



A teaching sequence for the development of statistical literacy in the 1st grade Elementary School

Abstract: With this study, an analysis was conducted on the teaching of Statistics in the 1st grade of Elementary School, considering its contribution to scientific thinking. Of a qualitative nature and with a theoretical-propositional character, the study is supported by a recent bibliographic review on statistical literacy in Elementary School and by references from the field. It presents a teaching sequence, which is analyzed based on the theoretical framework, articulating the cognitive and attitudinal components of statistical literacy and the use of concrete materials. Its main objective was to analyze the potentialities and limitations of the teaching sequence, offering contributions that provide support for future research and for teaching practice in statistics education.

Keywords: Statistical Literacy. Teaching Sequence. Concrete Materials.

Una secuencia de enseñanza para el desarrollo de la alfabetización estadística en el 1.er grado de la Educación Primaria

Resumen: Con el estudio, se realizó un análisis sobre la enseñanza de la Estadística en el 1.er grado de la Educación Primaria, considerando su contribución al pensamiento científico. De naturaleza cualitativa y de carácter teórico-propositivo, el estudio se sustenta en una revisión bibliográfica reciente sobre el alfabetismo estadístico en la Educación Primaria y en referencias del campo. Presenta una secuencia de enseñanza, que es analizada a partir del marco teórico, articulando los componentes cognitivos y actitudinales del alfabetismo estadístico y el uso de materiales concretos. Tuvo como objetivo central analizar las potencialidades y limitaciones de la secuencia de enseñanza, aportando contribuciones que brindan insumos para futuras investigaciones y para la práctica docente en la enseñanza de la Estadística.

Palabras clave: Alfabetización Estadística. Secuencia de Enseñanza. Materiales Concretos.

Uma sequência de ensino para o desenvolvimento do letramento estatístico no 1º ano do Ensino Fundamental

Resumo: Com o estudo, fez-se uma análise acerca do ensino de Estatística no 1º ano do Ensino Fundamental, considerando sua contribuição para o pensamento científico. De natureza qualitativa e caráter teórico-propositivo, o estudo é sustentado por um levantamento bibliográfico recente acerca do letramento estatístico nos Anos Iniciais do Ensino Fundamental e em referências do campo. Apresenta uma sequência de ensino, que é analisada a partir da base teórica, articulando os componentes cognitivos e atitudinais do letramento estatístico e o uso de materiais concretos. Teve como objetivo central a análise das potencialidades e limitações da sequência de ensino, tecendo contribuições que dão subsídios para pesquisas futuras e para a prática docente no ensino de estatística.

Palavras-chave: Letramento Estatístico. Sequência de Ensino. Material Concreto.

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ARTICLE

1 Introduction

This study was conducted as part of a Final Course Paper within the scope of the Licenciature Degree in Pedagogy and Professional and Technological Education at the Federal Institute of São Paulo (IFSP), Brazil. The central theme of the study was Statistical Literacy in the 1st grade of Elementary School.

In contemporary society, being a critical thinker is essential, considering the high demand for information and situations we experience at all times in our daily lives. Therefore, promoting an education that keeps pace with the demands of society, forming critical and active citizens in their society, is fundamental, and in this context, the idea of literacy gains importance. The ten general competencies for Basic Education prescribed in the *Base Nacional Comum Curricular* [National Common Curriculum Base — BNCC] (Brasil, 2017) present a considerable emphasis on the development of critical skills and attitudes by students, considering the complex demands of daily life, understanding these competencies as fundamental learning rights that must be guaranteed to students throughout Basic Education.

The study focused on discussing the line of statistical literacy that is embedded within the framework of mathematical literacy. This line is extensively addressed in Gal's (2002) research, which argues that statistical literacy is realized through the interrelation of skills in interpreting statistical information with skills in critically and reflectively evaluating this information.

Statistics is undeniably present in our daily lives, whether through weather forecasting provided by climate studies, disease monitoring in the health field, investments in the financial area, electoral research, or even in the analysis of football matches, based on quantitative data such as ball possession and the performance of each player. Thus, it becomes necessary to train statistically literate students, who are able to do more than just process data, but who can develop skills to critically analyze them and discuss them in a broader context, linked to reality.

Research in Mathematics Education, such as Gal (2002) and Cazorla, Utsumi, and Santana (2020), emphasizes the need to develop statistical literacy from the Elementary School, given the flow of data and information that students receive daily. However, a mapping carried out by Mello *et al.* (2024) reveals that there is little research on the subject, in addition to pointing out the need for continuing teacher training, scientific production on the investigative cycle of research, development of teaching sequences aimed at developing statistical literacy, use of multiple resources, among others.

This situation highlights important gaps in the literature, in which we understand the role of the teacher as essential, since it is from the work carried out in the classroom that students can develop statistical literacy skills, provided that a space is provided that encourages student protagonism and the formation of a critical position in relation to the data presented. Considering the important work of the teacher for statistical literacy and the premises raised previously, a teaching sequence proposal is presented and its potential and limitations are analyzed in light of Gal's (2002) statistical literacy. The teaching sequence was developed from the perspective of Santana (2010), who presents a definition of what a didactic sequence is. In addition, we worked with the use of concrete materials, such as Lego blocks, based on the considerations of Lorenzato (2006), who discusses the benefits of their use.

Considering the analyses and assumptions above, we outlined the following research question: What potential and limitations emerge from the analysis of a teaching sequence designed to develop statistical literacy in the 1st grade of Elementary School?

In response to this question, we defined the objective of the study as analyzing the potential and limitations, from a theoretical point of view, of a teaching sequence for the

development of statistical literacy in the 1st grade of Elementary School. Considering this, the articulation of the teaching sequence with the cognitive and attitudinal components of Gal (2002).

The article is structured in six sections. The first is the introduction to the study, the second presents a brief contextualization of the study's theme. The third points out the methodology used, the fourth involves a suggestion of a teaching sequence that can be developed in the classroom, with the aim of promoting students' statistical literacy; the fifth refers to the analysis of this sequence based on Gal's study (2002). Finally, in the sixth, we present the final considerations.

2 Theoretical framework

Statistical Education is a fruitful tool for dealing with the demands brought about by modern society, which, through digital information technologies, disseminates an inherent need among the population to critically analyze information and situations that require statistical knowledge. The current BNCC discusses considerations about uncertainties and data processing, which are addressed in the thematic unit of Probability and Statistics:

[...] it proposes the approach of concepts, facts, and procedures present in many problem situations of daily life, science, and technology. Thus, all citizens need to develop skills to collect, organize, represent, interpret, and analyze data in a variety of contexts, in order to make well-founded judgments and take appropriate decisions. This includes reasoning and using statistical concepts, representations, and indices to describe, explain, and predict phenomena. (Brasil, 2017, p. 274)

This need to carry out meaningful work with Statistics, which allows the development of skills to be mobilized in real life, is highlighted in the study carried out by Gal (2002). This author outlines a concept of statistical literacy based on meticulous research work carried out on the subject, in which he addresses, at a global level, the little importance given to Statistics in the school curriculum, based on the approaches brought by other authors on statistical literacy and scientific literacy. Gal (2002) goes beyond the idea of working with a curriculum based on statistical concepts, defending the need to develop skills that can be mobilized to critically analyze the information received and develop considerations about it.

Statistical literacy can be defined, according to Gal (2002, p. 19), as “the ability to interpret, critically evaluate, and if needed communicate about statistical information, arguments, and messages”. In this conception, Gal (2002) lists two components that must be interrelated, namely the cognitive component and the attitudinal component. Gal (2002) describes these two interrelated components as:

(a) people's ability to interpret and critically evaluate statistical information, data-related arguments, or stochastic phenomena, which they may encounter in diverse contexts, and when relevant (b) their ability to discuss or communicate their reactions to such statistical information, such as their understanding of the meaning of the information, their opinions about the implications of this information, or their concerns regarding the acceptability of given conclusions. (Gal, 2002, p. 2-3)

The cognitive component has five elements — literacy, statistical knowledge, mathematical knowledge, contextual knowledge, and critical skills — while the attitudinal

component has two elements, namely, critical stance and beliefs and attitudes. Below we will summarize each of these elements.

- *Literacy*: Gal (2002) links literacy skills with statistical literacy skills, since statistical information is presented in various ways, such as texts, graphs, tables, among others, requiring interpretation skills to understand the statistical part. Therefore, it is necessary for people to be able to satisfactorily interpret the wide range of information that arrives daily.
- *Statistical knowledge*: This is related to knowledge specific to Statistics and, beyond that knowledge, the knowledge necessary to achieve statistical literacy. Thus, Gal (2002) suggests five main dimensions of the statistical knowledge base aimed at achieving statistical literacy, namely (i) knowing why data is needed and how it can be produced; (ii) familiarity with basic terms and ideas related to Descriptive Statistics; (iii) familiarity with basic terms and ideas related to graphical and tabular displays; (iv) understanding basic notions of probability; and (v) knowing how statistical conclusions or inferences are reached.
- *Mathematical knowledge*: Essential skills related to knowledge of mathematical tools and procedures.
- *Contextual knowledge*: World knowledge is necessary within statistical literacy, allowing for the creation of meaning. For example, when faced with collected data, a person can focus not only on the numbers, but also on the context in which they are embedded, thus providing a qualitative interpretation of this data.
- *Critical skills*: This refers to the need for people to be concerned about the credibility of the statistical messages they receive, reflecting on possible interpretations different from those that were transmitted. To assist in the analysis of received statistical messages, Gal (2002) suggests that the person create a list of concerning questions that guide this analysis.
- *Critical stance*: This relates to the expectation that the person will have a critical attitude, questioning statistical messages that may be fraudulent.
- *Beliefs and attitudes*: Gal (2002) considers that beliefs can be understood as ideals or opinions about something, and that attitudes are the emotional expression of feelings. The author also states that beliefs and attitudes are interconnected and that together they form the basis of the subject's critical stance.

Gal (2002, p. 20) concludes that: “statistical literacy should be regarded as a set of capacities that can exist to different degrees within the same individual, depending on the contexts where it is invoked or applied”.

To this end, the school plays an important role in promoting the student's integral development, making the work done by the teacher in the classroom a key piece for meaningful, contextualized, and emancipatory teaching. In this respect, the teacher can promote classroom work that allows the student to abandon a peaceful, receptive, and static approach, and to take their place as the protagonist of their own learning processes in an active way.

In this sense, the research carried out by Cazorla, Utsumi, and Santana (2020) makes important considerations about the inherent need to promote meaningful teaching for the student, developing an active role in the teaching of Statistics from teaching sequences that address topics of their interest, which, in addition to promoting the learning of statistical concepts, can enhance critical attitudes.

The research conducted by the authors implemented a university-school partnership,

creating a collaborative group with teachers to develop and validate teaching sequences that would enhance student learning. To this end, they carried out a diagnostic study with 1305 students from the 1st to the 5th grade of Elementary School and 6th to the 9th grade in Middle School in four public schools in Bahia, Brazil, evaluating their performance in Statistics.

Aligned with the same thinking as Cazorla, Utsumi, and Santana (2020) and based on the concept of statistical literacy brought by Gal (2002), authors such as Cazorla, Magina, and Santana (2021), Santos and Santana (2020), and Alves and Santana (2019) linked Gal's (2002) conceptualization of statistical literacy with the Theory of Conceptual Fields developed by Vergnaud (1996), seeking to understand the elements that act and interfere in the structuring of a concept in the cognitive field, based on problem situations that aim to overcome the difficulties of teaching Statistics, from contextualized work that starts from the student's reality and that contributes to a critical education.

The authors cited, as well as Silva and Couto (2021), use the PPDAC Investigative Cycle methodology, proposed by Wild and Pfannkuch (1999), to construct the phases of a teaching sequence that would enhance the teaching of statistical concepts by students in Elementary School.

In the works of Cazorla, Magina and Santana (2021), Santos and Santana (2020), Alves and Santana (2019) and Silvia and Couto (2021), one can perceive as results a contribution to the development of the teaching and learning processes of Statistics in a critical way, thus moving towards statistical literacy. The works present similar characteristics, not only in the theoretical contribution, but in the way in which the students positioned themselves as protagonists, actively participating in the entire process, from outlining the theme relevant to their lives, raising questions and collecting and analyzing data critically and developing changes in attitudes.

Furthermore, the works converge on the development of teaching sequences as an important tool, which, when organized in a way that promotes contextualized work with student protagonism, enhances the development of statistical literacy. It is also worth noting that these works focus on the possibility of developing statistical literacy with students in Elementary School, from the 1st grade, also focusing on the integral formation of students with critical and reflective thinking and who know how to act in contemporary society. In the study presented in this article, we consider the definition of teaching sequence presented by Santana (2010, p. 113): “a set of situations elaborated and arranged in such a way that previously selected concepts are addressed to be worked on”. Thus, we base the teaching sequence around statistical literacy, articulating a series of previously organized situations aimed at achieving it.

Another tool that contributes positively to the teaching and learning processes — when preceded by prior planning through intentional work on the part of the teacher — are concrete materials. Lorenzato (2006, p. 22) presents considerations about its use, in which he approaches the process of abstraction, discussing that “this process begins with the support of our senses and, thus, it is apparently paradoxical because, to arrive at the abstract, it is necessary to start from the concrete”. In this sense, Lorenzato (2006) also highlights that the use of didactic material (DM) contributes to the learning of any subject at any age, by enabling the student to learn at their own pace, in addition to contributing to “the carrying out of observations, findings, discoveries and even the raising of hypotheses and the elaboration and testing of strategies [...]” (Lorenzato, 2006, p. 29). However, the author points out that the use of DM is not always easy, as the teacher needs to carry out directed work, with specific knowledge. To know how to use DM properly, students need to carry out a mental activity, in addition to the manipulative one.

Furthermore, Lorenzato (2006) discusses some of the criticisms raised against the use of MD, defending them, but emphasizing that the use of concrete materials alone does not

promote effective teaching and learning processes; for this reason, the teacher's work is important.

One of the works that discusses critical reflections on the use of concrete materials is that of Fiorentini and Miorim (1990), who express concern about their use as if they were the solution to teaching problems, highlighting that “the simple introduction of games or activities in mathematics teaching does not guarantee better learning of this subject” (p. 9), emphasizing the importance of the teacher reflecting on their “political-pedagogical proposal; on the historical role of the school, on the type of student we want to form, on what mathematics we believe is important for this student” (p. 9), before opting for the use of a concrete material or game.

3 Methodology

This study is characterized as having a qualitative approach and a theoretical-propositive nature regarding statistical literacy, in order to produce the proposed teaching sequence. It was also developed from a bibliographic survey on statistical literacy, with recent research in the area and a main focus on Elementary School. However, it should be noted that it was not implemented in situ.

The study includes an analysis of the potential and limitations of a teaching sequence of our own authorship, based on the theoretical basis of the study, mainly considering Lorenzato (2006) on the use of concrete materials and Gal (2002) regarding statistical literacy.

The analysis is carried out based on the contributions of the teaching sequence to statistical literacy in the 1st grade of Elementary School, using the articulation with the cognitive and attitudinal components of statistical literacy proposed by Gal (2002).

It is worth highlighting that the study aims solely to contribute to teaching practice in Statistics Education, based on the analysis and problematization of the teaching sequence articulated with theory, in order to suggest its implementation in the classroom, through a reformulation that takes into account the particularities of each educational context, raising data on its contributions and limitations for the statistical literacy of children.

4 Teaching sequence: description and analysis

The teaching sequence focuses on *healthy and sustainable food*. We will analyze its contributions to the development of statistical literacy, as conceived by Gal (2002), among first-grade Elementary School students, seeking to observe the cognitive and attitudinal components present at each stage, as well as to discuss its potential and limitations.

This theme can be justified by its current relevance and proximity to the students' reality. Data collected by the Food and Nutritional Surveillance System (Sisvan) of the Ministry of Health in 2023¹ indicate an alarming rate of childhood and adolescent obesity, with approximately 185,552 children and adolescents between 0 and 19 years of age in the city of São Paulo, Brazil, alone being overweight. Furthermore, food education is among the Contemporary Cross-Cutting Themes addressed in the BNCC (Brasil, 2017), supported by Law No. Law 11.947/2009, which discusses school food services and other provisions (Brasil, 2009), is also present in the Curriculum of the City of São Paulo, with specific pedagogical guidelines for Food and Nutrition Education in Basic Education in the municipality of São Paulo (São Paulo, 2024).

We understand that the theme of *healthy and sustainable food* can be understood as a

¹ Data available at: Desiderata. Childhood Obesity in Focus. Overview of Obesity in Children and Adolescents. [Internet]. Desiderata. Collective Work Health in Focus. 2023. Available at <https://panorama.obesidadeinfantil.org.br>

potential, considering that it is a relevant topic today and significant for students, as it is a problem arising from their daily lives and that allows for the creation of meaning. In this way, it is possible to observe an articulation of the theme with contextual knowledge, which is one of the cognitive components of statistical literacy according to Gal (2002). A limitation that can be overcome in the classroom is the delimitation of the theme, which can emerge from a survey conducted with the students themselves, considering their interests and enhancing their protagonism. Another point that could be expanded upon in a possible reformulation for the implementation of the teaching sequence would be a deeper exploration of the topic, with critical reflections woven from debates about eating habits, food preferences, and possible causes for these choices from an age, socioeconomic, and cultural perspective.

The central objective of the teaching sequence is to provide the means for 1st-grade Elementary School students to achieve statistical literacy. To achieve this objective, specific objectives were defined, namely: to promote student protagonism in all phases of the pedagogical process; to promote steps that support teamwork; to conduct classroom research using data collected by students; to carry out classification activities; to analyze and interpret data collected from classroom research; and finally, to use concrete materials as pedagogical resources that assist in the construction and interpretation of graphs and tables in a playful way.

The teaching sequence is aligned with the skills and competencies present in the BNCC (Brasil, 2017), namely the skill EF01MA21 (Read data expressed in tables and simple column graphs) and the skill EF01MA22 (Conduct research, involving up to two categorical variables of interest and a universe of up to 30 elements, and organize data through personal representations), belonging to the thematic unit Probability and Statistics for the 1st grade. Its structure estimates the contemplation of 5 classes of 50 minutes each, in addition to being organized into six stages, which will be described below.

The first stage aims to delve into the theme subjectively, mobilizing prior knowledge through the presentation and reading of two books, the book *Verdura? Não!* [Vegetables? No!], by Claire Llewellyn and Myke Gordon, and the book *Bibi come de tudo* [Bibi eats everything], by Alejandro Rosas. Next, the aim is to encourage students to share their experiences on the topic, starting with an open discussion where the teacher will orally ask students questions about their favorite foods; whether they consider their favorite foods healthy or not; whether they know the difference between fruits, vegetables, and legumes; and where these foods come from, among other things. Also in this first stage, it is expected that, guided by the teacher, students will form groups of five or six members to participate in the tasks that will be proposed in the following stages and the distribution of materials to be used — a package with some four-pin Lego blocks in different colors, a Lego base plate, graph paper, sheets of sulfite paper, colored markers, scissors, and two colors of sticky note pads.

Analyzing this first stage, we observe that literary reading becomes a potential and brings students closer to the theme that will be worked on in a relevant and attractive way. However, it is possible to broaden the questions beyond descriptive and opinion-based questions of a pedagogical nature, aiming to problematize and encompass statistical concepts such as uncertainties and variability.

The second stage of the sequence aims for students to become familiar with and develop some statistical concepts such as data collection, classification, and categorization, starting from interaction with their peers. It is expected that, for the development of the concept of data collection, students will conduct a survey in their group about their favorite foods, recording this data on a sheet of paper with the name of the member and their favorite food. Aiming at the development of the concepts of classification and categorization, it is expected that, based on the teacher's instruction, students will create cards with the representation of their own favorite food through drawing and writing — as in the example in Figure 1 — and that they

will use these cards to classify these foods. The aim is for students to discuss in their groups how they could carry out this classification and, based on their personal experiences and the discussions already held, classify these foods as healthy foods and unhealthy foods.



Figure 1: Example of a card (Own elaboration)

It is possible to highlight the potential of this second stage when we consider the important actions that students are encouraged to take. Firstly, the investigation into their own reality, which can be understood within the context of knowledge, as proposed by Gal (2002), and which, in addition to allowing students to create meaning, strengthens — as does the construction of the cards — their self-esteem, their protagonism, and their autonomy. Another cognitive component related to this stage is statistical knowledge, which employs concepts linked to Statistics such as data collection, classification, and categorization. However, we emphasize the need to stimulate students' critical thinking regarding what is presented in each stage, such as, for example, in this stage, the discussion about the construction of the definition of what constitutes a healthy food and what constitutes an unhealthy food, this being a non-unanimous and variable conception according to scientific, cultural, and socioeconomic aspects. Promoting these and other discussions throughout the stages of the teaching sequence contributes to the development of a critical stance and changes in beliefs and attitudes, these being attitudinal components of statistical literacy.

The third stage of the sequence aims at creating an intuitive table sketch, constructing a playful graph using Lego blocks², and constructing a graph using graph paper. First, aiming at the construction of an intuitive table, based on problems brought by the teacher, it is intended that students take a position on how they could organize the collected data, considering that they are separated into healthy and unhealthy foods. It is expected that students will make this distinction by the name of the foods or by the quantity of healthy or unhealthy foods, using sheets of paper for writing, as in the example in Figure 2.

UNHEALTHY FOODS	HEALTHY FOODS
5	1

Figure 2: Example of a table on a sheet of sulfite paper (Own elaboration)

Designing the construction of a graph using Lego blocks to represent the data presented in the already constructed table, it is expected that students will use the two colors of Lego

² Activity inspired by the video: Teach through play: graphs with building blocks. IBGE Educa. Available at <https://educa.ibge.gov.br/professores/educa-recursos/20571-ensine-brincando-graficos-com-blocos-de-montar.html>

blocks available to represent a tower of healthy foods and another tower of unhealthy foods, stacking the blocks on top of each other, as in the example in Figure 3.

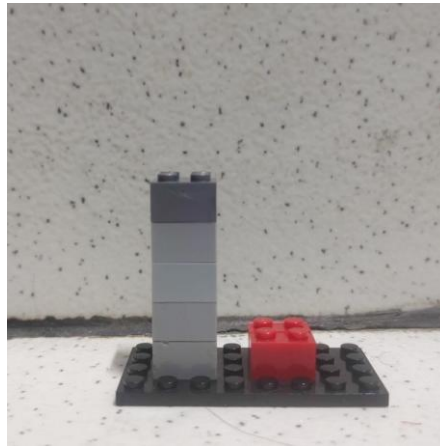


Figure 3: Example of a Lego chart (Own elaboration)

The final part of the third stage involves constructing a graph on graph paper to represent the collected data. Students are expected to color the corresponding quantity of healthy and unhealthy foods with different colored markers, using each square of the grid as if it were a Lego block from the previous activity, as in the example in Figure 4.

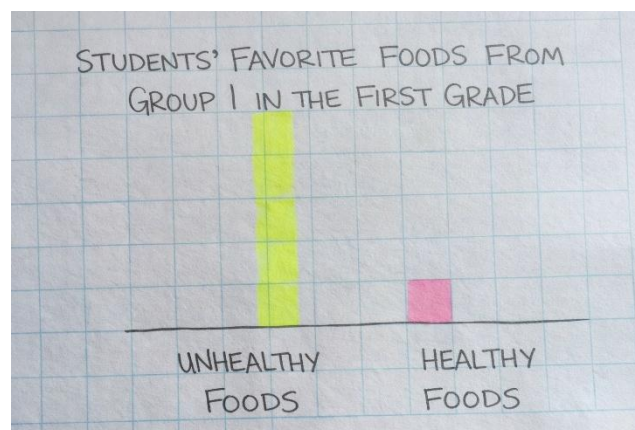


Figure 4: Example of a graph on graph paper (Own elaboration)

Starting with the teacher's prompting, students are encouraged to reflect on the elements that make up a graph, such as the legend and title, thus raising questions about how to identify what each drawn column represents and how to recognize what the data are about. It is estimated that students will raise suggestions on how to carry out this first identification (legend), which can be represented by drawings or writing the names of healthy foods and unhealthy foods, and for the second identification (title) by writing about what the represented data are. Finally, it is expected that students will share the representations made with the Legos and graph paper with the rest of the class.

In this third stage, the implicit intentionality of using concrete materials is observed, based on the propositions of Lorenzato (2006), which contributes to the learning of the concepts addressed through the process of abstraction that occurs with the use of manipulable materials. Although the mathematical and statistical knowledge proposed by Gal (2002) is evident, it is possible to expand the attitudinal components at this stage for a possible implementation of the teaching sequence in the classroom. Thus, we reinforce the need to deepen the questions raised by the teacher, for an inference to statistical thinking in a critical way, which does not focus solely on procedural aspects of how to construct graphs, but problematizes the meaning of those forms of representation, or even discusses different ways of representing the collected data.

The fourth stage of the sequence aims to conceptualize what a graph and a table are, in addition to creating a collective table and graph, based on the data collected by the groups. Starting from questions listed by the teacher regarding the students' prior knowledge about the representations made so far, it is expected that the students will share their knowledge about tables and graphs with the group and that the teacher will later bring these definitions, also addressing their importance and practical purposes.

Starting from questions raised by the teacher about how it would be possible to assemble a collective table with the data collected by all the groups, it is expected that the students will point out that it will be necessary to add the data collected from each group, both for healthy and unhealthy foods, and then count them, representing the data on the blackboard, as in the example in Figure 5. In addition, they should identify the table with a title to indicate what the data refers to, just as they did with the graph in the previous step.

HEALTHY FOODS	UNHEALTHY FOODS
11	19

Figura 5: Exemplo de tabela coletiva (Elaboração própria)

Idealizing the collective construction of the graph from the data presented in the table constructed on the blackboard, it is expected that the students will use the colored self-adhesive³ blocks to carry out this construction, just as they did with the Lego blocks, sticking one on top of the other, as in the example in Figure 6. In addition to identifying each tower as healthy foods and unhealthy foods, as well as naming a title for the graph.

Based on questions raised by the teacher, about the need to identify the number of self-adhesive blocks, without necessarily having to count them every time they want to know this quantity. It is expected that the students will suggest that the quantity of each category should be noted on the graph, in addition to stipulating that this quantity be described on the vertical axis under the teacher's guidance.

At the end of this stage, it is intended that the students will share their impressions of what they thought of the use of graphs and tables to represent the collected data, what difficulties they encountered, among other observations.

This stage provides an overview of some elementary knowledge of Mathematics and Statistics, which are necessary for the construction of tables and graphs, being duly aligned with the skills of the Brazilian National Curriculum Base — BNCC (Brasil, 2017), which it proposes to develop, in addition to promoting collaborative work among students and developing elements of the attitudinal component, such as beliefs and attitudes, when it prompts students to position their impressions regarding the research, collection and processing of statistical data carried out jointly. With the aim of adopting a critical and reflective stance towards the work

³ Activity inspired by the video: Teach through play: graphs with building blocks. IBGE Educa. Available at <https://educa.ibge.gov.br/professores/educa-recursos/20571-ensine-brincando-graficos-com-blocos-de-montar.html>

carried out, we propose once again expanding the discussion held in the classroom, with questions that encourage the development of critical skills in the face of statistical information, problematizing the quality and reliability of the data.

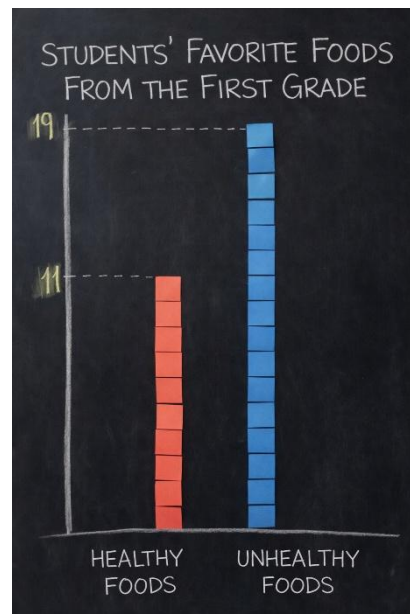


Figure 6: Example of a collective chart with self-adhesive blocks (Own elaboration)

In the fifth stage of the sequence, the intention is to carry out a critical analysis of the data collected, both those explicit in the graphs and tables, and those that are implicit. To that end, the process begins with questions raised by the teacher about what the data expressed on the blackboard represent in relation to the class's eating habits, how these habits influence the students' health, as well as the importance of having balanced eating habits and the interconnection between healthy eating and physical activity.

In this fifth stage, a critical analysis of the collected data is suggested, in which we perceive more clearly the articulation between some cognitive components — statistical knowledge, mathematical knowledge and contextual knowledge, explicit in the data represented in the table and in the collective graph — and the attitudinal components — critical stance and beliefs and attitudes — of statistical literacy proposed by Gal (2002), developing a critical and reflective stance towards the data treated in the other stages, fueling discussions about the class's eating habits and consequently their influence in a broader context on health. However, it is essential that the teacher, at this stage, expands the critical analysis leveraged by the discussions, with questions that raise the relationship between statistics and the context of the reality addressed, in order to understand Statistics as a powerful tool for the critical understanding of the world, not reducing it to an instrument for collecting and processing data.

In the sixth and final stage, it is intended that students carry out an analysis of the data individually, recording on a sheet of paper what they have learned from the activities carried out, highlighting their view on the importance of having healthy eating habits. In addition to considering their impressions of the activities carried out, their difficulties and suggestions. It is important to consider that in the 1st year of Elementary School, children are still in the process of becoming literate, so this record can be made through drawings or spontaneous writing.

At this stage, it is possible to see the contribution to student protagonism when they are asked to revisit their journey during the resolution of the teaching sequence and reflect on their learning. However, the main focus of this stage, as it is organized, is on eating habits, without explicitly linking them to statistical concepts. Thus, it is pertinent for the teacher to ask students to express, in addition to their critical view on the subject in question, the learning they have

built up throughout the stages that are related to statistical concepts, as well as their relationship with the theme being worked on.

The evaluation of the teaching and learning processes of the teaching sequence in question aims, continuously, to make observations about the students' involvement in the tasks provided, in the expression of their impressions about the tasks, and in their participatory involvement in the group. In all discussions held, the evaluation process will consider the following items: respecting the opinion of colleagues, paying attention to what is being discussed, and presenting consistent arguments to defend their idea. In addition, some stages of the teaching sequence include specific evaluations. In the second stage, the evaluation will be determined through participation in the research, creation, and organization of the cards. In the third stage, the evaluation will be based on participation in the construction of the table, the assembly of the Lego graph, the construction of the graph on graph paper, and the presentation of the constructions to the class. In the fourth stage, the evaluation will be based on participation in the construction of the collective table and graph. In the sixth stage, the evaluation will be based on the record on the sheet of paper.

Regarding the evaluation of the teaching and learning processes proposed in the sequence, it is possible to highlight as a potential its considerable formative character that permeates all its stages; however, we understand that in the way the evaluation is planned, it is not possible to have concrete data on the real reach of statistical literacy through the development of cognitive and attitudinal components. Therefore, it becomes pertinent to develop an instrument that maps more clearly the points achieved and those that still need to be developed more properly, without losing its formative character.

In general terms, the teaching sequence's potential lies in its structuring into gradual and successive stages, designed to develop the cognitive and attitudinal components of statistical literacy. Other strengths to be highlighted include its development based on the context in which students are immersed, constructing meaning for them, the use of concrete materials focused on the abstraction process, and the active participation and protagonism of students in all stages of the sequence. However, the analysis points to the need to review the teacher's role throughout the stages, with the teacher fostering problematizations that encourage students to adopt a critical stance towards the statistical information presented. Thus, it is necessary to pay closer attention to deepening the attitudinal components for a critical approach, not only in the final stages of the teaching sequence, but throughout its entire length. In addition, it is pertinent to restructure the assessment processes in order to qualify this element and gather evidence of the real development of statistical literacy by the students.

Based on an understanding of the potential and an assessment of the limitations of the sequence in question, it is essential to reformulate the points highlighted as limitations, in order to create a teaching sequence that becomes powerful in developing statistical literacy among first-grade elementary school students.

5 Final considerations

The study aimed to analyze the potential and limitations of a teaching sequence for the development of statistical literacy in the 1st grade of Elementary School. To this end, the analysis was carried out based on the theoretical framework, taking as a fundamental reference the cognitive and attitudinal components established by Gal (2002).

From the analysis, it was possible to identify that such a teaching sequence can contribute to a contextualized approach to initial statistical representations and to the protagonism of students throughout the stages of the sequence. However, the analysis reveals considerable limitations regarding the development of critical skills relevant to the attitudinal

component, in addition to the absence of evaluative criteria that clearly express the development of statistical literacy by students. Thus, it is possible to understand that, although the teaching sequence is pedagogically well-structured, its contribution to statistical literacy is partial, requiring a reformulation of the limitations pointed out.

We believe that the points made in this article contribute to the literature by offering a theoretical-propositive analysis directed at a field little explored by empirical research, especially when related to the 1st year of Elementary School. We recognize its pertinent contribution to the teaching of Statistics. Consequently, we suggest that in future studies, the teaching sequence could be implemented in a real context, considering the limitations pointed out; and that the real results obtained be analyzed according to the classic theoretical frameworks of the area, thus indicating data on its effectiveness, its weaknesses, and its effects on the development of statistical literacy. We also suggest that future research incorporate the phases of the PPDAC Investigative Cycle, proposed by Wild and Pfannkuch (1999), as already suggested by Mello et al. (2024) and other cited authors, due to its considerable potential for the development of statistical literacy.

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Conflicts of Interest

The author declares that there are no conflicts of interest that could influence the results of the research presented in this article.

Data Availability Statement

This article was developed from a theoretical study; therefore, no data is available.

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