Statistical education at EJA:
an experience with statistical research[1]

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ABSTRACT

Understanding the importance of Statistics for improving people's quality of life and for the development of society, especially through actions that involve collecting, organizing, reading and interpreting data, is a fundamental aspect in contemporary times. In this sense, we defend the importance of implementing Statistical Education at EJA as an action to meet the demands of the current days. Thus, this report discusses the need to address such knowledge in this teaching modality and presents an experience with students from Cycle VI - High School of a state public school. The results obtained were analyzed from the perspective of the qualitative approach, of case study type, based on descriptive aspects, and showed that this proposal helps to develop the competences and skills indicated by the BNCC, providing critical and reflective training.

KEYWORDS: Statistical Education; EJA; Statistical Surveys.

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Educação Estatística na EJA: uma experiência com pesquisas estatísticas

RESUMO

Compreender a importância da Estatística para melhoria da qualidade de vida das pessoas e para o desenvolvimento da sociedade, especialmente através de ações que envolvem coleta, organização, leitura e interpretação de dados, é um aspecto fundamental na contemporaneidade. Nesse sentido, defende-se a importância de implementar a Educação Estatística na EJA como sendo uma ação para atender às demandas da atualidade. Assim, este relato discute a necessidade de abordar tais conhecimentos nessa modalidade de ensino e apresenta uma experiência vivenciada com os alunos do Ciclo VI- Ensino Médio de uma escola pública estadual. Os resultados obtidos foram analisados sob perspectiva da abordagem qualitativa, do tipo estudo de caso, a partir dos quais foram considerados seus aspectos descritivos, e mostraram que essa proposta auxilia no desenvolvimento de competências e habilidades indicadas pela BNCC, proporcionando uma formação crítica e reflexiva.

PALAVRAS-CHAVE: Educação Estatística; EJA; Pesquisas Estatísticas.

Educación estadística en la EJA: una experiencia con la investigación estadística

RESUMEN

Comprender la importancia de la Estadística para la mejora de la calidad de vida de las personas y para el desarrollo de la sociedad, especialmente a través de acciones que implican la recogida, organización, lectura e interpretación de datos, es un aspecto fundamental en la época contemporánea. En este sentido, se defiende la importancia de implantar la Enseñanza de la Estadística en la EJA como una acción para responder a las demandas de hoy en día. Así, este informe discute la necesidad de abordar tales conocimientos en esta modalidad de enseñanza y presenta una experiencia con alumnos del Ciclo VI - Bachillerato de una escuela pública estatal. Los resultados obtenidos se analizaron desde la perspectiva de un enfoque

cualitativo, de estudio de caso, a partir del cual se consideraron aspectos descriptivos, y mostraron que esta propuesta ayuda a desarrollar las competencias y habilidades indicadas por el BNCC, proporcionando una formación crítica y reflexiva.

PALABRAS CLAVE: Educación estadística; EJA; Investigación estadística.

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Introduction

Statistics exerts an important role in people's lives, mainly because it is present in numerous daily circumstances, especially those involving the collection, organization, evaluation and interpretation of information. Therefore, understanding it is a fundamental aspect for everyone, since it contributes to improving and understanding the facts of society, as well as helping people in decision making.

This report discusses the need to approach and implement Statistical Education at EJA (Youth and Adult Education), based on didactic activities involving statistical research. Such activities were applied to students in Cycle VI - High School, at the Escola Estadual de Ensino Fundamental e Médio Professor Luiz Aprígio, located in the municipality of Mamanguape, state of Paraíba, Brazil.

The aim of these activities was to develop students' abilities to plan and carry out statistical research and to represent the data collected using vertical bar graphs and frequency tables (absolute and relative). In line with this, we sought to answer the following guiding question: *What is the importance of carrying out statistical research with EJA students so as to consolidate competencies and abilities from the perspective of the BNCC (National Common Curriculum Base)?*

In order to achieve these objectives and answer the question above, the students were asked to carry out statistical surveys on a variety of socially relevant topics that would arouse the interest of students from other classes at the school. Based on this experience and the results obtained by the

students, the data were analyzed and discussed from the perspective of the qualitative approach, since this is a case study, in which their descriptive aspects were considered.

Thus, this report is divided into three sections. The first section discusses the importance of teaching Statistics It also discusses the implementation of statistical education at EJA, based on reflections and guidelines for consolidating competencies and abilities. Next, the methodology adopted and the didactic activities proposed to the students are presented. The third section contains the final considerations on the objectives outlined and the answers to the guiding question.

Statistical education at EJA: perspectives, challenges and reflections on educating for the exercise of citizenship

On a daily basis, it is possible to perceive statistics in various situations and in different contexts, especially in activities that involve collecting, organizing, evaluating and interpreting data. These actions are easily identified in all segments of society, such as in personal planning, in professions, in the development of scientific studies, as well as in medical, social and governmental areas.

Thus, it is essential to understand and recognize the importance of Statistics, as well as the need to relate certain actions to statistical situations so as to perceive how indispensable it is for the development and understanding of the facts that happen in society every day. This way of conceiving this knowledge reinforces the need for individuals to know how to collect, evaluate, organize, interpret and reproduce information. This is why we advocate the implementation of statistical content in school curricula since the early years of Elementary School, especially at EJA.

From this perspective, it is understood that the development of this knowledge should be based on activities that encourage students in decision making, as well as making predictions, projections and

interpretations. That is, by approaching situations that involve research. It is worth mentioning that this type of activity is the core of the work with Statistics. However, when adopting a pedagogical practice in this direction, the teacher must plan the whole process, especially how the data will be systematized. Thus, they should guide their students through the following stages: choosing a topic, a sample, how the data will be collected, and organizing and interpreting this data.

When it comes to this approach at EJA, statistical research activities should enable students to critically analyze the data, encourage their active and consistent participation in the environment in which they live and enable them to exercise their citizenship, so that the desired competencies and abilities can be developed.

Although the BNCC does not deal directly with the EJA, this paper defends the importance of developing statistical competencies and abilities with these students, so that they can be considered statistically competent. According to Lopes (2010), the consolidation of this capacity is linked to students' appropriation of statistical attitudes and knowledge that enable them to be critical and reflective regarding the information that is produced and disseminated.

The BNCC abilities include:

> (EM13MAT102) Analyze tables, graphs and samples of statistical research presented in reports [...]; (EM13MAT202) Plan and carry out sampling research on relevant issues, using data collected directly or from different sources [...]; (EM13MAT406) Construct and interpret frequency tables and graphs based on data obtained from statistical sample research [...] (Brasil, 2018, p. 533, 534, 539).

Developing these abilities extends beyond getting students to master statistics based on mathematical models, as they need to be able to question, analyze and write justifications with creativity and criticality. Based on this

approach, Dante (2013) states that this is one of the most important subjects to be taught by teachers, which is why its approach at EJA is indispensable.

It is clear that statistical topics should be addressed at all levels and in all types of education. However, at EJA, the importance of Statistics is highlighted, as many teachers shrink back from approaching it (Duarte, 2009). Therefore, it is suggested that, in this modality, activities involving Statistics should be dealt with by means of situations that are real and familiar to the students, so that they are in accordance with their age.

Implementing statistical education at EJA is an indispensable action, especially when the focus is on the student's civic education and the development of the three competencies in this area: statistical literacy, statistical thinking, and statistical reasoning.

According to Perin (2020), literacy is related to the student's ability to read and interpret tables and graphs, as well as to make inferences and encourage them to make decisions based on statistical data. It also includes the ability to organize data in its different representations. In turn, statistical thinking refers to the ability to relate quantitative data to concrete situations, detailing what the data explains in a given problem or context. Statistical reasoning involves the conceptual understanding and connection of ideas related to variation, distribution, dispersion, association, sampling and ideas of uncertainty.

It is believed that, in order to develop these three competencies, it is necessary to understand the context in which statistical information is produced, collected and interpreted, which can help students in choosing the appropriate statistical procedures for each type of situation. This statement emphasizes how important it is for statistical activities to address the context and experiences of EJA students, once it is through their own experiences that they are able to understand and apply their knowledge to solving problems.

According to Fonseca (2012), given the role that EJA has assumed in the construction of citizenship, the approach to knowledge needs to be increasingly contextualized, so that it enables students to understand, analyze, interpret, solve and validate results obtained in solving problems in various areas.

In addition to consolidating these abilities, Dante and Viana (2020) highlight the importance of students: recognizing Statistics as the area of Mathematics responsible for measuring and processing data; identifying and classifying statistical variables; constructing frequency tables and graphical representations; interpreting and comparing data; using statistical measures to represent and summarize data; planning and carrying out research; and presenting research data to the school community.

The development of such abilities shows that it is necessary to provide opportunities for EJA students to plan and carry out research, communicate the results through reports and make representations in graphs and tables, especially based on meaningful situations that address their interests and consider them as protagonists of the pedagogical process (Conti; Carvalho, 2009).

From this perspective, it is understood that it is essential to treat this knowledge through statistical research, with the students themselves as the researchers and participants in the entire investigative process.

The planning and execution of a statistical research: the methodological path and the activities developed with EJA students

Implementing Statistics Education at EJA, especially from the perspective presented here, is a way of guaranteeing the right to learning for students in this teaching modality, especially the right to the education for the exercise of citizenship. In this regard, it is believed that the development of activities involving statistical research can assist in this process, especially if they are planned, executed and analyzed by the students themselves.

Thus, in order to answer the question that guided this work and achieve the proposed objectives, the teacher researcher provided the experience of activities involving statistical research by the students of Cycle VI - High School, of the Escola Estadual de Ensino Fundamental e Médio Professor Luiz Aprígio, located in the municipality of Mamanguape, in the state of Paraíba, Brazil. The activities were developed jointly with classes A and B, and took place at ten different moments, totaling ten Mathematics lessons, between August and September of 2022. The aim was to help students understand and recognize the importance of Statistics in people's lives, its methods and its forms of representation.

To analyze the results of the activities carried out, a qualitative approach was adopted, since this is a descriptive case study, which considers the nature in which the data was produced.

The idea of adopting these criteria followed the guidelines of Richardson (1999) and Chizzotti (2006), who indicate that this is the most appropriate way to understand the results of what students have produced, especially as it allows them to identify and interpret the meanings they give to these results. It is understood that these advantages derive from the type of research implemented, given that it describes the experience, in other words, it is "the case study" (Lüdke; André, 1986, p. 17).

Based on these approaches, Fazenda (2015) points out that, among the advantages of such approach, is the fact that it allows the researcher to be part of the research and the opportunity to use their life experiences, their knowledge and inductive methods to interpret what the students have produced. That way, this approach is justified because it enables the understanding of what is being studied from a more detailed view of the case, especially because of the communicative relationship between the researcher and the researched, both seen as subjects of knowledge and history.

As there is no specific material for EJA students at school, at first, the text "Statistics", by Dante (2016), was made available in the textbook used by third year regular high school students, so that they could read it and discuss the importance of this knowledge with their classmates.

Initially, the students were asked about their impressions of the topic of the text. Some replied that they didn't know about it, whereas some others believed that it was about research. The answers obtained prompted subsequent discussions. Then, the shared reading of the text was initiated, followed by a moment of discussion and directed, interpretative study of the text.

In the second moment, the terms of a statistical research were explained, focusing mainly on the notions of population and sample; individual or object; and qualitative and quantitative variables. After this explanation, an oral activity in the classroom was applied to identify and differentiate the variables.

The third moment began with counting the number of students present in the class, which led to the identification of 25 students. Subsequently, they were asked how many were male and how many females, reaching the number of seventeen female students and eight male students. After this, they were asked whether they agreed that 50% of the students were male. The answer was quickly no, justifying that this percentage represented the half and that the number of men was less than that. Then, again, they were asked what the percentage for each group was that corresponded to this variable.

With this question, the students began to reflect on how to find this percentage rate. Then, one student responded that she could use a rule of three to determine the answer. Another student replied that, if 10% equaled 2.5 of the total number of students, then 20% equaled 5 students, and 40% equaled 10 students. Therefore, the percentage of male students was less than 40%. Using the same relation, we asked them what rate corresponded to one student. To make it easier, the table (Table 1) was written on the blackboard to represent the relation between these two quantities.

TABLE 1: Percentage rates of students present.

Number of students	Percentage rate (%)
25	100
2,5	10
5	20
10	40
20	80
1	X

Source: Own production.

When observing the table above, one of the students mentioned that it would be enough to divide 80 by 20, 40 by 10, 20 by 5, 10 by 2.5, and 100 by 25, which would lead to the result of 4. Therefore, to determine the rate corresponding to each gender, multiplying the number of students by 4 would be enough. The results would be 8 x 4 = 32 and 17 x 4 = 68, that is, 32% of the students in the class were male and 68% female. This discussion resulted in the explanation and understanding of frequency tables – especially the meaning of absolute frequency (AF) and relative frequency (RF-%) –, the relation between these two frequencies, as well as identifying and calculating frequency distributions and the construction of frequency tables.

In the fourth moment, problem situations were applied, addressing knowledge related to the construction of frequency tables, based on the variables: gender, age, height, weight, number of siblings, hair color, hobby, shoes size, clothing size and performance in Mathematics.

In the fifth moment, the study of Statistics was mediated by discussions on graphical representations, in which segment graphs, bar graphs and sector graphs were presented. The study of graphical representations continued in the sixth moment by solving problems, which presented situations that required analysis, interpretation and construction of graphs, specifically those of bar.

Later, in the seventh moment, a more specific discussion took place about the variables of a statistical research and the researcher's interest in discovering something. The students were then asked to split into small

groups and discuss possible topics that could be researched at school, in addition to formulating a question that could foster such topic. This activity required a lot of thinking on the part of the students, as they discussed the importance of choosing an interesting topic that could arouse curiosity about something unknown and that they had the interest in finding out. Thus, the topics chosen by the groups were: being for or against abortion, favorite school meal, favorite music genre, favorite football team, favorite social network, plans to attend university, number of students who are employed, and being for or against the death penalty in Brazil.

At the same time, they discussed how many students would be interviewed and whether the groups would be able to survey all the students enrolled in the evening shift. The students were then explained the ideas behind sampling in research. After this explanation, they agreed on carrying out the research with 30 out of 100 students, which totaled a little more than 1/3 of them, having this amount divided between the four EJA classes. After this discussion, some guidelines were given on the application and approach to data collection, as the survey was to be applied over a two-day period and the results presented in the following class.

The eighth and ninth moments took place in an integrated way, once the students first applied their respective surveys and then organized the data in any way they pleased, without necessarily using tables or graphs. However, the students pointed out that tables and graphs facilitate reading and understanding data. They were therefore instructed to construct frequency tables so that they could organize and, consequently, present the information they had collected. Based on this representation, they were asked to construct bar graphs on a grid.

Figures 1 to 13 represent the frequency tables and graphs constructed and presented by the A, B, C, D, E, F, G and H groups.

Group A carried out the following survey: *Are you for or against abortion?* Figure 1 shows the data obtained in a frequency table, which is divided into three categories: *for*, *against* and *I have doubts*, respectively.
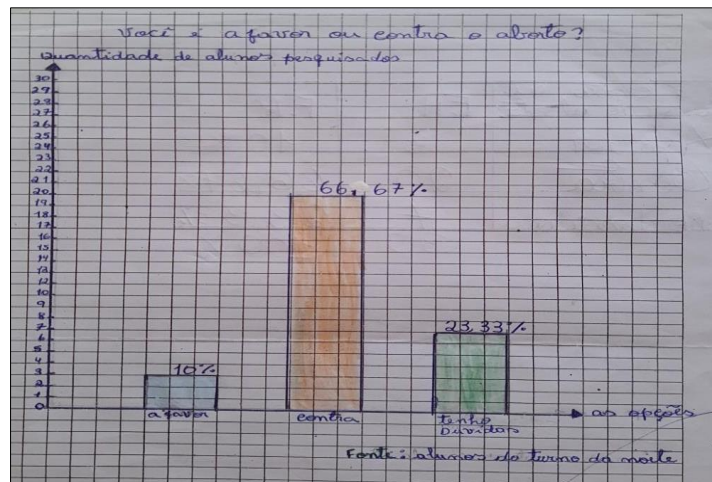
FIGURE 1: Research Data applied by Group A

Source: Group A.

These same data were represented in a bar chart, as shown in Figure 2.

**FIGURE 2**: Research Data applied by Group A

Source: Group A.

According to the graph, the first column shows that 10% of the students are in favor of abortion, while 66.67% are against it, and 23.33% of them have doubts. Still with regard to the research of this group, the members said that it was a controversial topic that needed to be treated delicately. In addition, the team pointed out that the majority of students, even though they said they were against it, were hesitant to answer the question.

Group B researched about the school meals, in order to identify which one the EJA students preferred, as shown in Figure 3.

FIGURE 3: Research Data applied by Group B
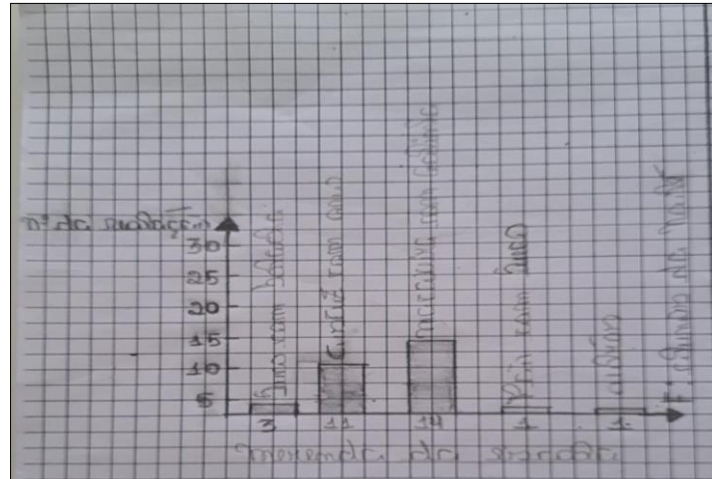
Source: Group B.

Group B only used a bar graph. During this survey, the following options were identified: cookies and juice, couscous with eggs, cassava with chicken, bread and juice, among others. In the graph constructed by the group, the bars correspond, respectively, to the options presented, among which the cassava with chicken is their favorite, chosen by fourteen students, which corresponds to 46.67% of the participants in the survey. Despite the results, it was found that the group did not represent correctly the number of people who participated in the survey. However, this study did not evaluate the error, but rather the meanings that the group attributed to the data collected.

The evaluation methodology adopted for this group was based on Cury's (2008) guidelines, as we agree with the author that:

> To try to interpret the results of the research, obtained through this detailed analysis of the errors, it is first necessary to ask: what did the students want to say? In other words, what can their written productions reveal,

not only about what they do not know, but also about what they do know? (Cury, 2008, p. 73).

On this issue, it is understood that both success and error are part of the learning process, because they involve invention and discovery, but "in the formal dimension (of the adult), error is something bad that needs to be avoided or punished" (Pinto, 2000, p. 39). In this sense, it is understood that the mistake made should be seen as a learning opportunity, which can facilitate the organization of teaching. The implementation of appropriate situations can help students overcome their mistakes and acquire the necessary knowledge.

Group C, in turn, researched the favorite music genre of EJA students, based on the question: *What is your favorite music genre?* The data obtained are represented in Figure 4.

FIGURE 4: Research Data applied by Group C
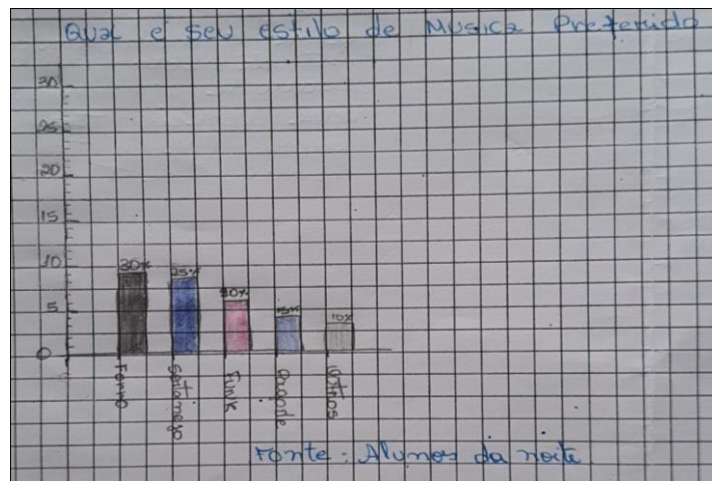
Source: Group C.

Among the favorite music genres, the group point out *forró* (30%), *sertanejo* (25%), Brazilian funk (20%), *pagode* (15%), and other musical genres (10%). According to Group C, *forró* was chosen as their favorite music genre, because it is a contagious style. This graph shows that there is no standardization in the intervals that represent the number of students who

chose each of the musical genres, although it can be seen that the group adopted the sequence of multiples of 5, and that the scale does not represent exactly the length that should be in the bars of the graph.

Group D developed the survey based on the question: *What is your favorite football team?* Among the options, following teams were represented: Flamengo (66.66%), Palmeiras (13.33%), Corinthians (10%), Vasco (3.33%), and São Paulo (6.66%) (Figure 5).
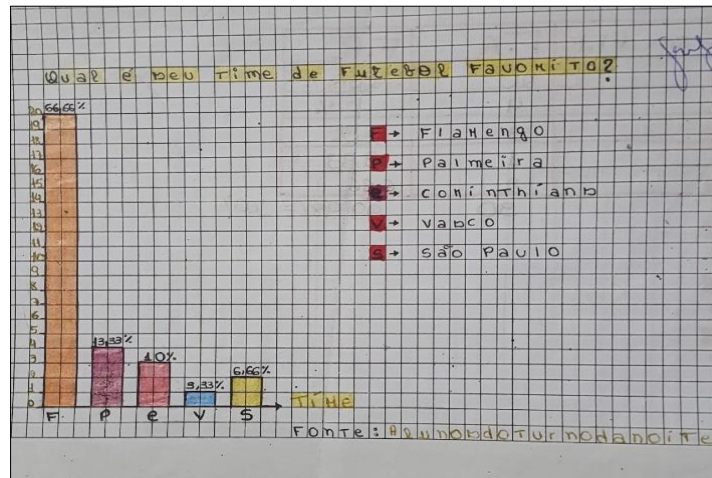
FIGURE 5: Research Data applied by Group D

Source: Group D.

Looking at Group D's production, we can see in Figure 5 that the team represented the relative frequency with a number of two decimal orders. In addition to the frequency table, Group D decided to make the graphical representation of the data obtained, as shown in Figure 6.

FIGURE 6: Research Data applied by Group D

In the column graph (Figure 6), the group used a legend to indicate the team names, so that the first column corresponded to Flamengo, the second one to Palmeiras, the third one to Corinthians, the fourth one to Vasco, and the fifth column to São Paulo. During their presentation, the group justified choosing this topic, because it was of interest to many people.

Group E developed the following survey: *What is your favorite social network?* The data collected are presented in a frequency table (Figure 7).

FIGURE 7: Research Data applied by Group E

Among the social networks, those mentioned by respondents were WhatsApp (43.4%), Facebook (10%), and Instagram (46.6%). In addition to the table, the group used a bar graph, represented by Figure 8, to show the data of their survey.

FIGURA 8: Research Data applied by Group E
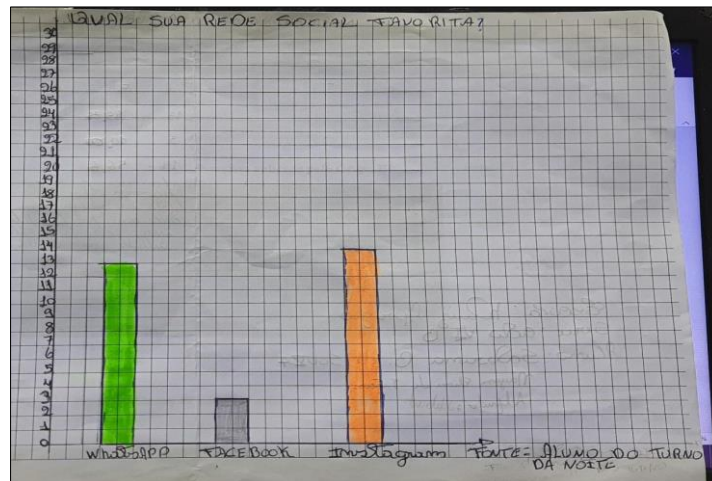
Source: Group E.

In this graph, the group represented the first column for WhatsApp, the second one for Facebook, and the last one for Instagram.

Group F researched EJA students' interest in going to university. It is believed that this topic is essential and needs to be researched among students of this modality of education, given that the data can influence and motivate those who have no prospects of continuing their student life. Figure 9 shows the data obtained.

FIGURE 9: Research Data applied by Group F

Source: Group F.

Analyzing this data, it can be seen that the frequency table has been constructed horizontally, unlike those that follow the traditional pattern, in which the categories are arranged vertically. The data show that 40% of EJA students intend to attend university, whereas 30% do not intend to have a higher education degree, and 30% are unsure. The data of this survey were also presented in a graph, which is shown in Figure 10.

FIGURE 10: Research Data applied by Group F
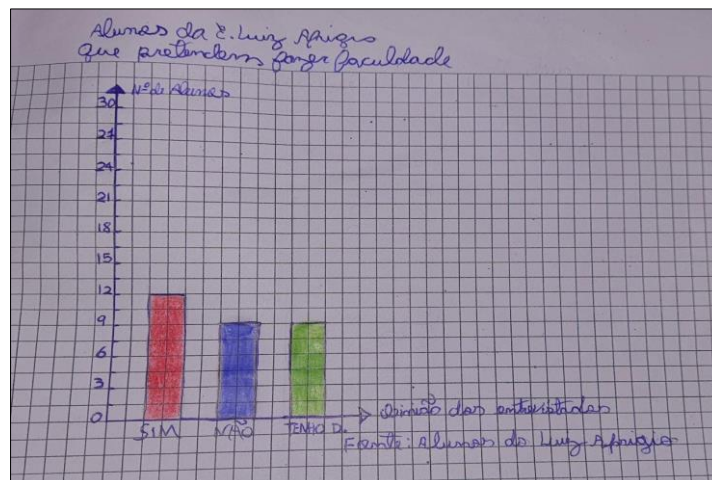
Source: Group F.

The first column represents the number of students who answered 'yes', the second column represents the number of those who said 'no', and the third column represents those who are unsure whether or not they want to go to university.

The students in Group G researched the number of EJA students who have a paid job, in order to identify how many of them work and those who are unemployed. According to the members of this group, this is an issue of great social relevance and can directly influence the school's pedagogical process, as many students give up on their studies, especially when they start working in places where class hours coincide. The results obtained are shown in Figure 11.

FIGURE 11: Research Data applied by Group G

Source: Grupo G.

Based on the data presented, 76.6% of EJA students have remunerated activity, while 23.3% are unemployed. An important observation is that Group G implemented another category to identify who these working students are, pointing out that 46% of them are men and 30% are women. It is important to highlight that the percentage figures refer to the total number of students who were interviewed.

Group G also presented the data in a graph, which is shown in Figure 12.

**FIGURE 12**: Research Data applied by Group G
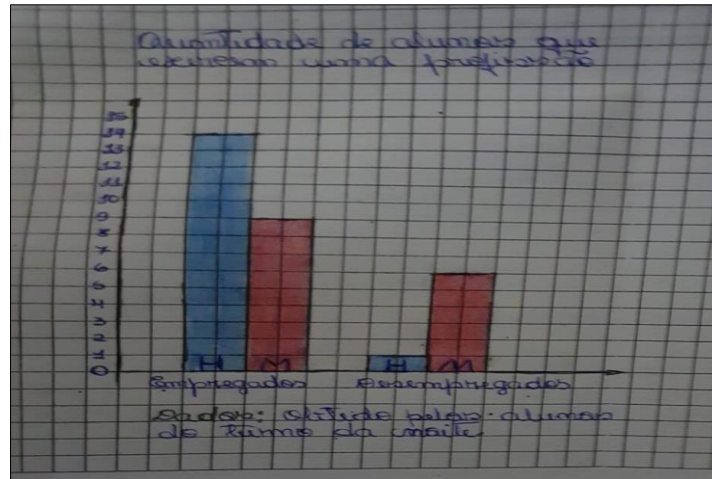
Source: Grupo G.

In this graph, the students used blue to represent the number of men and red to represent the number of women. The first two bars represent working students and the last two non-working students. The group also explained that they surveyed fifteen men and fifteen women. They explained that they had chosen this topic, because it was one of the most widely covered subjects by media, and that the results were in line with the reality of the students who attend evening classes.

Another topic the students researched was the death penalty in Brazil. Group H carried out the survey based on the following question: *Are you in favor of the death penalty in Brazil?* The results are shown in the bar graph in Figure 13.

FIGURE 13: Research Data applied by Group H
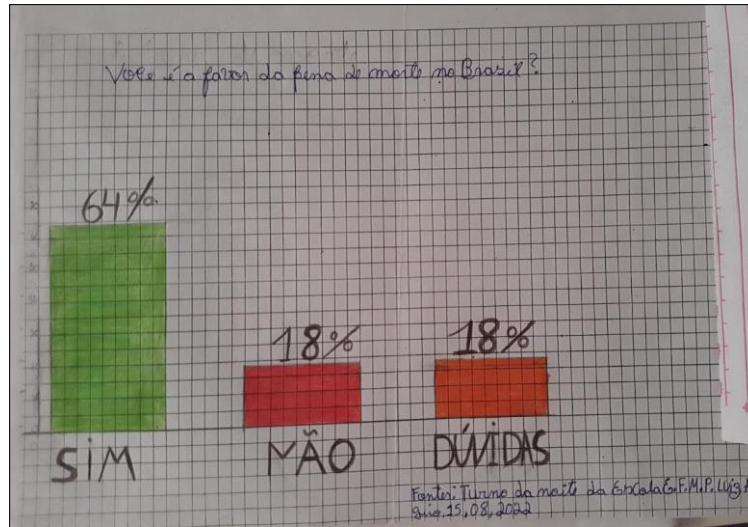
Source: Grupo H.

It can be seen that Group H used the bars on the graph to represent the number of interviews in percentage rates, but it cannot be said that the team used a scale for each of them. However, it is possible to identify that the majority of EJA students interviewed (64%) are in favor of the death penalty in Brazil, while 18% are against it. When justifying the choice of this topic, the group said it was motivated by the very nature of the subject, since it is not only controversial but also of public interest, and opinions differ in a Christian country like Brazil.

The tenth moment was characterized by the dissemination of the research carried out by the students. During this phase, each group shared with the others a report of their process, addressing aspects such as planning, execution, organization and data analysis. In addition, each student expressed their perspective on the experience and the knowledge they had acquired during this time, emphasizing the relevance of Statistics for the advancement of today's society.

In view of the report presented, as well as the way in which it was developed, the importance of working with statistical research at EJA is emphasized. It is understood that such type of research mobilizes, motivates

and involves students throughout the investigative process, enabling discussion and reflection on the topics covered, as well as influencing the development of a critical and reflective student.

Conclusion

By applying activities involving statistical research, the aforesaid the experiences emphasize the need to implement the contents related to Statistics at EJA classes, as a way of developing competencies and abilities in these students, especially those related to: exercising curiosity, reflection and critical analysis; valuing diversity, exercising the true role of the citizens; building consistent arguments; and adopting attitudes related to autonomy, responsibility, flexibility, resilience and determination, which can help society progress.

However, for this to happen, it is important for the teacher to adopt significant methodological strategies based on problem situations, such as those experienced and presented in this experience report. In addition, we emphasize the need for the reorganization of pedagogical proposals, especially with regard to the implementation of Statistics content in the Mathematics curriculum.

With regard to the need to consolidate specific Statistics abilities in EJA students – especially those related to working with statistical research –, we believe that, by applying research – such as those presented here – that they will be able to understand and differentiate between types of research and variables, as well as understand the need to plan and carry out each phase. This highlights the importance of student participation in all processes, especially when choosing the topic, since it should be chosen based on their previous experiences and on the knowledge they have about it.

We understood that there may be challenges when it comes to processing data, especially when they are analyzed from the descriptive

perspective of Statistics, in which mathematical procedures take center stage. After all, these contents, when addressed, emphasize quantitative processes. However, the teacher needs to be sensitive and understand their importance in evaluating students by using qualitative criteria, – such as those based on constructivist currents, as explained by Cury (2008) and Pinto (2000). That way, they can monitor the development of students, especially the consolidation of specific abilities in Statistics.

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