistics content taught and (b) didactic resources used by the teachers

Teachers were also asked about which guidelines they use as a support for teaching mathematics. The BNCC (National Common Core Curriculum) was listed by 33 teachers (46%), despite being relatively recent. It was followed by the PCN (National Curricular Parameters) (24%), the PNAIC (National Pact for Proper Age Literacy) and, finally, the municipal bureau of education’s syllabus. We then asked about the instruments used in the student assessment process. The written test was found to be the most used instrument by 68 teachers (96%), followed by school assignments (63 teachers, 89%). The penultimate question sought to determine if the teacher agreed with a statement from the BNCC, shown in Figure 2.

All citizens must develop skills to collect, organize, represent, interpret and analyze data in a variety of contexts, in order to make well-informed judgment and appropriate decisions. This includes reasoning and the use of concepts, representations and statistical indices to describe, explain and predict phenomena. (Ministério da Educação, 2018, p. 272).

Figure 2. Statement presented in the questionnaire

Most teachers (75%) responded positively, agreeing with the statement. It can be concluded that teachers understand the importance of statistics in people’s lives. The last question was an essay regarding the context of the previous statement. We asked: “In the context of the previous statement, how do you see your role as a teacher in the early years of elementary school?” In the analysis performed with the set of responses, five categories, called classes, were identified (Table 1).

Table 1. Classes resulting from Reinert’s method analysis

| | Class | | | | |
|-------------------|--------------------------|------------|---------------------------------|---------------------------------|----------|
| | Class 5 | Class 2 | Class 3 | Class 1 | Class 4 |
| Significant Terms | Tool Use Child Necessary | Take Think | Daily Problem Know Initial Form | Skill Develop Knowledge Student | Mediator |
| Occurrence (%) | 24.3% | 16.2% | 18.9% | 18.9% | 21.6% |
| Name | Means | Reflection | Student reality | Skills | Teacher |

In class 1 (Skills), it was clear that, in the teacher’s view, he/she plays an important role in helping to develop the students’ skills. We selected two responses from teachers that represent that thinking. Teachers are represented by the letter P and a number, which corresponds to their order in the database. For P68, “The teacher’s role is to provide conditions for the student to become curious in the subject so that he/she develops the necessary skills for the construction of knowledge.” P70 draws attention to playfulness, with activities that lead the child to like what they are learning: “My role in this situation would be to develop skills in a playful way (games, among others), in which the child learns in a fun and enjoyable way. Learning important discoveries and skills that will be used in his/her daily life.”

Class 4 (Teacher) is characterized by the perception of the teacher’s role as a mediator. From the respondents’ perspective, the teacher is a mediator “of strategies” (P2) and “of knowledge” (P71). Such perspective agrees with the reflection by Pontes (2018), in which the mathematics teacher, a knowledge mediator, is responsible for finding new didactic strategies that will involve their students in the construction of knowledge in mathematics.

Class 2 (Reflection) showed that it is important for the teacher to entice and guide children to think. They must reflect and discuss, and curiosity must be a part of this process. The words of P32 make it clear: “It’s up to the teacher to offer strategies that lead the children into logical thinking, establishing relationships between the contents and the out-of-school experience.” This agrees with what was exposed by Rosa et al. (2017), who stress the importance of the mathematical knowledge in bringing up in students (and teachers) a taste for the challenge, allowing them to reflect on the underlying sociocultural reality.

Class 3 (Student reality) highlights the teacher’s perception of his/her role in bringing students’ everyday problems into the learning process. We selected two responses that allow us to reflect on the topic. The words of P59 stress the importance of associating mathematics with the child’s everyday situations: “The first steps in mathematics and its fields must be contextualized with the everyday reality in a practical and objective way, constructing the rules for the use of the mathematical language.” P11, in turn, reflects on the importance of motivating a reflection about what is experienced in class: “Planning meaningful everyday situations that provide the analysis and

reflection of data and indices to obtain probability and statistics information for students in the first years of school.”

Finally, class 5 (Means) revealed that, for a group of teachers, their role lies mainly in the development of tools and procedures. The concern lies in the mean to be applied. Class planning, the organization of teaching sequences, and the technologies used are perceived as essential elements.

We verified, therefore, that teachers understand their role as mediators, not the center of the teaching and learning process. For them, developing the expected skills in the early years of elementary school is important. In addition, they consider that bringing in the students’ reality to aid the construction of thoughts and the reflection process is fundamental.

FINAL CONSIDERATIONS

This paper aimed to analyze how probability and statistics is worked out in the elementary school, in the city of Joinville. The results show that teachers are aware of the importance of statistics and prioritize playful aspects. However, descriptive statistics contents predominate, making it necessary to create conditions for probability to be effectively inserted into teaching. For a follow-up study, one suggestion is to investigate the training of the teachers, the guidelines, and textbooks used. We believe that statistics is a living science, in motion, and, therefore, must be continually reconsidered in terms of initial and continuous training.

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REFERENCES

- Giordano, C. C., Araújo, J. R. A & Coutinho, C. Q. S. (2019). Educação estatística e a base nacional comum curricular: O incentivo aos projetos. *Revista Eletrônica de Educação Matemática*, 14, 1–20. <https://doi.org/10.5007/1981-1322.2019.e62727>
- Ministério da Educação. (2014). *Pacto nacional pela alfabetização na idade certa: Educação estatística*. Brasil.
- Ministério da Educação. (2018). *Base nacional comum curricular*. Brasil. http://basenacionalcomum.mec.gov.br/images/BNCC_EI_EF_110518_versaofinal_site.pdf
- Poffo, C., Possamai, J. P., & da Silva, V. C. (2020). Trabalho docente com estatística nos primeiros anos de escolarização: Um estudo de caso. *Jornal Internacional de Estudos em Educação Matemática*, 13(2), 196–202. <https://doi.org/10.17921/2176-5634.2020v13n2p196-202>
- Pontes, E. A. S. (2018). O Ato de ensinar do professor de matemática na educação básica. *Ensaios Pedagógicos*, 2(2), 109–115. <https://www.ensaiospedagogicos.ufscar.br/index.php/ENP/article/view/76>
- R Core Team. (2021). *R: A language and environment for statistical computing* [Computer software]. R Foundation for Statistical Computing. www.r-project.org.
- Rosa, B. R., Lima, S. M. F., da Costa, C. A. & Konrad, M. L. F. (2017). Aprendizagem matemática na educação ambiental. *Revista de Ensino, Educação e Ciências Humanas, Londrina*, 18(3), 184–190. <https://revistaensinoeducacao.pgskroton.com.br/article/view/3407>
- Samá, S. & da Silva, R. C. S. (2020). Probabilidade e estatística nos anos iniciais do Ensino Fundamental a partir da BNCC. *Zetetike*, 28, Article e020011. <https://doi.org/10.20396/zet.v28i0.8656990>
- Secretaria de Pesquisa e Planejamento Urbano. (2020). *Joinville cidade em dados 2020*. Prefeitura Municipal de Joinville. <https://www.joinville.sc.gov.br/publicacoes/joinville-cidade-em-dados-2020/>
- Souza, M. A. R., Wall, M. L., Thuler, A. C. M. C., Lowen, I. M. V., & Peres, A. I. (2018). O uso do software IRAMUTEQ na análise de dados em pesquisas qualitativas. *Revista da Escola de Enfermagem da USP*, 52, Article e03353. <https://doi.org/10.1590/S1980-220X2017015003353>
- Votto, T. R. & Silva, M. P. M. (2019). A formação docente e as habilidades estatísticas desenvolvidas por professores dos anos iniciais. *REMEA–Revista Eletrônica do Mestrado em Educação Ambiental*, (2), 61–74. <https://doi.org/10.14295/remea.v0i2.8878>