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Statistical literacy and critical competence in a creative learning environment[1]

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ABSTRACT

This paper aims to analyze the development of statistical literacy with regard to reading, interpretation and critical analysis of statistical graphs in students of the 1st year of high school. We looked for a space that we considered ideal for this development and found support for this pedagogical approach in the precepts of creative learning. In order to interpret the results, we rely on Narrative Analysis. Data analysis showed that the groups of students passed through the three highest levels of statistical literacy, according to the classification used in this study. We affirm that reading stand at the highest levels, as students sought to read between the data, that is, they compared results, established mathematical relationships and formulated questions beyond the existing data. Furthermore, the students were also concerned about the aspects of society portrayed in the graphic representations, showing social inequalities presented there, that is, they built socio-political criticisms.

KEYWORDS: Critical analysis; Graf and tables; Narrative analysis.

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Letramento estatístico e competência crítica em um ambiente de aprendizagem criativa

RESUMO

Este artigo objetiva analisar o desenvolvimento do letramento estatístico no que se refere a leitura, interpretação e análise crítica de gráficos estatísticos de um grupo de alunos do 1º ano do Ensino Médio. Buscamos um espaço que julgamos ideal para esse desenvolvimento e encontramos nos preceitos da aprendizagem criativa amparo para essa abordagem pedagógica. Para interpretação do material, apoiamo-nos na Análise Narrativa. A análise dos dados mostrou que os grupos de estudantes transitaram pelos três níveis mais elevados de letramento estatístico, segundo a classificação que empregamos neste estudo. Afirmamos que a leitura residiu nos níveis mais elevados, pois os estudantes buscaram fazer leitura entre os dados, ou seja, compararam resultados, estabeleceram relações matemáticas e formularam questionamentos para além dos dados existentes. Ademais, os estudantes também se mostraram preocupados com os aspectos da sociedade retratados nas representações gráficas, mostrando desigualdades sociais ali apresentadas, ou seja, construíram críticas sociopolíticas.

PALAVRAS-CHAVE: Análise Crítica; Gráfico e tabelas; Análise narrativa.

Alfabetización estadística y competencia crítica en un entorno de aprendizaje creativo

RESUMEN

Este artículo tiene como objetivo analizar el desarrollo de la competencia de alfabetización estadística en lo que respecta a la lectura, interpretación y análisis crítico de gráficos estadísticos en estudiantes del 1° año de secundaria. Buscamos un espacio que consideráramos ideal para este desarrollo y encontramos apoyo para este enfoque pedagógico en los preceptos del aprendizaje creativo. Para interpretar el resultado, nos apoyamos en el Análisis Narrativo. El análisis de los datos mostró que los grupos de estudiantes pasaron por los tres niveles más altos de alfabetización estadística, según la clasificación utilizada en este estudio. Afirmamos que la lectura estuvo en los niveles más altos, ya que los estudiantes buscaron leer entre los datos, es decir, compararon resultados,

establecieron relaciones matemáticas y formularon preguntas más allá de los datos existentes. Además, los estudiantes también se preocuparon por los aspectos de la sociedad retratados en las representaciones gráficas, mostrando las desigualdades sociales allí presentadas, es decir, construyeron críticas sociopolíticas.

PALABRAS CLAVE: Análisis critico; Gráficos y yablas; Análisis narrative.

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Introduction

This paper is the product of a project developed with 1st-year high school students, aiming to provide a learning space which promotes the development of statistical literacy in terms of reading, interpretation and critical analysis of statistical tables and graphs.

This space that we call favorable to the development of statistical literacy was organized based on the principles of Creative Learning, which argues that the meanings constructed by the students occur through experience, characterized by thinking, creating, inventing and critically reflecting.

Creative Learning is understood as a process which begins with an activity involving objectives and simple tools, but has the potential to grow and expand to more complex applications and broader understandings. In addition, Creative Learning sees the possibility of multiple paths to be approached in creating a project, in other words, it encompasses a diversity of creative methodologies in the learning process (Papert, 2008).

Paulo Freire (1993), emphasized the importance of students to realize, since the beginning, that studying requires effort and commitment, but it can also be enjoyable and intellectually responsible, corroborating with certain pedagogies that emphasize fun and affection. Skovsmose (2006) explained how Mathematics Education can contribute to what Freire (1993) defended and, thus, develop creativity, logical

reasoning and analytical skills. According to Skovsmose (2006), it becomes possible when the problems addressed in the classroom have importance to the students, meaning they have objective relevance to them as the problems are connected to their experiences in the world and enable political and social engagement.

In this context, we lean on Papert (2008), who explains that there is a multitude of pedagogical approaches which have connections with the principles of Creative Learning for the elaboration of the activity described here. As our background, we used the concept of creative learning, which is theoretically grounded in the ideas of learning advocated by the educator Paulo Freire (2011). Creativity here isn't understood as an "especial" skill of the individual in creating a product or process, but it's related to what Winnicott (2011) asserted in the context of the teaching and learning process. According to the aforementioned author, creativity is associated with creative living, and, in terms of existence, it should be part of everyone's life experiences. To be creative, a person must exist, have a sense of existence and a positioning toward the reality they're observing or analyzing.

In the light of this, this qualitative study aims to analyze the development of statistical literacy and critical competence in sixteen 1st-year high school students, based on a project structured according to the principles of Creative Learning for reading, interpreting and critically analyzing statistical tables and graphs. In sequence, we'll briefly present the theoretical framework which we rely on for data analysis.

Statistical literacy and critical competence

Campos, Wodewotzki and Jacobini (2011) define literacy (which we treat as a synonym for statistical literacy) as a competence related to the study of arguments that use statistics as a reference, meaning the hability to argue by using statistical terminology correctly. They also include basic skills

for understanding information, which require the capacity to organize data, construct tables, understand symbols, vocabularies, concepts and probability as a measure of uncertainty.

Wallman (1993) defines statistical literacy as:

> the capacity to understand and critically evaluate the statistical results which permeate our daily lives – along with the capacity to appreciate the contributions that statistics can make to public and private decisions, both professional and personal. (Wallman, 1993, p. 1)

From these definitions of statistical literacy, it can be inferred that to understand statistical information, it's not enough to have only mathematical calculations skills, because it's necessary to consider the context in which the data are presented and engage in a critical analysis of them. Therefore, it can be said that merely having the ability to calculate specific statistical measures is not enough, but it's also necessary to know how to explain why those measures were used in a specific context. Students need to have a clear understanding of why a specific statistical measure or graphical representation was chosen over another and be able to explain the type of interpretation and understanding of the data it provides to the reader.

Besides, statistical literacy is associated with an individual's posture in situations where statistical knowledge is used to communicate a message inserted in a specific context. However, to do it, it's necessary to have knowledge of statistical tools, as well as an understanding of their potentialities and weaknesses.

Watson and Callingham (2003) explain that the development of this statistical is comprised of six levels, which are represented in Table 1.

TABLE 1 – Levels of Statistical Literacy

IDIOSYNCRATIC	The student demonstrates a basic mathematical skill associated with reading and counting (one by one) values in a table, but he is unable to use simple terminology.
INFORMAL	The student demonstrates the ability to use basic elements of terminology, perform basic calculations from tables and graphs.
INCONSISTENT	The student demonstrates using statistical concepts and being able to draw some conclusions without justifications.
NON-CRITICAL CONSISTENT	The student demonstrates ability associated with mean, simple probability, variation and graphical interpretation.
CRITICAL	The student demonstrates the ability to develop critical opinion, as questions in some contexts, use appropriate terminology and interpret quantitatively.
MATHEMATICALLY CRITICAL	The student demonstrates sophisticated mathematical skills to perform many tasks, develop a critical posture, make interpretations and ask questions.

Source: Watson and Callingham (2003, p. 24)

Campos and Perin (2020) explain that statistical literacy is related to critical competence. This competence was presented by Skovsmose (2014), who distinguished it, based on many characteristics, such as dialogue, democracy, reflective knowledge, among other. according to the author, critical competence is only exercised if there is a focus on dialogue among students and the teacher in the educational environment, if there are democratic attitudes in the classroom, and if knowledge inspires reflection. Another fundamental aspect for developing critical competence

is bringing everyday problems from the community and social issues involving mathematics into the classroom for argumentation.

Statistical literacy carries within itself a critical dimension related to the idea of forming statistically literate citizens, referring to the development of skills to act as a literate individual in the information age. However, for critical competence, criticism is at the center of the teacher's pedagogical planning. The students' problem and their contexts are the driving forces behind the issues to be addressed in the classroom. Statistical knowledge, without losing sight of its rigor, is yet another tool for understanding and tackling the questions raised by students. In addition, the elements of literacy can be tools for the development of this competence.

Campos and Perin (2020) observed that critical competence is built based on two distinct aspects: the sociopolitical and the epistemological. The sociopolitical one relates to questioning and analyzing an individual's everyday experiences and situations, meaning it is associated with discussions about the issues and opportunities in the world they live in. The epistemological aspect represents a critique of the knowledge itself and is linked to the recognition of some weaknesses in statistical tools. In light of this, we understand that the construction of such critiques has strong connections with the development of statistical literacy.

Methodological Procedures

The organization of the activity

Considering the conceptions of creativity by Winnicott (2011) and Freire (2011), we aim to create a space in which learning becomes a process of construction that starts within the learner themselves and not through a process of mere transfer. Furthermore, we seek to support students' creativity in a way that enables them to intervene in reality with a personal touch, through a consistent use of imagination and perception.

Initially, we had the following concern: How can we help students advance in reading data expressed in graphs and tables? It was based on this concern and the conceptions of creativity that we had been studying that we developed the pedagogical approach that we called "Data Journalists."

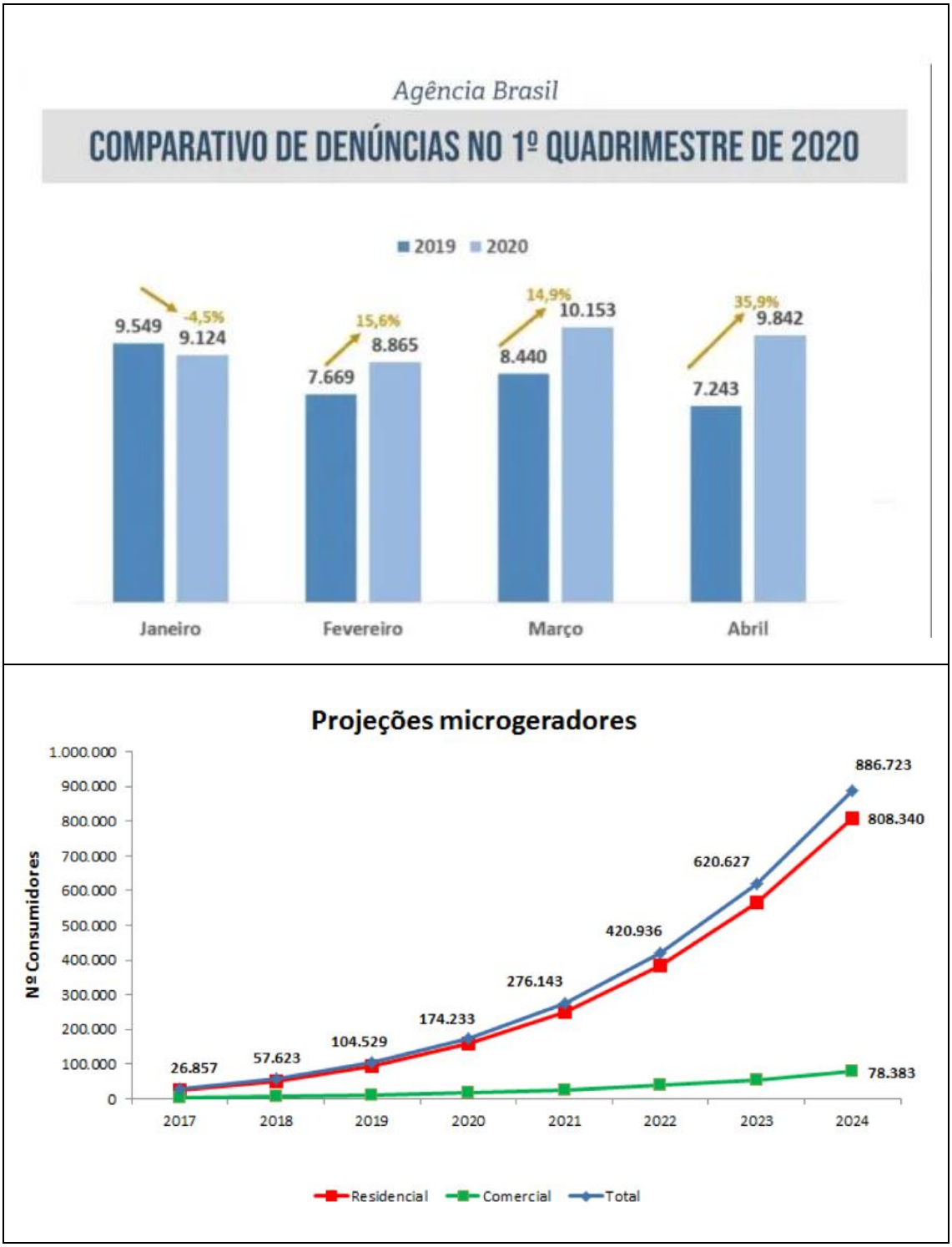
This activity was developed in a class of 32 students in the 1st year of high school at a private school in the interior of the state of São Paulo, where the first author of this article works as a Mathematics teacher. To carry out the activity, 8 groups of 4 students each were formed.

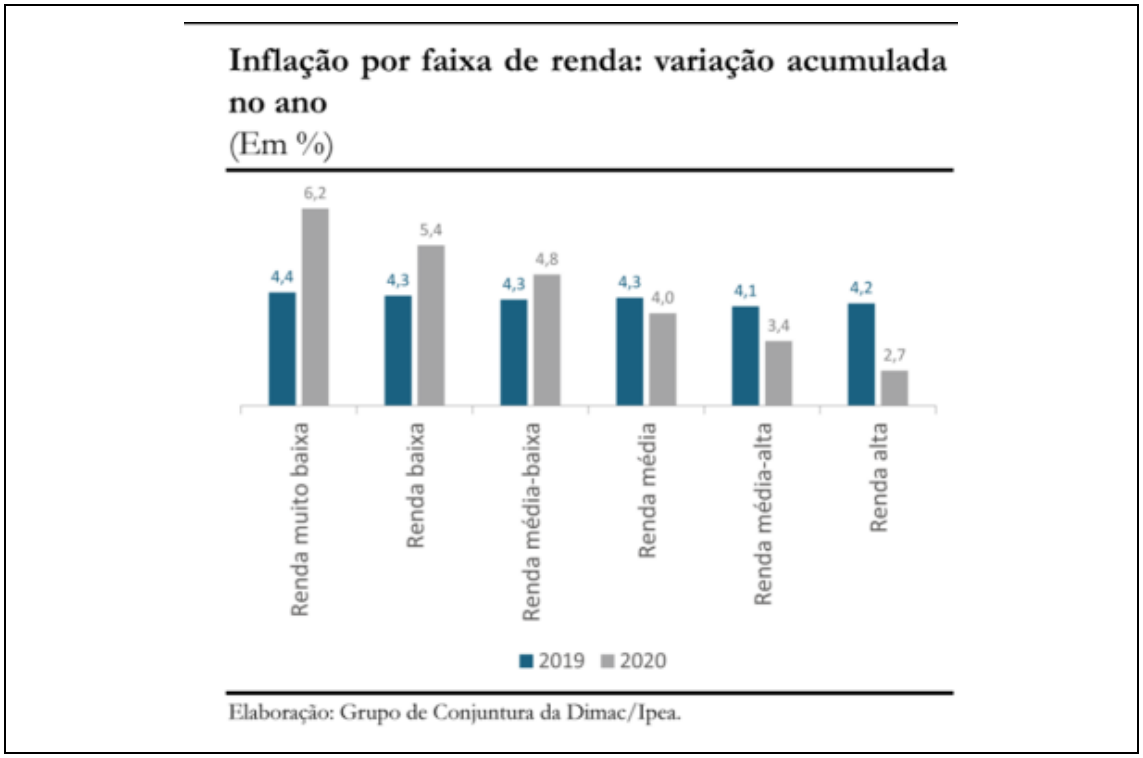
We aimed to bring into the classroom the discussion of topics that were of interest to the students. To achieve this, each group was asked to bring a graph on a subject they deemed relevant, interesting, and current. After this request, a one-week deadline was set for the groups to bring this material to the class.

On the agreed-upon date, the students brought their graphs, and the teacher also brought some (Figure 1). The graph images were projected onto a screen, and then the teacher raised the following questions: What topics are addressed in these graphs? What do these data tell us?

Although it was requested that the graphs be current, it can be observed in Figure 1 that this request was not met by the students, as two of them were based on 2020 data. Due to the fact that the teacher understood that these were topics in which the students could engage and, therefore, contribute to the development of critical competence, the lack of recent data was respected, and the analysis was continued.

FIGURE 1 – Graphs analyzed in the classroom





Source: Teacher's class materials.

In the initial stages, the reading remained at a more basic level, because the analyses were limited to commenting on the most or least predominant facts. For example, in the first graph in Figure 1, the students initially pointed out the periods in which the highest and lowest number of reports occurred.

After that, the students were questioned about how to advance to a higher level of data interpretation. At this point, one student said, "*It's about saying something that's not written there. For example, how much is the percentage increase from April 2019 to April 2020*.[4]" Another student commented, "*Calculating the average installation of photovoltaic cells in households over the last 5 years*.[5]" This sparked further discussions in the classroom about the information that could be extracted from these and other graphs. These analyses of the graphs presented by the teacher took one class session to complete.

[4] Teacher-researcher's field journal.
[5] Teacher-researcher's field journal.

In the following class, the students were asked how they could analyze the graphs they had selected. Several students suggested, "*We can ask questions about our graphs*." Based on these suggestions, the students were guided to work within their groups to develop and answer 5 to 6 questions of varying levels by exploring their respective graphs. It took the duration of one class session to formulate these questions. During this time, the teacher facilitated the groups and assisted them as needed.

Here, it's essential to provide an explanation: when we referred to different levels of graph and table reading with the students, we based it on their own arguments that advancing in the level of reading means seeking information that are not explicitly stated in the graph. At no point did we mention the levels described by Watson and Callingham (2003).

In the next class, the students were questioned about how they could present their analyses. It was at this point that we received suggestions to write a journalistic text to be published on the school bulletin board. It was agreed, therefore, that each group should produce a text based on their graph analyses. To this text, a critical commentary on the depicted reality should be added. It took two class sessions to produce this text. During this time, the teacher also facilitated discussions within the groups, encouraging them to look at, analyze, and critique the social reality depicted in the graphs. Several groups had already initiated this process while formulating their questions.

Next, we describe our methodological procedures for organizing and analyzing the collected material.

Data organization and analysis

To analyze the development of literacy and critical competence, we took the written production of four groups of students, namely, their respective journalistic texts. The groups are designated here as G1 - Group 1; G2 - Group 2, and so on, up to G8 - Group 8. This denomination was made without a specific criterion.

In this paper, due to space limitations, we present the written productions of groups G1, G3, G7, and G7. The selection of the productions from these groups was done randomly, so that any other productions could have been chosen for analysis.

We chose the Narrative Analysis methodology as we believe it is suitable and convenient for recognizing and analyzing various perspectives of the students' resolutions. Besides, it can be understood as a subfield within the broad spectrum of qualitative research. According to Bolívar, Domingo, and Fernández (2001), narratives can employ the sense of investigation as a way to discuss and analyze narrative phenomena.

For the authors mentioned (2001), narrative not only denotes the structured quality of experience viewed as a story but can also establish guidelines/forms for meaning construction based on personal temporal events through the description and analysis of data. Thus, for Bolívar, Domingo, and Fernández (2001), narrative is both a framework and a method for recapitulating experiences. Narrative should not be understood in the trivial sense of a prose text with a set of stated sentences; instead, it is a special type of discourse that consists of a narrative.

Hence, we understand narrative as an experience expressed through a report and also as a research approach, containing guidelines and/or forms of meaning construction based on personal temporal actions through the description and analysis of data.

According to Bruner (2001), it is through narratives that a person comes to know themselves and others. When individuals interpret situations or new information, they do it through a narrative, which goes beyond being a mode of thought; it serves as the structure for organizing knowledge and a vehicle in the process of education. Thus, according to the author, it is likely that an individual organizes their own knowledge and experiences through narrative.

We understand that narrative helps students make conjectures about things that are ready through experiences they have already lived, making

the most of what they know about something, learning to think based on what is already known. Thus, by reasoning with oneself, the individual makes conjectures based on what they already know, arriving at conclusions and expanding their knowledge. According to Bruner (2001), education should be focused on comprehension and understanding the relationships between facts and ideas, as it is a way to grasp new situations.

The importance of narrative in Mathematics classes gives students the opportunity to approach the content based on their own knowledge, without the strict mathematical rigor, but by making associations with their own experiences. This makes the content interesting because it becomes more understandable.

In Narrative Analysis, the objective is to produce a narrative that captures subtleties and unique aspects of the data that are generated (rather than merely collected and described) through a report that provides details and specificities about how students create meanings and construct objects.

Therefore, the authors begin with written productions and construct a narrative that consists of the articulation of characteristics, particularities, and subtleties regarding how students approach an open mathematical question.

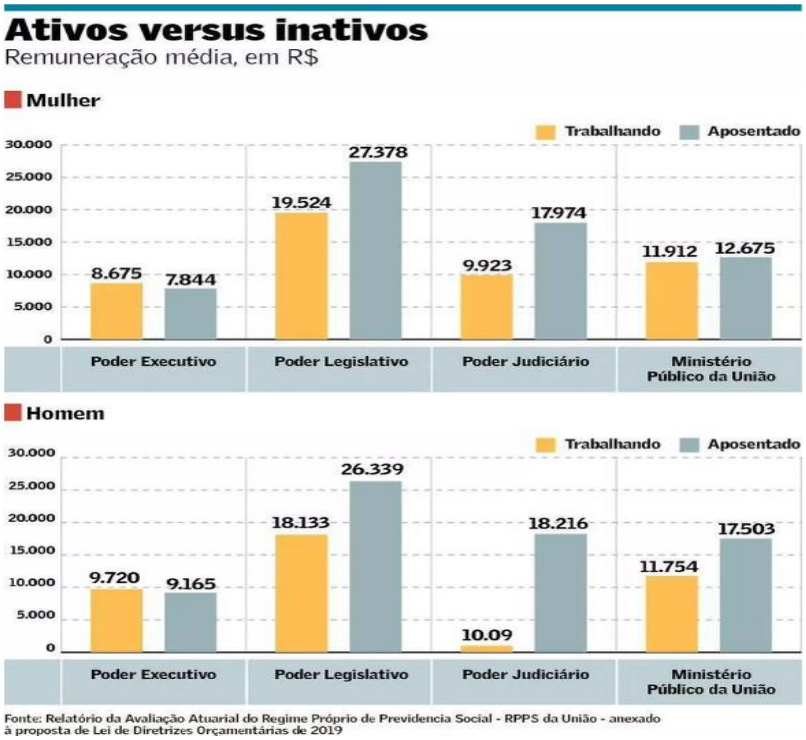
Presentation and discussion of the results

Below, we present the graphs analyzed by each of the four selected groups. The choice of these groups was made randomly, as we could have discussed any of the eight productions. It will be possible to note that the graphs are not current, as requested, and refer to publications from 2017, 2018, and 2019. However, the students demonstrated engagement with their respective topics, and that's why we decided to endorse the work with them.

Primarily, we present the graph analyzed by Group 3, a snippet of the students' narrative regarding reading, analysis and interpretation, and then we provide a discussion in the light of the theoretical framework adopted on

the levels of reading tables and graphs and the development of critical competence. Similarly, we proceed with the narratives of the other groups. In Table 2, we show the graph analyzed by Group 3 and an excerpt from their respective textual production.

TABLE 2 - Graph analyzed by Group 3 and an excerpt from their respective textual production**.**



Fonte: https://valor.globo.com/brasil/noticia/2018/06/04/aposentados-do-legislativo-mp-e-judiciario-ganham-mais-que-ativos.ghtml.

Group 3 - In this graph, we have the average remuneration of active and retired workers from the Executive, Legislative, and Judiciary, separated by gender. This graph shows that in virtually all situations, a retired person earns more than someone who is working. For instance, a retired woman in the Legislature earns approximately 40% more than when she is working. (...). This difference is also significant for men in the Judiciary, but as it seems that there is an error in this graph, we prefer not to comment. (...). Our group understands that this shows a certain social inequality, as the majority of Brazilian workers earn less after retirement, and their salaries do not even come close to this.

Source: Class material from the teacher-researcher.

Through the narrative produced by Group 3 while analyzing the graph of workers' remuneration in different branches of government, it is evident that the group established a comparison between the columns, working and retired, aiming to compare the average salary differences between these two groups. When they state, "a retired woman in the Legislature earns approximately 40% more than when she is working," it is understood that they calculated the percentage difference between the salaries of R$ 19,524.00 and R$ 27,378.00. By expressing this salary difference between retirees and active workers, it is clear that the students used mathematical knowledge regarding relative numbers to quantify the mathematical relationships between these two salary groups. This effort demonstrates an attempt to extract information from the analyzed graph that is not explicitly stated but proved to be relevant, given their intention to analyze the salary differences.

Through the narrative, "This difference is also significant for men in the Judiciary, but as it seems that there is an error in this graph, we prefer not to comment," we understand that the choice of columns to be analyzed was based on the belief that this group contained the largest percentage difference. Furthermore, this passage indicates that they were able to identify an error in the information related to the column that represents the salary of men in the Judiciary who are currently active. This fact shows that the students have a command of mathematical knowledge when it comes to understanding scales and units of measurement in the construction of statistical graphs.

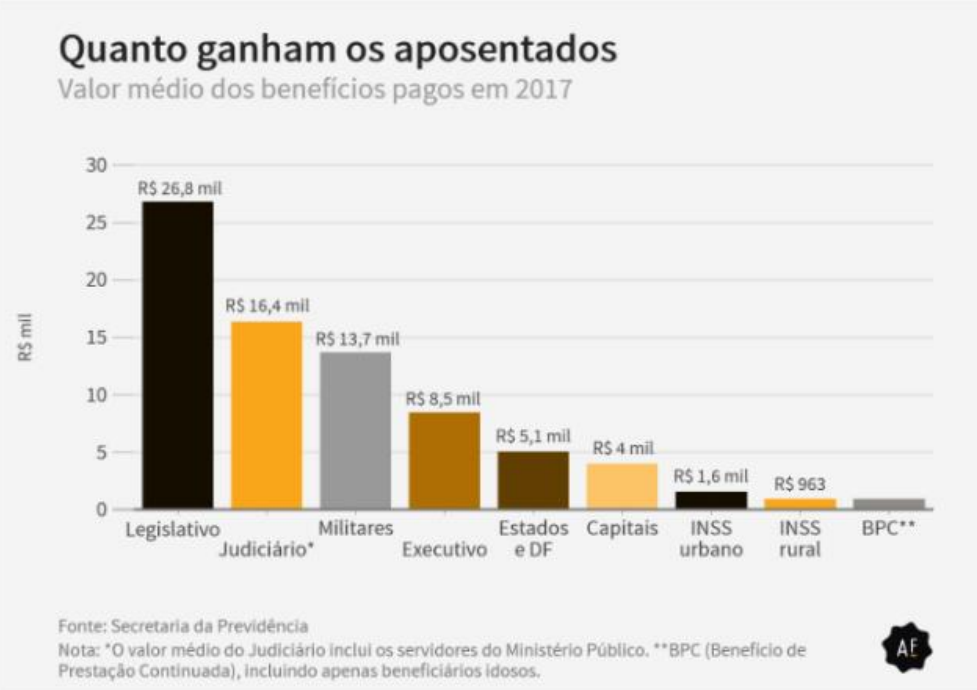
Therefore, we can infer that the level of statistical literacy achieved by the students in this activity falls between what Watson and Callingham (2003) refer to as Critical and Mathematical Critical. This is because they were able to use appropriate terminology to quantitatively interpret the data presented in the graph. It can be considered Mathematically Critical because they pointed out an error in the graph and flagged it.

Furthermore, it's worth noting that these students were able to construct a sociopolitical critique, as defined by Perin and Campos (2020), when they formulated the following narrative: "Our group understands that this shows a certain social inequality, as the majority of Brazilian workers earn less after retirement, and their salaries do not even come close to this." In this passage, it is evident that the students developed arguments with the intention of highlighting evidence of existing issues in the world we live in. It is a passage marked by the students' desire to raise awareness about a fact that seems to have concerned them.

The textual production of this group demonstrated mathematical and statistical skills in the discussion of the presented data, as they discussed the percentage differences between salaries and showed the ability to develop a critical opinion on the subject, in this case, regarding wage disparities among different groups of workers. It's worth adding that this engagement may be related to the fact that the students worked with a topic of their choice, as they selected this graph for analysis and subsequent textual production.

In Table 3, we present the graph analyzed by Group 7, along with an excerpt from their respective textual production.

TABLE 3 - Graph analyzed by Group 7 and an excerpt from their respective textual production



Fonte: https://www.aosfatos.org/noticias/a-situacao-da-previdencia-social-em-6-graficos/

Group 7 - In this graph, it shows how much Brazilian retirees earn. (...) it's noticeable that there's a significant difference between the classes of workers. We also know that the vast majority of workers belong to the INSS retirees' class, meaning a large number of people earn very little, which we believe might not even be enough for household expenses, while only a few people earn a lot of money every month.

Source: Class material from the teacher-researcher.

This group, through their narratives, also demonstrated the intention to establish a comparison between the salaries of different classes of workers. However, they do it without using the appropriate terminology, "it's noticeable that there's a significant difference between the classes of workers." They claim that the difference is significant but do not explain how or what arguments they used to conclude that the wage disparities between the classes of workers are meaningful. For this reason, we can say that the argument expressed in the narrative is at an informal level, as they used significantly simplistic elements to

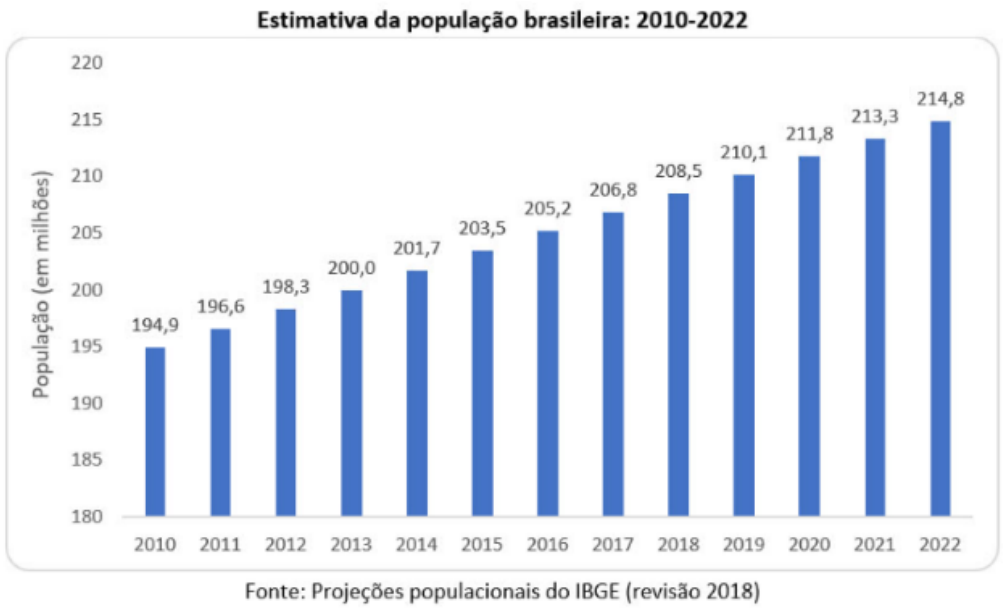
construct their argument. It seems they relied on the difference in the size of the bars rather than a percentage difference or proportionality between the salaries.

Similarly, they did the same in the following argument, "We also know that the vast majority of workers belong to the INSS retirees' class, meaning a large number of people earn very little," and did not use more appropriate concepts. Although the group did not use consistent statistical concepts in the narrative they constructed, we understood that they explored the graphical representation they had at hand when looking at wage differences and pointed out what is more predominant.

Just like Group 3, Group 7 was also able to make a sociopolitical critique of the presented data, as they expressed seeing social inequality reflected there, with few people earning a considerably high salary, according to them, while others receive a salary they deem insufficient for personal expenses.

In Table 4, we present the graph analyzed by Group 1, along with an excerpt from their respective textual production.

TABLE 4 - Graph analyzed by Group 1 and an excerpt from their respective textual production.



Group 1 - In this graph, we have the estimated population growth in Brazil. Looking at it, we can say that it's expected for the population to increase over all these years. (...). Another thing to mention is that this growth is linear, meaning it increases by approximately the same number of people each year. (...). Thinking about the increase in the number of people, our group was wondering: Is Brazil prepared to meet the needs of all these people? How are the investments in health and education to meet this population?

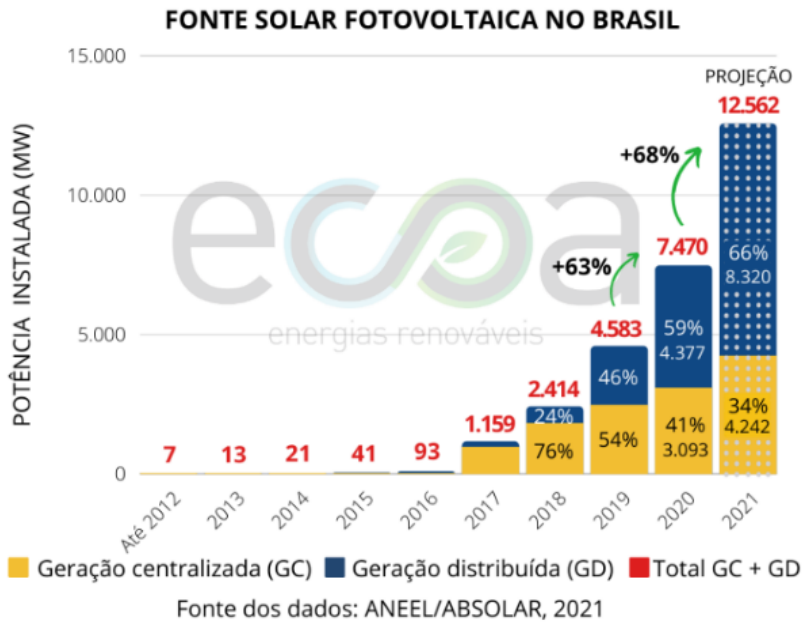
Source: Class material from the teacher-researcher.

Group 1, when analyzing the graph of the estimated Brazilian population, used appropriate terminology to express their interpretations: "this growth is linear, meaning that approximately the same number of people increases every year." These students used the expression "linear growth" and explained its meaning. As a result, we assert that the level of reading of this group for this graphical representation is consistent and non-critical. According to Watson and Callingham (2003), this level of reading is characterized by the ability to interpret the graph without establishing a critique of the concept expressed there. In the understanding of Campos and Perin (2020), this is done without constructing an epistemological criticism.

It's worth noting that this group looked at the growth of the Brazilian population taking into consideration individual needs such as education and healthcare. Therefore, we assert that this group was also able to construct a sociopolitical criticism, as they questioned whether the government is prepared to meet the needs of this population.

In Table 5, we present the graph analyzed by Group 4, along with an excerpt from their corresponding text.

TABLE 5 - Graph analyzed by Group 4 and an excerpt from their corresponding text.



Fonte: https://ecoaenergias.com.br/energia-fotovoltaica-crescimento-2021/

Group 4 - The graph shows the growth in the installation of photovoltaic cells in recent years. (...) The growth of distributed Generation has outpaced centralized generation. If we look at the increase between the years 2020 and 2021, we can see that distributed generation increased by 90%, whereas centralized generation increased by 37.1%. (...) This is good in one way, as it shows that people are more concerned about the environment and seeking alternative energy sources (...), but even though it has grown significantly, we still have very few homes with this resource. (...) We believe that the cost of installation is quite high, and as a result, few people have access and still pay a premium to have energy in their homes.

Source: Class material from the teacher-researcher.

Group 4 analyzed the growth of electricity generation in centralized and distributed modes for the years 2020 and 2021. In the passage from the narrative: "If we look at the increase between the years 2020 and 2021, we can see that distributed generation increased by 90%, whereas centralized generation increased by 37.1%," it's evident that the students calculated the percentage difference between the values expressed in the graph to construct an argument about the increase in these types of electricity generation. With this, we understand that the level of reading of this group falls between the critical and mathematically critical, as they looked at economic and environmental aspects involved in the context presented in the graph. The critique of this index was perceived in the following part of the narrative: "This is good in one way, as it shows that people are more concerned about the environment and seeking alternative sources of energy (...), but even though it has grown significantly, we still have very few homes with this resource. (...) We believe that the cost of installation is quite high, and as a result, few people have access and still pay a premium to have energy in their homes." We understand that, despite finding a significant percentage increase in this type of residential electricity generation, the absolute number of installations is small, and access is restricted due to the perceived high installation cost.

Based on the analysis of the students' narratives, we can assert that the levels of statistical literacy concerning the reading and interpretation of graphs fell into the categories of consistent non-critical, critical, and mathematically critical, according to Watson and Callingham's classification (2003). This is because the students demonstrated the ability to form critical opinions about the data, ask questions, and employ appropriate terminology. Additionally, they displayed adequate mathematical skills in understanding graphs and tables.

It's worth noting that all the groups didn't just look at the data in isolation but aimed to understand, identify, and discuss the social aspects

expressed therein. This allows us to assert that all the groups constructed sociopolitical critiques through the readings they conducted.

In summary, we observed that the students' creativity was evident during the execution of the proposed activity. They actively sought out mathematical relationships in the data without specific commands to do so. Furthermore, the groups expressed their perspectives on social, political, economic, and environmental facts that were implicit in the analyzed graphs. This activity went beyond working on cognitive skills typically associated with an exercise-based lesson, and it is clear that the abilities to imagine, create, produce, and invent were present – creativity was exercised.

Conclusion

This work aimed to analyze the levels of statistical literacy and the development of critical competence in reading graphs and tables.

Based on the presentation and discussion of the results, we have shown that the student groups moved through the three highest levels of statistical literacy, according to the classification we used as a reference. We assert that their reading skills were at the highest levels because the students went beyond merely reading the data; they compared results, established mathematical relationships, and formulated questions that went beyond the existing data.

In addition, the students were also concerned about the aspects of society portrayed in the graphic representations, showing social inequalities presented there.

Finally, we understand that the methodology employed, Creative Learning, favored this development because the students worked in groups and, through critical questioning, sought to express possible interpretations and conclusions of the analyzed graphs. The construction of narrative texts also contributed to the organization of their thoughts, the comprehension of statistical concepts, and the advancement of levels of reading graphs and tables.

Referências

BOLÍVAR, A.; DOMINGO, J.; FERNÁNDEZ, M. *La investigacción biográfico-narrativa en educación*. Madrid: Editorial La Muralla, 2001.

BRUNER, J. *A Cultura da Educação*. Porto Alegre: Editora Artmed, 2001.

CAMPOS, C. R.; PERIN, A. P. Sobre as competências crítica e comportamental na Educação Estatística. *Zetetike*, Campinas, v. 28, p. 1-19, 2020. DOI: https://doi.org/10.20396/zet.v28i0.8656795.

CAMPOS, C. R.; WODEWOTZKI, M. L. L.; JACOBINI, O. R. *Educação Estatística*: teoria e prática em ambientes de Modelagem Matemática. Belo Horizonte: Autêntica Editora, 2011.

FREIRE, P. *Pedagogia da Autonomia*: Saberes Necessários à Prática Educativa. São Paulo: Paz e Terra, 2011.

FREIRE, P. *Pedagogia da cidade*. New York: Continuum, 1993.

PAPERT, S. *A máquina das Crianças*: repensando a escola na era informática. Porto Alegre: Artes Médicas, 2008.

SKOVSMOSE, O. *Educação Matemática Crítica*. 3. ed. Campinas: Papirus, 2006.

SKOVSMOSE, O. *Um convite à Educação Matemática Crítica*. Campinas: Papirus, 2014.

WALLMAN, K. K. Enhancing statistical literacy: enriching our society. *Journal of the American Statistical Association*, Alexandria, v. 88, n. 421, p. 1-8,1993.

WATSON, J.; CALLINGHAM, A. R. Statistical literacy: a complex hierarchical construct. *Statistical Education Research Journal*, New Zeland, v. 2, n. 2, p. 3-46, 2003.

WINNICOTT, D. W. *Tudo começa em casa*. São Paulo: Martins Fontes, 2011.

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