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Contributions of statistical literacy in the promotion of Health Education in Elementary Education[1]

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ABSTRACT

According to the World Health Organization - WHO, education for health is a process based on scientific rules that use educational opportunities designed to enable individuals to make informed decisions about health-related matters. The National Common Curriculum Base asserts that educating for health has been a challenge. We present a teaching sequence about eating habits, developed in a 5th-grade class, covering the phases of the investigative cycle. The students individually filled out a questionnaire and, in groups, reflected on their eating habits. Using the data, they built tables and graphs, and carried out analyses and reflections, which culminated in the conclusion that the class's diet was healthy, and that the boys' diet was healthier than the girls'. The interdisciplinary and contextualized activity favored their dialogue and protagonism, contributed to developing elements of statistical literacy, and raised awareness about the need to make assertive decisions regarding eating habits.

KEYWORDS: Statistical Education; Educate for Health; Investigative Cycle; Statistical Literacy; Experiential Learning Cycle.

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Contribuições do letramento estatístico na promoção da Educação para Saúde no Ensino Fundamental

RESUMO

Educar para a saúde, segundo a Organização Mundial da Saúde - OMS, é um processo baseado em regras científicas que utiliza oportunidades educacionais planejadas para capacitar os indivíduos a tomarem decisões fundamentadas sobre assuntos relacionados à saúde. A Base Nacional Comum Curricular assevera que educar para a saúde tem sido um desafio. Apresentamos uma sequência de ensino sobre hábitos alimentares, desenvolvida em uma turma do 5º ano, contemplando as fases do ciclo investigativo. Os estudantes preencheram individualmente um questionário e, em grupos, refletiram sobre seus hábitos alimentares. Com os dados construíram tabelas e gráficos e realizaram análises e reflexões que culminaram na conclusão de que a alimentação da turma era saudável e que a dos meninos era mais saudável do que a das meninas. A atividade interdisciplinar e contextualizada favoreceu o diálogo e o protagonismo deles, contribuiu para desenvolver elementos do letramento estatístico e conscientizar sobre a necessidade da tomada de decisões assertivas com relação aos hábitos alimentares.

PALAVRAS-CHAVE: Educação Estatística; Educar para Saúde; Ciclo Investigativo; Letramento Estatístico; Ciclo de Aprendizagem Experiencial..

Aportes de la alfabetización estadística en la promoción de la Educación para la Salud en la Educación Básica

RESUMEN

La educación para la salud, según la Organización Mundial de la Salud-OMS, es un proceso basado en reglas científicas que utiliza oportunidades educativas diseñadas para permitir que las personas tomen decisiones informadas. La Base Nacional Común Curricular afirma que educar para la salud ha sido un desafío. Presentamos una secuencia de enseñanza sobre hábitos alimentarios, desarrollada en una clase de 5° grado, que abarca las fases del ciclo investigativo. Los alumnos llenaran individualmente un cuestionario y, en grupo, reflexionaron sobre sus hábitos alimentarios. Con los datos construyeron

tablas y gráficos, realizaron análisis y reflexiones que culminaron con la conclusión de que la alimentación de la clase era saludable y que los niños tenían hábitos más saludables que las niñas. La actividad interdisciplinaria y contextualizada favoreció el diálogo y protagonismo, contribuyó para promover los elementos de la alfabetización estadística y a concientizar sobre la necesidad de tomar decisiones asertivas en cuanto a hábitos alimentarios.

PALABRAS CLAVE: Educación Estadística; Educar para la Salud; Ciclo Investigativo; Alfabetización Estadística; Ciclo de Aprendizaje Experiencial.

* * *

Introduction

Since 1997, the National Mathematics Curricular Parameters [Parâmetros Curriculares Nacionais de Matemática - PCN] (Brasil, 1997) recommend the statistics teaching from the initial grades of elementary school in the content block called "Information Treatment." Recently, the National Common Curricular Base [Base Nacional Comum Curricular – BNCC] (Brasil, 2017) ratified the importance of this block of content in line with what was done in most countries, which included statistics in basic education, according to Batanero (2001), given the recognition of its importance in shaping citizens capable of reading the statistical information that permeates society and making informed decisions.

This insertion enhanced the development of research related to the teaching and learning of statistics in an area called statistical education, especially in basic education, both nationally and internationally. According to Santos (2015), Silva, Curi and Schimiguel (2017), Viali and Ody (2020), and Schreiber and Porciúncula (2020), among other authors, Brazilian scientific production in the area in this period has been quite fruitful.

Despite this movement, Tishkovskaya and Lancaster (2012) found that, even with the growing interest and attention given to some aspects of teaching and learning in statistics, some of the problems identified

persist, i.e., statistics teaching focused on mechanical aspects and knowledge mathematicians, which produces students unable to use the statistical knowledge learned to solve problems arising in specific contexts; development of aversive feelings regarding statistics (negative attitudes, anxiety, phobia, and lack of interest); poor mathematical and statistical knowledge base; insufficient prerequisites regarding abstract reasoning and mathematical skills; and the absence of alternative approaches to validly and reliably assess student achievement, such as statistical reasoning.

When we look at our classrooms and/or the results of large-scale assessments, such as the SAEB – Basic Education Assessment System [Sistema de Avaliação da Educação Básica], we see that the problems identified more than a decade ago have barely changed, despite advances in research.

Furthermore, the COVID-19 pandemic, which devastated Brazil and the world, reinforced the importance of statistically literate individuals capable of reading, understanding, and making decisions based on statistical and scientific arguments. Monitoring the evolution of the pandemic, reported daily by the mainstream media, often used false or manipulated data and statistical information of the most diverse nature – epidemiological, economic, and educational– to induce people to make wrong decisions, which may even have caused them harm or loss since, as stated by Cazorla and Castro (2008), numbers and statistical information convey an idea of scientificity and neutrality that give credibility to the information and are difficult for ordinary citizens to contest. They may even be questioned, but individuals generally cannot argue them.

Making informed decisions is also a concern of the World Health Organization (WHO), which defines educating for health as a process that is based on scientific rules and uses planned educational opportunities to enable individuals to act consciously in matters related to health.

In addition, the BNCC asserts that educating for health has been a challenge in terms of the possibility of guaranteeing effective learning and transforming attitudes and lifestyle habits.

Therefore, society urgently needs to help individuals become statistically literate citizens capable of making informed decisions. In this sense, schools have much to contribute to this initiative from the initial grades, promoting the investigative spirit and critical capacity in students, as recommended by official documents (Brasil, 1997; 2017).

We also highlight that "health" was already one of the cross-cutting themes introduced by the PCN at the end of the 1990s. These themes gained greater prominence at BNCC with the transversal contemporary themes [Temas Contemporâneos Transversais – TCT] (Brasil, 2019), and now the health theme also covers food and nutritional education.

According to Cazorla and Giordano (2021), the contemporary term highlights the current nature and relevance of transversal themes for basic education, as they directly affect the student's life on a local, regional, and global scale. The authors emphasize that statistics teaching can play an essential role in implementing TCT as long as it is anchored in statistical literacy principles involving students in the research process.

However, Lima *et al.* (2022) identified some weaknesses in initial and continuing teacher education courses for the development of skills and competencies related to statistics listed in the BNCC, suggesting the need to update and equip professionals to implement active methodologies, especially proposals based on collaborative projects, completing the investigative research cycle.

Regarding the research on statistical education in the initial years, Lima, Paula and Giordano (2022) surveyed seven Brazilian journals between 2011 and 2019, concluding that this is still a small quantity and suggesting the need to develop other studies to expand this research base.

Furthermore, other research shows that difficulties persist in statistics learning in the initial years, such as that of Azerêdo and Arruda (2020), who analyzed the knowledge of students in a 3rd-grade elementary school class about column graphs and observed students' difficulties in reading graphs, especially solve problem situations. Evangelista, Guimarães and Oliveira (2022) carried out a teaching intervention involving the construction of simple and double-entry tables with 2nd and 5th elementary school graders, verifying that intentional and systematic teaching with real data helps students construct and overcome difficulties.

Similarly, several educators (e.g., Frankenstein, 1995; GAL, 2002; Skovsmose, 2000; Gutstein, 2003; Monteiro; Carvalho, 2021) defend the teaching of mathematical or statistical content that makes sense to students, encouraging a critical approach, evoking social, political, and everyday issues to enable engagement, discussion, and protagonism.

In this sense, we identified some initiatives, including using teaching sequences to teach statistical content in basic education from the perspective of the investigative cycle and statistical literacy.

For example, Santos and Santana (2020) and Silva and Couto (2021) analyzed the elements that favored statistics teaching based on a sequence in which students actively participated in the planning and development of the activity, collecting, analyzing, and communicating their data, which promoted the exercise of citizenship in collective decision-making with colleagues and teachers, strengthening the learning of statistical concepts. Cazorla, Magina and Santana (2021), in turn, evaluated the potential and limitations of a sequence to teach measures of central tendency, presenting several classroom activities involving students.

Baccar's studies *et al.* (2022) and de Pontes, Souza and Castro (2021) focused on teachers who teach statistical content in the initial years. The former pointed out that the development of didactic sequences allowed learning opportunities, which favored the teachers'

professional development. Pontes, Souza and Castro (2021) indicated that, after the training, teachers began to develop proposals using the investigative cycle methodology, which contributed to the statistical literacy of their students.

In this way, we can observe that activities involving statistical concepts, in which students actively participate in the research process, reflecting on the problem, and collecting and analyzing their own data, have benefited both students and teachers.

In this context, this article aims to present a pedagogical practice developed with an elementary school 5th-grade class based on the participation of a basic education teacher in an experiential learning cycle (Kolb, 1984) when attending a postgraduate statistics subject at a public higher education institution.

The article is structured into an introduction and four sections. In the first section, we present the theoretical foundations that guided the investigation and construction of the teaching sequence (TS); in the second, the methodological design; in the third, we analyze the TS developed in light of theoretical references; and in the fourth section, we weave considerations and implications of the experience.

Experiential Learning Cycle

The experiential learning cycle proposed by Kolb (1984) involves four stages: concrete experience, reflective observation, abstract conceptualization, and active experimentation –supported by the belief that knowledge is not independent, nor can it be transferred to someone, but is created by transformed experience, as we can see from the description of each stage of the cycle.

In the first stage, concrete experience, the course participants play the role of students. In this research, we want him to have tangible experience and understand the elaboration and development of the teaching sequence (TS).

In the next stage, reflective observation, course participants collectively reflect on their experience, analyzing the answers they gave, discussing conceptual errors and/or educational gaps they identified, besides possible difficulties their students would have with the content to be taught and ways to provide them with constructive feedbacks, i.e., they reflect on the object of study from different angles.

The third stage is dedicated to elaborating an activity/task, in this case, a TS on a statistical content foreseen in the curriculum for one of its classes, which is then developed in the last stage of the cycle, called active experimentation.

In this article, we will concentrate on the last stage of the experiential learning cycle and analyze the TS to develop statistical literacy using the investigative cycle.

Statistical Literacy

According to Ben-zvi and Garfield (2004), the community of researchers on statistics teaching advocates that it should focus on developing students' literacy, reasoning, and statistical thinking.

Like delMas (2002), we understand that the content of these three constructs is not independent and that statistical literacy encompasses statistical thinking and reasoning.

It is possible to find several definitions of statistical literacy in academic literature.

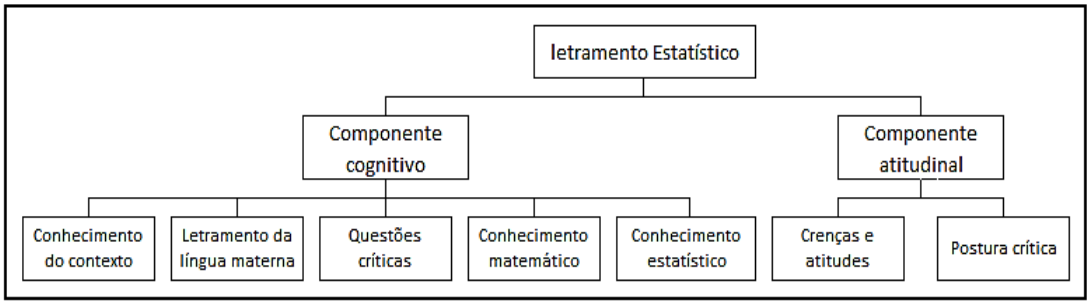
In this article, we adopt Gal's (2002) perspective, who considers that an ordinary citizen literate in statistics is capable of reading statistical information, which implies having basic mathematics (mathematical knowledge) and statistics (statistical knowledge) tools that allow him to recognize the appropriate use of statistical summaries, tables, and graphs. Also, they must be able to formulate questions that present other perspectives of analysis (critical questions), which reveals

that they must know the reality in which the data were generated (knowledge of context), in addition to mastering their mother tongue (literacy). These five pieces of knowledge comprise what Gal (2002) calls the cognitive component.

The reader must also be able to recognize the origin of the data and how it was produced, i.e., whether by institutional or scientific research bodies, whether guided by standards of ethical conduct or other interests.

Gal (2002) also considers the attitudinal component: how beliefs and attitudes can influence our reading and the critical stance; that is, how we react to information and what decisions we make based on it (Figure 1).

FIGURE 1: Gal Statistical Literacy Model.



Source: Built by the authors based on Gal's (2002) model.

We consider this model complete and valuable to guide the construction of basic education teaching sequences from the investigative cycle perspective.

Investigative Cycle

The investigative cycle – PPDAC (Wild; Pfannkuch, 1999) is organized into five phases: problem, planning, data, analysis, and conclusion. It is a teaching methodology that investigates problem situations in the social and cultural context of students, schools, and communities. With this methodology, teachers can develop interdisciplinary teaching sequences, enabling students to participate in all phases of the investigative cycle actively.

In the first phase, problem (P), the teacher and students discuss some issue or problem they are facing that needs to be solved.

The second phase is planning (P), the time to plan the actions to be developed in the search for a possible solution to the problem. Thus, the teacher and students collaboratively start with the research question and set the objective, thinking together about the appropriateness of using research materials or instruments: investigation form, interview, questionnaire, and documents from school or student productions, among other instruments. With this, they define the procedures, tools, and organization and choose the data collection instrument that will be used.

The third phase corresponds to the collection and organization of data (D). In the fourth phase, students and the teacher will analyze the collected data (A), transforming the raw data into tables, graphs, and statistical measures to extract relevant information.

In the fifth phase of the investigative cycle, students must extract conclusions (C) and answer the research question. This conclusion can be presented and shared with the class, school, or school community in a conversation circle, seminar presentation, science fair, Facebook/blog/school newspaper, among other possibilities, to communicate the results.

Methodology

This exploratory study[5] used a teaching sequence constructed in light of the assumptions of the investigative cycle and statistical literacy. For qualitative data analysis, we used data triangulation (Araújo; Borba, 2013), considering aspects to avoid observation bias: some of the dialogues recorded in the logbook of one of the researchers during the TS development, excerpts from students' activities and the report presented in the course to identify

[5] CAAE: 59403322.3.0000.8142

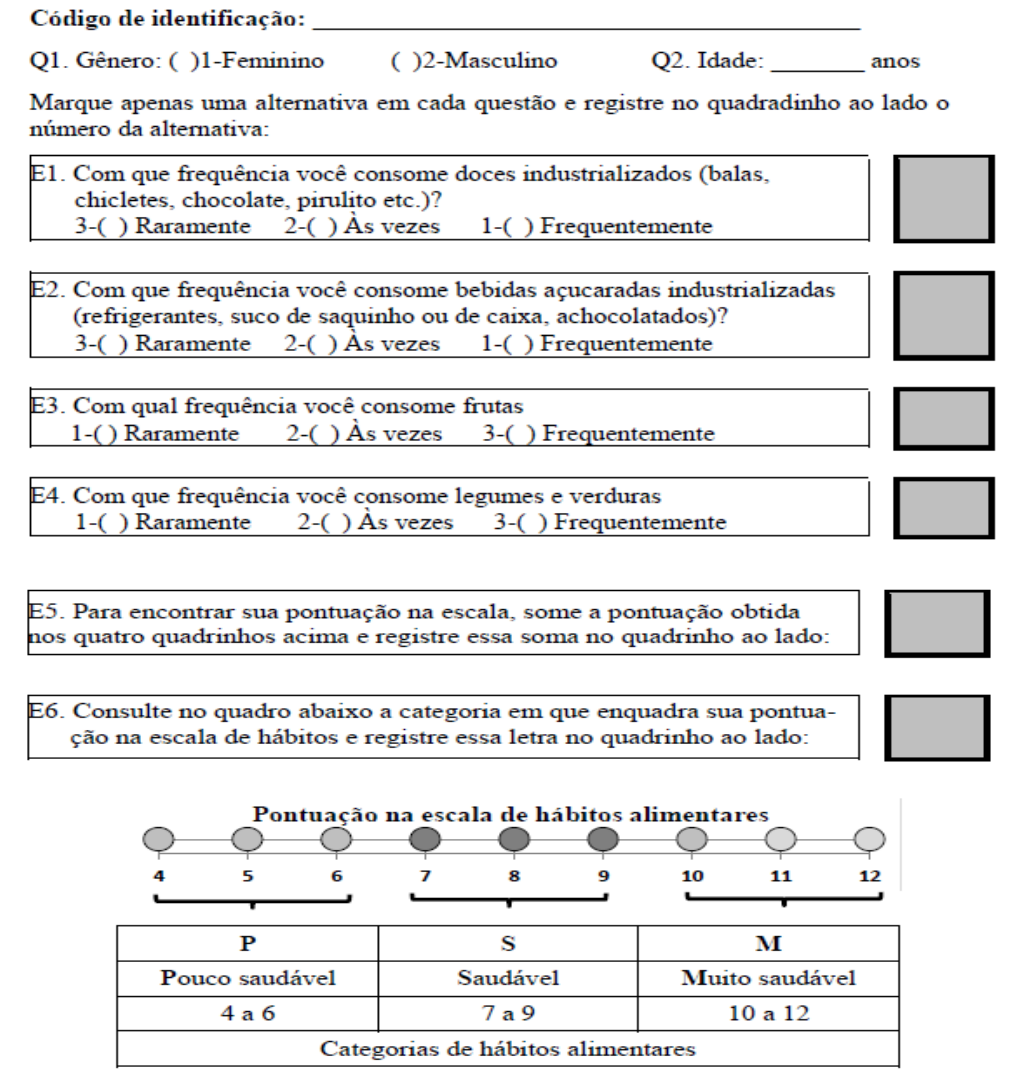
signs of the development of statistical literacy and the potential of the activity developed.

The research was carried out at a public school of the early years, which, in 2022, served 426 students from the 1st to 5th grades, in the morning and afternoon shifts, from the neighboring peripheral areas formed by socially vulnerable families. This educational institution has a partnership with a non-governmental organization.

Twenty 5th graders from the afternoon shift, aged between 10 and 13, participated. Only 12 students were present due to rain and flooding on the day of the data collection instrument completion.

We used a questionnaire that preserved students' identity, composed of two variables (gender and age) and a Likert-type eating habits scale, constructed based on Cazorla, Silva-Júnior and Santana's (2018) scale, referring to the frequency of consumption of four food groups (items), two with a negative meaning (E1-processed sweets and E2-industrialized sugary drinks) and two with a positive meaning (E3-fruits and E4- greens and vegetables), whose response categories were: rarely, sometimes, and frequently, which were assigned scores of 1, 2, and 3 for items with a positive meaning, and 3, 2, and 1 for those with a negative meaning. Healthy habits always got a higher score, and less healthy habits got a lower score. Students should select an alternative and register the number in the square to the right. To calculate the score on the scale, one adds up the scores (E5), which ranged from 4 to 12. From this score, the "variable type of diet" (E6) was created, with the categories: Unhealthy (score from 4 to 6), Healthy (score from 7 to 9), and Very healthy (score from 10 to 12), as seen in Figure 2.

FIGURE 2: Instrument used in TS Eating Habits.



Código de identificação: _____

Q1. Gênero: ( )1-Feminino ( )2-Masculino Q2. Idade: _____ anos

Marque apenas uma alternativa em cada questão e registre no quadradinho ao lado o número da alternativa:

E1. Com que frequência você consome doces industrializados (balas, chicletes, chocolate, pirulito etc.)?
3-( ) Raramente 2-( ) Às vezes 1-( ) Frequentemente

E2. Com que frequência você consome bebidas açucaradas industrializadas (refrigerantes, suco de saquinho ou de caixa, achocolatados)?
3-( ) Raramente 2-( ) Às vezes 1-( ) Frequentemente

E3. Com qual frequência você consome frutas
1-( ) Raramente 2-( ) Às vezes 3-( ) Frequentemente

E4. Com que frequência você consome legumes e verduras
1-( ) Raramente 2-( ) Às vezes 3-( ) Frequentemente

E5. Para encontrar sua pontuação na escala, some a pontuação obtida nos quatro quadrinhos acima e registre essa soma no quadrinho ao lado:

E6. Consulte no quadro abaixo a categoria em que enquadra sua pontuação na escala de hábitos e registre essa letra no quadrinho ao lado:

P	S	M
Pouco saudável	Saudável	Muito saudável
4 a 6	7 a 9	10 a 12
Categorias de hábitos alimentares		

Source: Built by the authors.

The TS "Eating Habits" was experienced in the master's degree course and was adapted for teaching in the initial years, being developed by one of the authors, a master's degree student and teacher in the initial years. To do this, she contacted the class coordinator and teacher, who checked its suitability for the school curriculum and the mathematical skills prescribed to be worked on in the 3rd quarter with the class:

> (EF05MA24) Interpret statistical data presented in texts, tables, and graphs (columns or lines), referring to other areas of knowledge or contexts, such as health and traffic, and produce texts to synthesize conclusions;
> (EF05MA25) Carry out research involving categorical and numerical variables, organize data collected through tables, column, pictorial, and line graphs, with and without the use of digital technologies, and present a written text about the purpose of the research and synthesis of results. (Brasil, 2017, p. 297)

The TS was developed at the school in 6h/mathematics class and 4h/science class, distributed in five 2h-class meetings.

In the first meeting, we told students what an opinion survey was and asked whether they would like to participate in a survey about their eating habits.

The research question (P) asked whether the class's diet was healthy and whether the boys' diet was healthier than the girls'.

Individually, the students filled out a questionnaire about their eating habits (D) and, in groups, they began to reflect on these habits, based on a guided reading of short, well-illustrated texts about the consumption of industrialized sweets (Group 1), industrialized sugary drinks (Group 2), fruits (Group 3), greens and vegetables (Group 4) and types of food (Group 5), which were prepared by the authors (P).

The data (D) from the questionnaires filled out by the students were organized in a database (spreadsheet), with a copy being given to each group, which worked on its variable, counting the number of times each category appeared and filling in the table of simple frequency distribution (FDT). Students then transposed this data into a bar graph. Students also received a dot diagram framework to register the total score and thus have elements to answer the two research questions.

We chose to have the frameworks ready because of the limited time for the activity, and it was in our interest that the students were focused on

interpreting the data in each group and all together, to have an overview of the class's diet.

After completing the tables and graphs, the students proceeded with their interpretation (A), reflecting on the analyzed variable (food group).

At the end, in a conversation circle, discussions and reflections were shared that culminated in the conclusion (C), with the answer to the questions.

Results and Discussion

In the (P) phase, we opened a conversation circle for each group to share discussions and reflections with other colleagues about the readings and discussions of the printed material.

At this moment, several interesting reflections and discoveries emerged, such as the following statements from the students: "That's why my mother blends chayote in the blender when my grandmother has high blood pressure" (says a student upon hearing her colleague say that she learned that chayote is good for blood pressure) and "I'm going to tell my grandmother to eat a lot of chayote because it's good for swelling and she has a swollen leg." Another student also commented that he discovered soda has a lot of sugar during the activity.

From these extracts from the research participants' statements, we verified that the TS allowed students to relate the information in the texts (literacy content), in this case, about the benefits of a healthy diet, with the reality they experience, contributing to the development of the context knowledge, both components of statistical literacy. We also observed the importance of the TS for students to discover the amount of sugar in soft drinks.

After the conversation circle, the students resumed their group work. Figure 3 presents the simple FDT carried out by Group 2, which worked with the consumption of sugary drinks. We observed that the

script developed was identical for the other groups, each working with their own variable.

FIGURE 3: Example of simple FDT completed by Group 2.

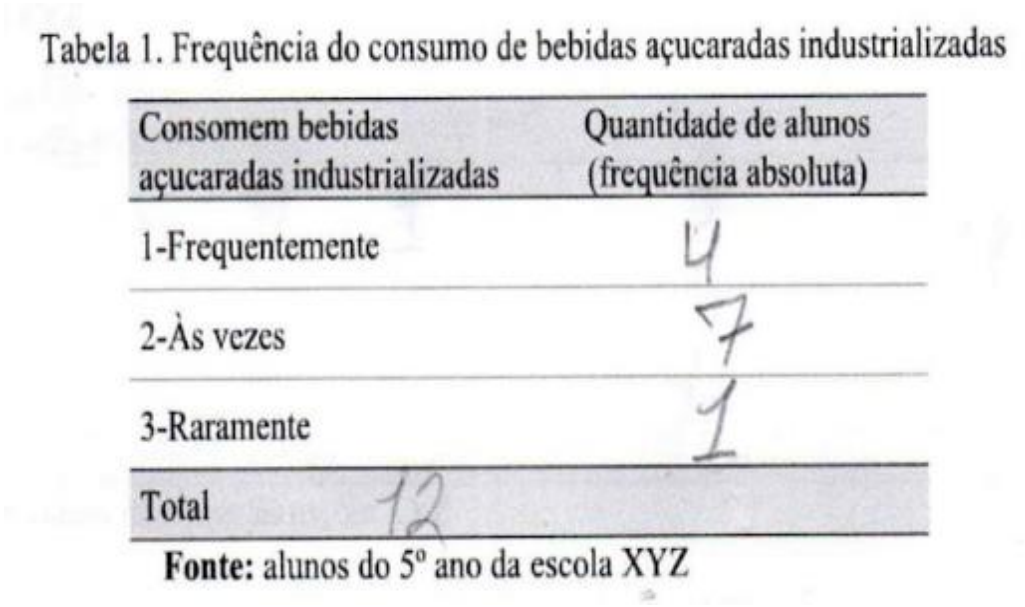


Tabela 1. Frequência do consumo de bebidas açucaradas industrializadas

Consomem bebidas açucaradas industrializadas	Quantidade de alunos (frequência absoluta)
1-Frequentemente	4
2-Às vezes	7
3-Raramente	1
Total	12

Fonte: alunos do 5º ano da escola XYZ

Source: Report presented in the statistics subject.

We explained the essential elements of the tabular representation (title, source, categories, and frequency) and how to complete the table, contents of mathematical and statistical knowledge of statistical literacy mobilized in (A).

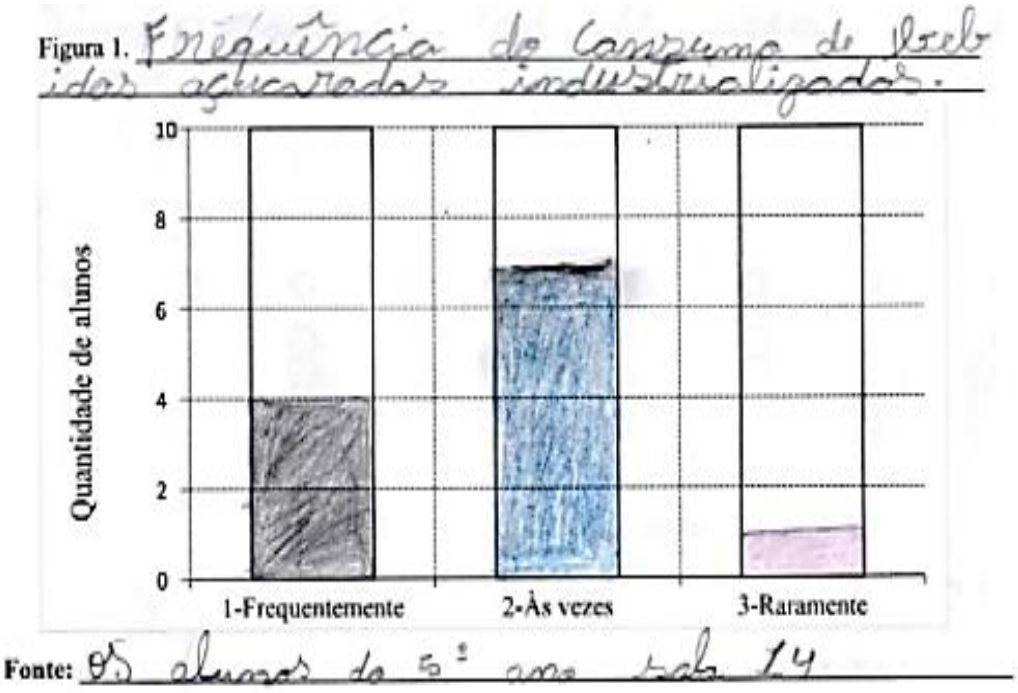
The students realized that the research results showed that four consumed sugary drinks frequently, seven consumed them sometimes, and one rarely had them.

Like the variable analyzed by the other groups, the consumption of sugary drinks is an ordinal qualitative variable. A type of proper graphical representation is the bar graph. Figure 4 shows the graph created by students in Group 2.

In this representation, students had to give the graph a title and write the data source. We clarify that due to our –the researchers– methodological choice, the graph framework was ready-made, with the defined scale, the bars with the same width, and the categories

explained so that the students could only paint the number of rectangles according to the frequency (number of respondent students) in each category. The objective was for students to transfer information from the table to the graph and understand that both types of representation presented the same information.

FIGURE 4: Example of a bar graph created by Group 2.



Source: Report presented in the statistics subject.

We observed that even though the curriculum prescribes tables and graphs content since the 1st grade of elementary school, students did not show skills and autonomy to construct them since all requested guidance to complete the activities. This lack may be a consequence of the closure of schools during the COVID-19 pandemic in 2020 and 2021 when teachers and students faced various teaching and learning difficulties. SAEB 2021 corroborated the data, revealing that in all subjects assessed, in all grades, there was a drop in student proficiency when compared to 2019 (Brasil, 2022; Feitosa; Gitirana; Rodrigues, 2023).

When developing the TS, we also noticed that the students found it hard to write; despite being in the 5th grade, some clearly still did not master the alphabetic writing system, as we can see when they separate the syllable of the word *bebida*, [drink] in Figure 4. SAEB 2021 confirms an average reduction of 7 points on the Portuguese language proficiency scale compared to data from the 2019 SAEB. During the development of the TS, we did not intervene in the students' spelling; these interventions were carried out by the class teacher in the Portuguese language classes.

Senkevics and Alcântara (2023) highlight that evidence produced in several countries indicates that students made little or no progress during the health crisis and that the leading national and international studies suggest significant learning losses, increased educational inequalities, increased school dropouts, and negative impacts on the students' and teachers' well-being and mental health.

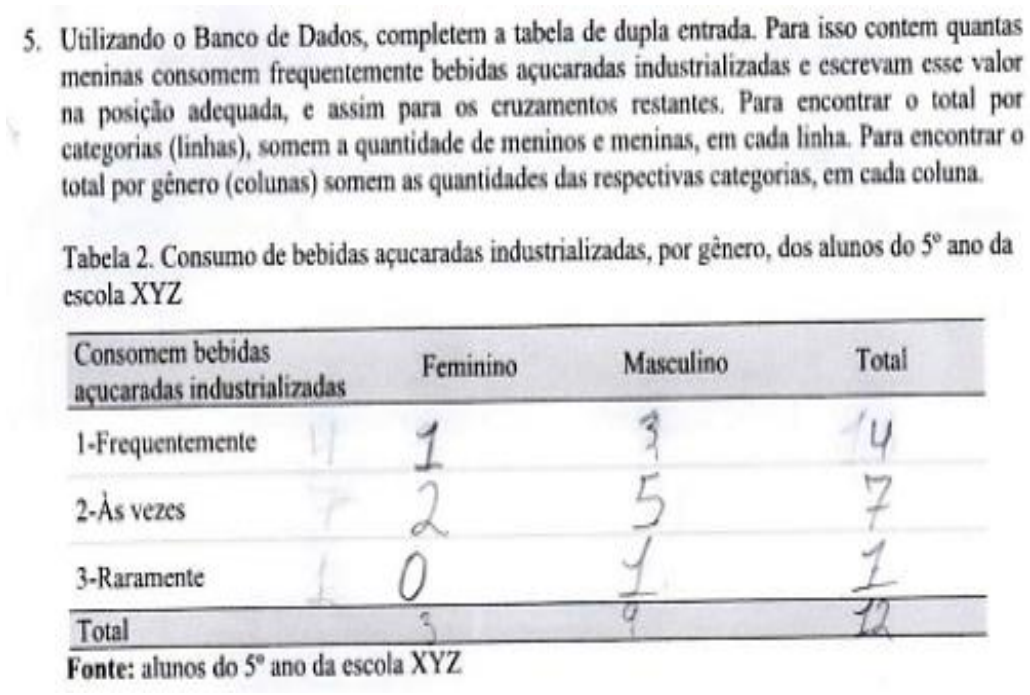
We created an interpretative question to ensure the students understood what the graphic representation was saying.

Group 2's answer, "We thought that the consumption of sugary and processed drinks was frequent in the 5th-grade F class, but the research [showed] that this consumption occurs just sometimes," shows that their perception differed from the research. This misunderstanding allowed us to discuss with the class the importance of knowing the data to make statements or believe in the information that comes to us through friends, social networks, TV, and newspapers (contents of the attitudinal component of statistical literacy), or even to contrast our opinions and change our prejudices, ideas, or formed beliefs.

We also observed that students looked for the highest frequency (mode) to support their answer, concluding that the consumption of industrialized sweets, industrialized sugary drinks, and fruit has a higher frequency in the option sometimes. The consumption of vegetables is more usual in the *frequently* option.

It was necessary to construct the double-entry DFT to answer the research question "whether girls' diets were healthier than boys'" based on the consumption of a food group. Figure 5 presents the consumption of sugary drinks by gender.

FIGURE 5: Example of a double-entry table.



5. Utilizando o Banco de Dados, completem a tabela de dupla entrada. Para isso contem quantas meninas consomem frequentemente bebidas açucaradas industrializadas e escrevam esse valor na posição adequada, e assim para os cruzamentos restantes. Para encontrar o total por categorias (linhas), somem a quantidade de meninos e meninas, em cada linha. Para encontrar o total por gênero (colunas) somem as quantidades das respectivas categorias, em cada coluna.

Tabela 2. Consumo de bebidas açucaradas industrializadas, por gênero, dos alunos do 5º ano da escola XYZ

Consomem bebidas açucaradas industrializadas	Feminino	Masculino	Total
1-Frequentemente	1	3	4
2-Às vezes	2	5	7
3-Raramente	0	1	1
Total	3	9	12

Fonte: alunos do 5º ano da escola XYZ

Source: Report presented in the statistics subject.

To create this table, we explained to the students that, in addition to knowing how often students consumed sugary drinks, we also wanted to know whether girls consumed these drinks less frequently than boys. With our guidance, the students could fill out the double-entry table and took a stand concerning the research question, generally stating yes, "because the total number of girls was three and boys, nine."

We observed that students base their answers by looking at the total number of girls and boys as if the smaller number of girls implied less frequent consumption of sugary drinks. Here, we could verify that the students did not yet know how to construct double-entry tables nor how to read them because, to answer the question, they needed to compare how

many girls frequently consume those drinks compared to the total number of girls, i.e., one in three, with the proportion of boys, which was two in nine, given that there is a student who rarely drinks them.

This occurred in all groups; students always focused their analysis on the highest absolute frequency, not establishing proportionality in each gender.

Figure 6 discloses the results of the four variables together, which allows us to verify that boys tend to have slightly healthier habits than girls by frequently consuming Fruits (2/9 versus 0/3), Greens and Vegetables (4/9 versus 1/3) and rarely Sweets (2/9 versus 0/3) and Sugary Drinks (1/9 versus 0/3).

FIGURE 6: Overview of the results of the four groups.

Sentido negativo

Frequência	Doces industrializados			Bebidas açucaradas industrializadas		
	Feminino	Masculino	Total	Feminino	Masculino	Total
Raramente (3)	1	2	3	0	1	1
Às vezes (2)	2	5	7	2	5	7
Frequentemente (1)	0	2	2	1	3	4
Total	3	9	12	3	9	12

Sentido positivo

Frequência	Frutas			Legumes e verduras		
	Feminino	Masculino	Total	Feminino	Masculino	Total
Raramente (1)	2	1	3	1	3	4
Às vezes (2)	1	6	7	1	2	3
Frequentemente (3)	0	2	2	1	4	5
Total	3	9	12	3	9	12

Source: Report presented in the statistics subject.

Until that moment, the groups that had worked with types of food had a partial view of the problem, as they had analyzed a single variable. Only Group 5 analyzed the types of food, being the only one capable of answering about the quality of the class's eating habits.

Figure 7 shows the answer of this group, with the conclusion that the class's diet was healthy.

FIGURE 7: Group 5's answers about the class's type of food.

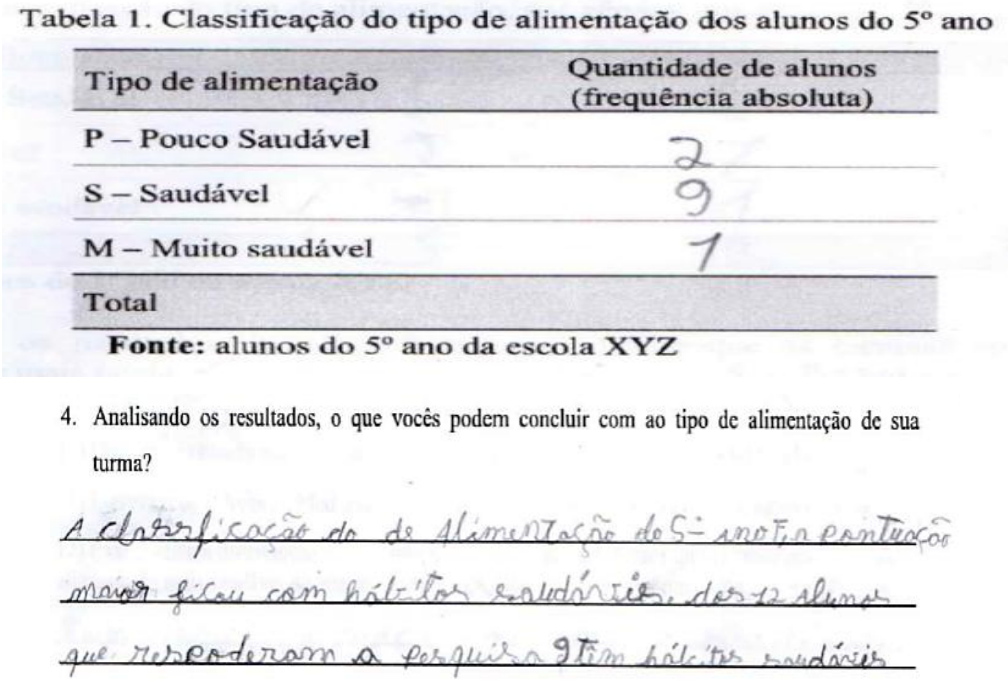


Tabela 1. Classificação do tipo de alimentação dos alunos do 5º ano

Tipo de alimentação	Quantidade de alunos (frequência absoluta)
P – Pouco Saudável	2
S – Saudável	9
M – Muito saudável	1
Total	

Fonte: alunos do 5º ano da escola XYZ

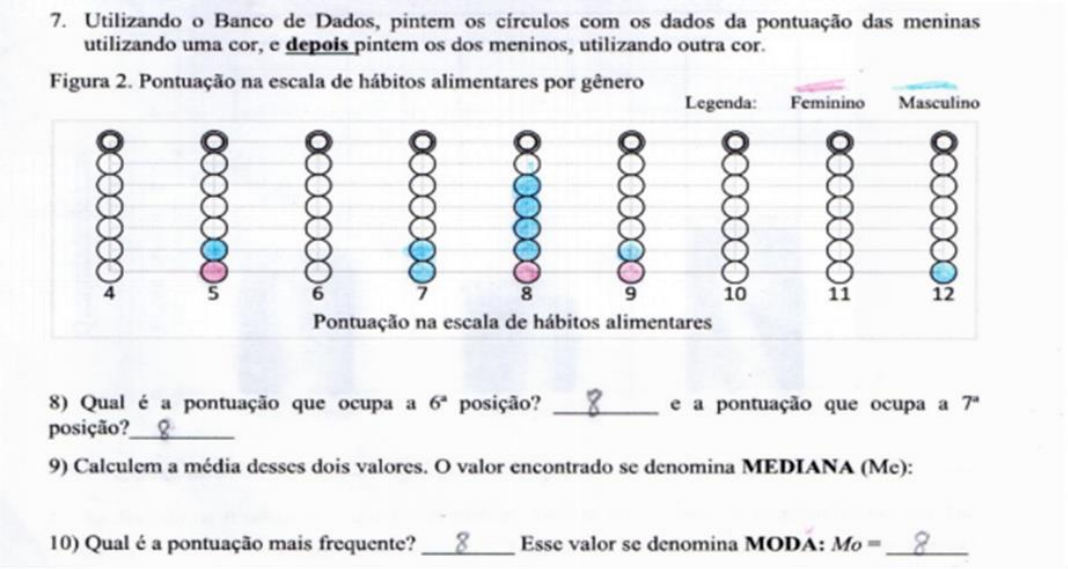
4. Analisando os resultados, o que vocês podem concluir com ao tipo de alimentação de sua turma?

A classificação do de alimentação do 5º ano a pontuação maior ficou com hábitos saudáveis, dos 12 alunos que responderam a pesquisa 9 tem hábitos saudáveis

Source: Report presented in the statistics subject.

So that all groups could answer whether the class's diet was healthy, students had to analyze the score on the scale. Figure 8 illustrates the data configuration. They were also asked to identify the mode and find the median.

FIGURE 8: Distribution of scale scores by gender.



Source: Report presented in the statistics subject.

The graph in Figure 9 allows us to visualize the data distribution, with values ranging from 4 to 12. The general score ranged from 5 to 12; the boys' score (represented by the blue color) from 5 to 12, and the girls' score (represented by the pink color) from 5 to 9. One boy and one girl scored 5, indicating unhealthy habits; seven boys and two girls scored between 7 and 9, i.e., a healthy diet, and only one boy scored 12 points, indicating a very healthy diet.

Once again, students looked at the absolute instead of the relative values because "boys have a healthier diet than girls because they occupy the 7th, 8th, 9th, and 10th positions in score 8 on the scale". We found that one group said no because girls scored higher in the healthy category.

To answer the general research question about the quality of the class's food, we found that students looked at the mode, concluding that their class has a score of 8 on the scale, and this value corresponds to a healthy diet.

Conclusion

The TS presented here constituted an educational opportunity to enable students to act consciously towards their diet, a subject included in the health contemporary transversal theme [Tema Contemporâneo Transversal Saúde].

The teaching sequence was designed based on the investigative cycle phases (Wild; Pfannkuch, 1999) and supported by the assumptions of statistical literacy (Gal, 2022). We also used texts with scientific information from reliable sources and enabled effective student participation in a scientific investigation that generated data that teachers and students analyzed critically. This work fostered reflection on children's and adolescents' eating habits, a relevant public health issue because it addresses topics related to their realities.

After completing the questionnaire, one of the students requested permission to review the answers because:

> He needed to change the options he had marked on the form, justifying that his mother always advised him on healthy eating habits. According to her, he should eat plenty of greens, fruits, and vegetables and reduce the consumption of sweets and soft drinks. With that, he was already starting to change his eating habits, following his mother's instructions. Based on the student's reflection, we allowed him to change answer options, and upon completing the form, he found he was having a healthy diet. (Excerpt from the report presented in the postgraduate course)

We observed that, depending on the school's reality conditions, it is not always possible to have the time necessary to genuinely implement an investigative cycle.

In the case of this teaching sequence, this would imply that we chose the topic together with the students, but the strategy adopted based on the guided reading of texts related to the topic served well in the first phase of the investigative cycle (P), so much so that the students could connect some benefits of healthy foods to controlling blood pressure, or to raise awareness of the amount of sugar contained in industrialized sugary drinks.

This phase could also have been covered by inviting a professional to lecture on the topic, always with guided readings so that they could interact with the speaker. These possible interesting strategies generate engagement, as shown in Lôbo and Cazorla (2019).

The second phase (P), which the class teacher, the pedagogical coordinator, and the postgraduate teachers carried out collaboratively, highlights the care of promoting research at school, focusing on school content prescribed by the curriculum and with the engagement of the school team.

The students participated effectively, carrying out the activities and correctly concluding that the boys' diet was healthier than the girls', although they did not realize the need to establish proportional relationships.

Throughout the development of TS, we realized that knowledge of the two components of statistical literacy of the model proposed by Gal (2002) was activated, in particular, the skills and abilities of reading and mathematics based on the understanding of statistical content, such as opinion research, variables, graphs, tables, median, and mode and knowledge of the context, review of attitudes, beliefs, and critical stance.

We note that although percentages other than 10%, 25%, 50%, 75%, and 100% are not taught in the 5th grade, it does not prevent teachers from fostering the comparison of proportions between groups, as shown *by* Watson *et al.* (2018). We also highlight the importance of the ability to read double-entry tables, as they can be read both by

comparing genres (columns) and categories (rows), which is the basis for the development of inferential reasoning and argumentation, as shown in Cazorla, Utsumi and Oliveira (2020).

If students already know how to calculate percentages, we recommend calculus of percentages (relative frequency) instead of using absolute frequency, as this eliminates the effect of groups having different sizes, which greatly facilitates the comparison required in table interpretation, such as in Figure 6.

We consider that the activities developed contributed to making assertive decisions regarding eating habits, and we believe that they will support new readings, understandings, representations, awareness-raising, and future decisions based on statistical information.

With this type of TS, we can work in an interdisciplinary and contextualized way, achieving student engagement and learning, including for those who generally do not actively participate in classes.

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