

Teaching statistics from the perspective of the Mathematics Club¹

O ensino de estatística a partir da perspectiva do Clube de Matemática

La enseñanza de la estadística desde la perspectiva del Club de Matemáticas

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ABSTRACT

This article aims to analyze the contributions of the Mathematics Club to the teaching of Statistics through the development of a learning-triggering situation, presented in the format of an emergent situation from everyday life and a virtual history for students in the final years of elementary school. The chosen methodological approach was the didactic experiment. The analysis structure consists of unit, episode and flashes. The results demonstrate that the theoretical and methodological support, offered by the Mathematics Club, enabled students to understand statistical concepts as conceptual tools for understanding environmental problems that make up objective reality.

Keywords: Learning Triggering Situation; Emergent situation from everyday life; Virtual history of the concept; Final years of elementary school.

RESUMO

O artigo tem como objetivo analisar as contribuições do Clube de Matemática para o ensino de Estatística a partir do desenvolvimento de uma situação desencadeadora de aprendizagem, apresentada no formato de situação emergente do cotidiano e história virtual para alunos dos Anos Finais do Ensino Fundamental. O caminho metodológico escolhido foi o experimento didático. A estrutura de análise foi composta de: unidade, episódio e flashes. Os resultados comprovam que os subsídios teórico-metodológicos, ofertados pelo Clube de Matemática possibilitaram a compreensão pelos estudantes dos conceitos estatísticos como ferramentas conceituais para o entendimento de problemáticas ambientais que compõem realidade objetiva.

Palavras-chave: Situação Desencadeadora de Aprendizagem; Situação emergente do cotidiano; História virtual do conceito; Anos Finais do Ensino Fundamental.

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RESUMEN

El artículo tiene como objetivo analizar las contribuciones del Club de Matemáticas a la enseñanza de la Estadística a partir del desarrollo de una situación desencadenante de aprendizaje, presentada en formato de situación emergente de la vida cotidiana y de historia virtual del concepto para estudiantes de los últimos años de la Educación Primaria (Enseñanza Fundamental). El camino metodológico elegido fue el experimento didáctico. La estructura de análisis estuvo compuesta por: unidad, episodio y flashes. Los resultados comprueban que los aportes teórico-metodológicos ofrecidos por el Club de Matemáticas posibilitaron la comprensión, por parte de los estudiantes, de los conceptos estadísticos como herramientas conceptuales para el entendimiento de problemáticas que conforman la realidad objetiva y como un posible camino para encontrar soluciones a estas cuestiones.

Palabras clave: Situación desencadenante de aprendizaje; Situación emergente de la vida cotidiana; Historia virtual del concepto; Últimos años de la Educación Primaria (Enseñanza Fundamental).

1 Introduction

The Brazilian National Common Curriculum Base (BNCC) proposes that students acquire skills and abilities related to the analysis and interpretation of statistical data, such as the collection, organization and interpretation of numerical information, as well as the ability to make predictions and inferences from sample data, which should lead to an understanding of basic concepts, such as mean, median, and mode (BRASIL, 2017).

Although there is agreement with the issues raised in the BNCC (Brazilian National Curriculum Base), it is argued that the teaching of Statistics can go further and address problems that make up the objective reality of students, so that they develop skills that allow them to understand social and natural phenomena. In this way, the emphasis would not only be on the development of quantitative thinking, but also on a qualitative-analytical thinking model, essential for full citizenship in the contemporary world. In line with these perspectives, the essentiality of emphasizing the historical knowledge of "statistical knowledge" is stressed, so that it is possible to "support the processes, modes and needs of experiencing" this model of knowledge, "so that teachers can articulate historical factors to contexts relevant to the reality of students" (Silvestre, Estevam, 2014, p. 293).

In this regard, Gal (2004) asserts that "[...] the context motivates the procedures; (and, that] the data should be seen as numbers with a context and, therefore, the context

is the source of meaning and basis for the interpretation of the results obtained” (p. 64). The relevance of such conceptions is supported by Silva and Silvestre (2022), who state that the teaching of mathematical concepts should be able to allow the perception “[...] that mathematics, like other sciences, was not ‘simply invented’ [...] but arose from the need to solve a particular situation and has experienced advances and setbacks and, moreover, is not finished, it is subject to change and reworking” (p. 5).

Therefore, despite the advances in the guidelines of official documents, several challenges still stand in the way of the effective implementation of statistics education that truly addresses the discussions put forward by authors, such as Silvestre, Estevam (2024); Silva, Silvestre (2022); Gal (2004), among others. One of the main obstacles is the persistence of a traditional and mechanistic approach to teaching, based on the repetition of decontextualized exercises and an excessive emphasis on technical procedures. This disjointed approach, without an objective link to the students' reality, contributes to statistics being perceived as distant and irrelevant to the students' daily lives, although its relevance to the formation of individuals aware of their role in global society is evident (FABRI; PANOSSIAN, 2019).

In order for change to occur in this scenario, a different pedagogical space is needed, one that differs from those already existing. The argument presented here is that the Mathematics Club should be that space. To support this justification, this article aims to analyze the contributions of the Mathematics Club to the teaching of Statistics through the development of a Learning Triggering Situation, presented in the format of an emergent everyday situation and a virtual history of the concept for students in the final years of elementary school.

However, to understand the actions, preceding the elaboration of this article, so that the objective could be achieved, initially, it is necessary to understand, from the perspective of Brazilian legislation, how the teaching of Statistics is structured in Basic Education. Next, the theoretical-methodological structure of the Mathematics Club is explained and how this proposal provides conditions for overcoming challenges in the teaching of mathematical concepts is shown, especially those of Statistics. Following this, the didactic experiment is presented as a methodological option for the development of the actions. Subsequently, the analysis of the data is discussed, based on a structure that prioritizes the movement of the phenomenon and, for this purpose, it will be used: units, episodes and flashes. Finally, there are some considerations regarding the investigation carried out.

2 Based on legislation: a look at teaching Statistics in Basic Education

In Brazil, the teaching of Statistics in Basic Education has been increasingly addressed in official documents, reflecting a vision of holistic student development, enabling them not only to understand mathematics, but also to become critical citizens prepared to make data-driven decisions.

The national proposal for teaching Statistics, as outlined in the National Curriculum Guidelines (DCN)⁵ and in the National Common Curriculum Base (BNCC)⁶, aims to include statistical concepts from the early years of basic education with a more contextualized and critical approach. These documents argue that statistics are not limited to the field of exact sciences, but extends to social sciences, health, economics and other areas of knowledge. Consequently, the inclusion of statistics in school curricula, especially in the final years of elementary school and in high school, has been widely discussed and regulated by official documents from the Ministry of Education (MEC).

Thus, given the reality experienced daily, permeated by an excessive amount of information, it is extremely important to train individuals capable of interpreting and using this information to understand the world around them, exercising critical thinking and, consequently, their citizenship. In this context, "[...] Statistics, like Mathematics, is configured as a symbolic tool that promotes the development of theoretical thinking, whose main characteristics are analysis, reflection and mental action" (MOURA et al., 2018, p. 22).

In this context, the publication of the BNCC (National Common Core Curriculum), in 2017, brought significant transformations to the teaching of Mathematics and, among them, the reformulation of the axis previously called 'Information Processing' stands out, which became structured in the thematic unit 'Probability and Statistics'. In this vein, the reorganization, proposed by the BNCC, (BRASIL, 2017) in the teaching of Mathematics, especially in Statistics, reflects a

⁵ The National Curriculum Guidelines are MEC (Ministry of Education) regulations that guide the organization of undergraduate course curricula in Brazil.

⁶ The BNCC is a normative document created by the Brazilian Ministry of Education that defines the essential content and skills that all students in Basic Education in the country should learn, regardless of the region in which they study.

significant change in how this teaching should be approached and developed throughout Basic Education. The document emphasizes the importance of Statistics as an essential competence for civic education, integrating it with literacy skills, critical data analysis and contextualized problem-solving.

These defenses are based on the fact that, in objective reality, which the subject is a part, your access to information, that brings social and economic problems, in the form of tables and graphs, which materialize data collection and comparison of perspectives, is becoming more common every day.

In such situations, this individual is often led to compare, analyze and defend ideas. Therefore, it is necessary for the school to provide the student with the formation of concepts that help them understand the reality of which they are a part and, among these, the statistical concepts of mean, median and mode are fundamental.

Furthermore, the BNCC (Brazilian National Curriculum Base) proposes problem-solving based on real-life situations, encouraging decision-making according to data and the development of a critical stance towards information circulating in society.

Therefore, the argument made here is that Statistics needs to be understood as a science and, for this, it needs to have its own object of study, which, in school, should be presented as an object of teaching for students, given that they are part of the social, historical, cultural and economic movements of the communities around them. "In this sense, if the student is the main element of the school context, and the main function of the school is to promote teaching and learning for their development, we understand that statistics contributes to this [...]" (MOURA; LOPES; ARAÚJO, 2019, p. 5).

In this context, the BNCC (BRAZIL, 2017) redefines the teaching of Statistics and proposes that it be approached in a cross-curricular manner and linked to situations that emerge from the student's daily life. The document emphasizes that all citizens should be able to collect, organize, represent, interpret and analyze data to make judgments based on established scientific knowledge. Furthermore, the BNCC suggests that the teaching of Statistics should be linked to problem-solving situations, using examples from everyday life, science and technology, in order to promote the development of statistical and probabilistic reasoning from the early years of Basic Education. The proposal goes beyond the simple exposition of formulas, emphasizing the importance of interpretive thinking.

These documents, by proposing an integrated curriculum, adapted to the objective reality of the students, aim to provide training that results in a critical understanding of data, essential for the exercise of citizenship in the 21st century. In this regard, Gal (2004) argues that Statistics should not be understood merely as a mathematical discipline, but as an indispensable tool for the critical analysis of reality. This involves understanding statistical concepts and the ability to interpret and question the presented records.

In this sense, the need for an approach that goes beyond the simple memorization of formulas and procedures is discussed. It proposes that the teaching of Statistics should be based on solving real-world problems, in which students can apply concepts to solve problem situations in the reality that surrounds them. Therefore, it suggests that, to achieve statistical literacy, the teaching process should include the exploration of data collected from contexts close to the students' reality, making learning more meaningful and relevant.

Complementing this view, Gal (2004) confirms that the teaching of mathematics — and, by extension, statistics — should be guided by an education capable of understanding and critiquing, in a coherent way, the reality of which the subject is a part and not only teach how to apply formulas, but also develop the ability to question information, evaluate its origin, intentionality, and social impact.

This implies creating pedagogical spaces in which the student actively engages in investigations that are meaningful to their life, using real elements and constructing interpretations that engage with their social reality.

In this direction, the Mathematics Club (CluMat) is one of those pedagogical spaces that are configured as a proposal to think about and establish a necessary and adequate organization of educational processes, which develop in the subject the maximum capacities, so that he or she can interpret and act upon the reality to which he or she belongs. In this context, it is valid to discuss the specificities of CluMat, supported by the theoretical-methodological assumptions of this space.

3 The theoretical and methodological structure of the Mathematics Club as a proposal for overcoming challenges in the teaching of mathematical concepts.

Given the growing need to rethink the traditional structure of teaching and learning mathematical concepts, it is essential to create new educational spaces that promote the construction of knowledge and not just adaptation to what already exists.

In this context, 'CluMat' presents itself as a proposal aimed at creating an environment conducive to the exchange of experiences and the development of a pedagogical activity model that values student learning. Thus, it emerges as an alternative to transform mathematics teaching, providing a way to overcome the traditional models used in classrooms.

To this end, 'CluMat' creates theoretical and methodological conditions that enable those involved – teachers and students – to deal with mathematical concepts as cognitive tools and, therefore, it is necessary to "seek to give social meaning to what they do" (MOURA, 2021, p. 3). In line with this objective, according to Silva and Moura (2024, p. 12), 'CluMat' seeks a dialectical interaction between teaching and learning, not seen as isolated processes, but rather as parts of a "spatiality of formation and learning," which "is not only a physical space," presupposing the transformation of processes, such as teaching to students and the learning of teaching by teachers. Beyond the above, the Mathematics Club also positions itself in defense of "the subject's relationship with itself as a universal being, that is, a representative of humankind, and the subject's relationship with other subjects through collaboration" (SILVA; MOURA, 2024, p. 12).

From this perspective, 'CluMat-UEG' has been based on the theoretical-methodological proposal of the Teaching-Oriented Activity (TOA) as one of the possibilities for transforming the reality of teaching Statistics. As discussed by Moura (2021), educational activity should be understood as a process of human development, mediated by the appropriation of historically constructed knowledge. Thus, TOA is assumed "as a possibility for the realization of teaching, which presupposes the intentionality of the teacher in an organization that allows students to appropriate knowledge and human experiences throughout history" (MOURA; SFORNI; LOPES, 2017, p. 91).

Therefore, the teaching of Mathematics and, especially, Statistics, cannot be reduced to the mechanical transmission of content or technical training. On the contrary, it must be guided by broader formative purposes, promoting the development of students' theoretical thinking through the resolution of significant and socially constructed situations throughout human life.

Thus, the learning activities planned and developed at CluMat involve "a process of meaning-making of the teaching content," which requires attention to the human-historical processes of emergence and development of the concepts addressed as well as "their interdependence with the formation of other scientific concepts in the historical moment" of their genesis and "their presence as a symbolic instrument in the current context and the relevance of their learning for the development of the potential of the subjects who participate in this activity" (MOURA; SFORNI; LOPES, 2017, p. 87).

Likewise, the teaching of Statistics, within this theoretical-methodological approach, in this training space, should allow students to understand the data and information that surrounds them. After all, the subject "appropriates mathematical knowledge in doing mathematics, in activity and, in this way, teaching proposals related to social and cultural, human and historical practices are structured" (MORETTI; SOUZA, 2015, p. 10), contributing to their conscious action as historical and social subjects.

Such stances and choices, in this context, are based on the concept of TOA, which is a form of organizing pedagogical activity that aims at the psychic development of the subjects involved, through constant approximation with theoretical knowledge, what means that TOA "presents itself as a possibility of carrying out educational activity based on the knowledge produced about the human processes of knowledge construction" (MOURA et al., 2017, p. 206).

In this space, the educational process is understood as a practice that occurs within a historical and social context, influenced by shared values and meanings, which lead to the establishment of theoretical thought. In this sense, 'CluMat' is one of the spaces for the development of this model of thought, especially through the mediation of knowledge in the interactions between teaching and learning. After all, this pattern of thought is not configured merely as an individual process, but as a construction that takes place in the dialectical relationship between the learner and the content that is taught, mediated by the teacher's actions.

Vygotsky (2009) and Moura et al. (2017) emphasize that the development of theoretical thinking, so strongly emphasized within the 'CluMat' framework, occurs more effectively when a pedagogical environment is created in which the teacher's actions are strategically planned and executed collaboratively, actively involving the student in the process. By connecting these ideas, it becomes clear that teaching goes beyond the simple transmission of knowledge, being seen as a conscious and planned action that must be organized in a way that promotes genuine transformation in the student.

The development of theoretical thinking, therefore, is not something isolated, but a phenomenon that results from the dynamic interactions between the student, the teacher and the content, favoring learning that goes beyond memorization and reaches comprehension and the ability to solve problems.

From this perspective, TOA, proposed by Moura and widely implemented within 'CluMat', can be understood as the unity between the content of learning, the learner and the teacher who teaches. It is not concerned with the simple transmission of knowledge, but seeks to promote a qualitative change in the student's development through actions and operations mediated by the teacher.

Teaching, thus, becomes a guided activity, capable of promoting the formation of the student's theoretical thinking, through the resolution of learning problems, establishing a connection between the social world and the student's individual development, constituting "[...] in the pedagogical activity, a dialectical unity between teaching and learning activities, means for theoretical thinking to be enhanced by the organization of actions by the teacher, which must be planned and executed collectively" (SILVA; SOUSA, 2024, p. 3).

Thus, the concept of TOA, which guides the actions of the Mathematics Club, implies a pedagogical organization that favors the theoretical learning of concepts, through a shared activity, in which both the teacher and the student play fundamental roles. The proposal is that the student, by appropriating knowledge, also develops their capacity for generalization and abstraction.

In this sense, TOA is seen and understood as a necessary mediation to ensure that the teaching and learning process is effective, allowing the student to develop intellectually, while the teacher, through their practice, also transforms and appropriates new knowledge. Moura et al. (2010, p. 221) argue that "TOA is the mediation in the

teacher's activity that has as its necessity the teaching of content to the subject in activity whose objective is the appropriation of this content understood as a social objective". Therefore, the relationship between teaching and learning is, in this conception, seen as a dynamic activity, in which actions, motives and objectives are articulated for the realization of quality knowledge.

The TOA is, therefore, configured as a fundamental mediation tool, as it allows both the student and the teacher to transform themselves in the appropriation of the content within a learning and training environment, such as 'CluMat'. From this perspective, by participating in teaching and learning activities, individuals not only assimilate knowledge, but also develop new cognitive abilities, becoming subjects with a deeper and more qualitative understanding of the surrounding world.

Therefore, the teacher's role in this special context – CluMat –, based on the principles of TOA, is to organize their actions in such a way as to ensure that students not only acquire facts and data, but, above all, appropriate general modes of action that allow them to access, apply and create knowledge autonomously and critically.

In this context, TOA becomes a unique process in which collective human experience and the individual experience of the student meet and mutually transform each other, creating a rich educational space, such as 'CluMat', where intellectual development is simultaneously collective and individual.

Thus, the organization of teaching mathematical concepts in the 'CluMat' context does not occur in an isolated or technical manner, but within a logical-historical movement, in which the student not only solves practical problems, but also appropriates the historical and logical conditions that gave rise to these problems. Such problems are part of Learning Triggering Situations (LTS), which, within the scope of the research that supported this article, were objectified as Emerging Situations of Daily Life (ESDL) and Virtual History (VH).

Given these theoretical assumptions, the next topic will present the methodological approach, highlighting the specificities of 'CluMat – UEG' and the presentation of the LTS, materialized in an Emerging Situation of Daily Life (ESDL) and HV, which connected statistical concepts, such as mode, mean and median to a real-life environmental problem: the increase in wildfires in the State of Goiás.

3.1 The unique characteristics of the Mathematics Club at the State University of Goiás

The creation of collaborative spaces, aimed at teacher training intertwined with the teaching of scientific concepts in Basic Education, has been consolidated in the 'CluMat' proposal ⁷– UEG, created in 2017, at the Southwest Campus – Headquarters: Quirinópolis-Goiás.

Therefore, 'CluMat – UEG' is part of a scenario of interinstitutional partnerships that favor the consolidation of formative experiences, based on the exchange of knowledge and shared action between students and teachers of Basic Education, undergraduate students, postgraduate students and professors of Higher Education.

The 'CluMat' is a field for didactic experimentation, in which knowledge is built collaboratively, respecting the unique characteristics of those involved and the sociocultural context in which they are situated. The collaborative nature of this space fosters the construction of links between theory and practice while promoting professional autonomy and the development of actions geared towards daily school life. It is, therefore,

[...] A collective space marked by collaboration among peers, because relationships must be established based on the values and objectives of actions, these factors being decisive for establishing the interaction process among individuals in this purported collectivity [...] (SILVA, 2022, p. 27).

The specific characteristics of 'CluMat – UEG' allow to ratify the importance of teaching proposals committed to the real challenges of Basic Education. In this perspective, collaboration among peers and its capacity to foster the establishment of bonds between the subjects and the object of teaching activity stands out as one of the greatest obstacles to educational processes.

Thus, pedagogical spaces, that wish to make use of collaboration, will need to "commit to raising their level of epistemological criticality, in order to promote

⁷ The CluMat - UEG is coordinated by Professor Dr. Maria Marta da Silva. This project has a headquarters of approximately 300m². The cost of construction and adaptation of the space exceeded R\$ 700,000.00. Since its inauguration, CluMat - UEG has received additional investments of around R\$400,000.00, from grants from the Goiás State Research Support Foundation (FAPEG), Legislative Amendments, and the University's own resources. CluMat - UEG maintains a formalized partnership with the Municipal Education Secretariat of Quirinópolis (SME - Quirinópolis) through Agreement No. 03/2021/UEG - SEI Process: 202100020007284.

situations of movement towards the transformation of existing concrete reality" (SILVA; CEDRO, 2022, p. 100). Therefore, in promoting their actions, whether of elaboration or development, they enable a relationship in which teachers and students are called upon to contribute, resulting in a process permeated by meaningful exchanges. The following, in Table 1, shows the organizational structure of the actions of 'CluMat – UEG'.

Table 1 – Structure of actions developed at 'CluMat – UEG'.

Planning	Development	Re-elaboration
Moments dedicated to the collective elaboration of the LTS, including the selection of the form in which this LTS will materialize (game, ESDL or VH). In this stage, the Historical Synthesis of the Concept (HSC) is carried out, aiming to reconstruct the historical path of the emergence and development of the mathematical concept contemplated in each LTS.	The development of the LTS takes place at the Club's own headquarters, where the students are taken (transportation provided by the university and the Municipal Education Department is used for this purpose). Since its creation, in 2017, more than 3,000 students from the public school systems of Quirinópolis and surrounding municipalities have been to this space, participating in the development of activities, teaching mathematical concepts, offered in Basic Education.	This phase involves holding regular meetings to evaluate the activities carried out, discuss the results obtained and identify areas for improvement. Based on this collective evaluation, the activities are reviewed and reworked, considering the needs, suggestions and experiences of those involved. The goal is to continuously improve actions and operations, making them more effective and aligned with the group's demands, thus, favoring the teaching and learning processes.

Source: The authors (2026).

The presented framework summarizes the organization of actions developed by 'CluMat – UEG', highlighting the stages that structure its formative dynamics. Following this, the planned and implemented LTS is presented, highlighting the stages that comprise its collective construction.

3.2 Palace in Flames: a LTS in the format of ESDL and Virtual History

To enable an understanding of the contributions of the Mathematics Club to the teaching of Statistics, based on the development of a learning-triggering situation, presented in the format of an emergent everyday situation and virtual story to students in the final years of elementary school, a summary of the steps that composed it is presented below.

This systematization highlights not only the methodological choices made, but also the theoretical foundations that support each decision, ensuring coherence between the objective and the practices adopted (Table 2).

Table 2 – Summary of the structure of the LTS, called ‘Palace in Flames’⁸.

Individuals and objective conditions	Actions	Reasons
<u>Individuals:</u> Approximately, 70 students from the final years of elementary school, specifically the 7th grade. <u>School Unit:</u> The participating school is part of the group of municipal schools that are partners in the project. <u>Data Collection:</u> This process took place throughout the development of the activities and used semi-structured group interviews (recorded in audio and video) and individual questionnaires. <u>Duration:</u> The development of the LTS lasted one school semester with weekly visits by the students to the Club.	- A LTS was developed, which was implemented in two formats: a ESDL and a virtual history (VH). Both complemented each other in such a way that real data were presented to students within the context of the VH and as essential elements that made up the learning trigger situations (LTS). - Students were presented with a news story about wildfires: Losses of up to R\$ 1.5 billion and a threat to biodiversity: wildfires grow by more than 130%, in Goiás, in 2024, and professionals are outlining prevention strategies [Goiás] G1 By Gabriela Macêdo, g1 Goiás 03/11/2024 06:00. - A dialogue was initiated with the students about the causes and consequences of these fires for the environment. Beginning of the Virtual Story: Faced with this scenario, due to the repercussion of this news, the governor of the State of Goiás, along with his advisors, showed substantial concern regarding the constant fires that have been occurring in our State. First, he asked Dona Letícia, his chief of staff, to create a commission with people who could contribute to this very important analysis. She, then, summoned the specialists from the environmental secretariat, the governor's advisors and the professionals dedicated to the analysis of environmental data, the statisticians (the students are called upon in the context of the Virtual History to occupy this role). - Students are guided, as the VH plot unfolds, to use ESDL data about wildfires in Goiás. 5 (five) groups of triggering problems were offered. The objectives of which allow them to understand the concept of mode, mean and median and, in the end, to solve the triggering problems.	The choice of the final years of elementary school was due to the fact that the mathematics curriculum for these years includes the teaching of statistics. It is suggested that these concepts be linked to significant environmental problems in the local context. The LTS in the format of ESDL and VH allowed students to perceive statistics as a tool for interpreting environmental phenomena close to their reality, strengthening the formation of critical and conscious citizens. Among the pre-established goals, the aim was to guide students to apply the statistical knowledge acquired in the construction of real proposals to combat wildfires in the state of Goiás. The objective was to develop critical thinking, socio-environmental responsibility and the ability to plan solutions based on statistical data.

Source: The authors (2026).

⁸ The learning-triggering situation is published in its entirety in Mendes (2026).

The next section presents an analysis of the data obtained throughout the didactic experiment, highlighting how the students understood the particularities of the Mathematics Club and how they constructed meanings, throughout the process of developing solutions, for a real impasse that affects their lives and communities, based on an understanding of the concepts of mean, mode and median.

4 Data analysis as a way to understand the process

The construction of scientific knowledge is not reduced to the simple observation of the immediate aspects of a phenomenon. For this, an analysis capable of grasping the intellectual movement of going beyond appearances is necessary, resorting to processes of abstraction that function as bridges between the visible and the deep structures that underpin reality.

From this perspective, analysis is the result of the effort to approach the concrete essence of the objects of study and not of superficial interpretations, shaped by the observer's initial impression.

Starting from this conception, it is recognized that human experience and scientific instruments are products of the same objective reality that gives them meaning and coherence.

Thus, carrying out an analytical process, based on the defended theoretical framework, requires relating the concrete conditions and contexts that originate the investigated phenomenon. This theoretical position values abstraction as an indispensable step in the analysis, since, through it, it is possible to grasp complex dimensions of what one seeks to understand. "This way [...] of perceiving reality [...] is also based on the principle that abstraction is an indispensable mediation, in which science approaches the essence, the real concreteness" (SILVA, 2014, p. 125).

To achieve this movement, it was decided to create units of analysis. "By unit we understand the result of the analysis which, unlike the elements, enjoys all the fundamental properties characteristic of the whole and constitutes a living and indivisible part of the totality" (VIGOTSKI, 1998, p. 20). In this sense, this form of analysis is inseparable from a vision of reality, which implies recognizing that approaching the essence of phenomena requires theoretical mediation, but that this abstraction must, necessarily, reconnect with the concrete.

To accomplish such an undertaking, the analytical structure will also consist of episodes, understood as "the attempt to construct a way of analyzing interdependencies [...] moments in which a conflict situation becomes evident that can lead to learning the new concept" (MOURA, 2004, p. 276). Associated with these episodes it will be flashes, defined as "the most significant moments in which action and thought are unified in the appropriation of the objective world" (SILVA, 2018, p. 145).

The centrality of flashes stems from the fact that the learning process is not explicitly and linearly apparent. In this sense, the adoption of flashes allows for capturing nuances of learning that are revealed only at specific moments in the activity. Thus, flashes are not mere illustrative excerpts, but objective expressions of the formative movement that unfolds during the pedagogical action, that is, "they are indications of the transformation of the subject's thinking, consisting equally of the finding of an observable datum, whose logical analogy with itself allows one to infer its own presence" (SILVA, 2018, p. 149). The articulation between episodes and flashes also makes it possible to understand that the development of subjects occurs in constant dialogue with the collective. Table 3, below, shows the structure of the analysis that will objectify this movement.

Quadro 3 – Data analysis structure.

Unit of analysis: The subsidies offered to the teaching of statistics, based on the theoretical and methodological framework of 'CluMat'.	
First Episode: Between the Club and the Classroom – Differences and Contributions.	Second Episode: Understanding statistical concepts as a means of understanding real-world problems.

Source: The authors (2026).

4.1 First Episode: Between the Club and the Classroom – Differences and Contributions

In 'CluMat', instead of limiting itself to the traditional model of knowledge transmission, continuous interaction between all those involved is proposed, from the planning of activities to their execution. The teacher is not seen as the sole holder of knowledge, therefore, the planning and development of actions are based on the principles of collaboration, in which "the activities are mostly organized collectively due to the necessary articulation between theory and practice, this being one of the main characteristics we have in the Mathematics Club" (SILVA, 2022, p. 20).

On the other hand, the student is not just a receiver of content, but a subject who constructs knowledge, mediated by interaction with their peers and with the teacher. The following flashes corroborate to this discussion: *"I like coming here to learn because it's very different from school, here you all strive for us to learn, everyone wants us to learn and we have each other to help too"* (Luisa⁹, Episode 1, Flash 1); *"Another thing I really like here is that our opinion has value, like you use what we say to solve the problems of the activity, it's not just what the teacher says that counts"* (Marcela, Episode 1, Flash 2).

The Flashes 1 and 2 allow us to understand that "[...] the comprehension of actions that can trigger formative movement" and are based on "the understanding of learning possibilities through the mediation of mathematical knowledge" (SILVA, 2022, p. 20) suggests the creation of a collaborative environment in which the transformation of mathematics teaching and learning processes is carried out intentionally. Thus, the theoretical arguments presented in this space emphasize social relations as mediators of human development, considering learning as a socially constructed phenomenon.

The subjects also stand out as another contribution of 'CluMat': the defense that mathematical concepts do not arise in isolation, but are part of a logical-historical movement, which has as its starting point the resolution of human problems, evolving according to the needs and solutions found over time. The following flashes corroborate this point: *"In math classes in our classrooms at school, we don't think that the contents of mathematics were invented to help solve human problems a long time ago"* (Cecília, Episode 1, Flash 3); *"They don't teach us how it was created or how it evolved to the way it is today, the way it is in the textbook"* (Luana, Episode 1, Flash 4).

At 'CluMat', there is a commitment to consider the historical context in the process of object change, in the stages of its emergence and development, and to understanding the logical as "the means by which thought performs this task in the process of reflection on the historical context, so that the logical reflects the main periods in the history of the object" (SOUZA, 2018, p. 1). This historical development is not linear, but rather a process that involves a series of transformations in ways of thinking that go from the concrete to the abstract. This movement cannot be disregarded during the planning of teaching activities for students, but rather valued,

⁹ The names are fictitious to protect the students' identities. The photos were taken from press conferences held during the development of the LTS.

as it contributes to the student's understanding of the origin and evolution of a concept, carrying out the logical movement of internalization of this concept, that is, moving from the understanding of the concrete phenomenon to its abstraction and generalization. In the words of Moura et al. (2016, p. 119), this means giving space to "[...] the unity of the historical and the logical as a premise for understanding the essence of an object, of a concept, its structure, its history, its development".

This structure stems from the understanding that school concepts are not isolated products, but rather result from historical processes in which certain human needs have driven the creation of specific forms of knowledge. Thus, "to reveal the essence of the object it is necessary to reproduce the real historical process of its development, but this is only possible if we know the essence of the object" (KOPNIN, 1978, p. 184).

Meanwhile, the 'CluMat' approach differs from what is commonly found in the classroom, which is highlighted by the students and materialized in various flashes, by keeping present in the teaching activities, offered to them not only the content to be taught, but also the path by which humanity arrived at its formulation. For Moura et al. (2018), this means that the teacher needs to know not only the content itself, but also the historical, social and cultural conditions that originated it. The next flash shows signs of this understanding: *"In order for us to do this type of activity, you here in the club have to know not only the mathematical content of the class, you have to know how it was created, and also why, because I never imagined that I used mathematics to understand problems of wildfires"* (Mariana, Episode 1, Flash 5).

Based on these understandings, it is noteworthy that the organized learning situations enabled students to experience a movement similar to that which, at some point in history, motivated the creation of the concept in question. This movement is presented to students in the form of a LTS.

The LTS is a concrete situation that challenges students to solve a collective problem, placing them before a need that mirrors, in didactic terms, the problems historically faced by humanity. This activity aims to create a learning environment in which the concept emerges as a response to a real demand and not as mere transmitted information. Thus, the next flash highlights: *"in the classroom, the mathematical content has no relation to real things, and when an exercise appears, like, it talks about news, but it doesn't use that to solve a mathematical problem, like here we use real information about wildfires to learn statistics"* (Luciana, Episode 1, Flash 6).

The LTS must ensure that the student not only learns the technique or the formulation of a concept, but also understands its historical and logical roots, with the theoretical appropriation of the content. Therefore,

The main objective of this is to provide the student with the need to appropriate the concept, so that their actions are carried out in pursuit of solving a problem that motivates them to learn and acquire knowledge (MOURA *et al.*, 2016, p. 116).

The LTS allowed students to engage in solving a problem as if they were part of a group (this situation was offered to them in the context of the virtual story when they became part of the group of statisticians, requested by the governor, to help find solutions to the problem of wildfires in the State of Goiás), facing challenges similar to those encountered in the construction of the concept over time. In this sense, the LTS did not limit itself to presenting a problem to be solved, but placed students in a challenging position, in order to develop a generalized mode of action that allows them to apply knowledge broadly.

4.2 Second Episode: Understanding statistical concepts as a means of understanding real-world problems.

In general, the teaching of mathematics is still strongly tied to traditional practices, centered on the mechanical memorization of formulas and the repetitive execution of exercises. In this approach, the focus usually falls almost exclusively on obtaining the correct result to the detriment of a deeper and more meaningful understanding of the concepts.

This model, which favors the reproduction of procedures, often distances students from the real meaning of the discipline, fostering negative perceptions, disinterest and the belief that mathematics is an area distant from everyday life. The signs that the flashes bring about these issues can be observed: *"When solving the problems in the history of the Governor's Palace of Goiás, the important thing was not just to find an answer, a number, the value of the average and that's it, in fact we had to understand the problem of the fires in general and that made all the difference, because then we saw that you can use mathematics to solve real problems, problems in our lives"* (Luciana, Episode 2, Flash 1).

In line with what has been stated in the flash above, it is assumed that the LTS is not an isolated task, but a provocative element capable of instilling a state of curiosity, questioning and intellectual mobilization in students. Thus, the LTS, offered to the students, allowed them to be placed "in creative tension, similar to those who experienced it, when solving their authentic problems, generated by practical or subjective needs" (MOURA; ARAÚJO; SERRÃO, 2019, p. 422). Therefore, the LTS was able to mobilize the individual or their collective to solve it. This understanding is present in the next flash: *"When we were helping Mrs. Letícia with the story itself, you know, helping her give answers to the governor, we didn't do it alone. At school we do everything alone, each one at their desk, here we do it together, and in the end the proposals were also everyone's because the problem of the fires was everyone's problem too" (Luana, Episode 2, Flash 2).*

By proposing a genuine problem, such as wildfires, generated by practical or subjective needs, the LTS invites the student to engage in the knowledge construction process, transforming them from a mere executor of tasks into a participatory subject, capable of establishing relationships, constructing meanings and developing intellectual autonomy. The third flash confirms this conjecture: *"I found it very interesting that the activity didn't have just any invented problem that had nothing to do with our lives; it was about wildfires, and every year the city suffers, and the people on the farm too. That's why it's so good to do the activities here at the club, because it's not just about doing exercises; here, the calculations to find the mean, the mode, and the median had to do with things that are important to me and to everyone else, right?" (Mariana, Episode 2, Flash 3).*

In this movement, the LTS acts as an intentional and planned starting point, going beyond the simple presentation of content, leading the student to reflection, critical thinking, and the development of skills to interpret and transform the reality in which they live.

From this, learning comes to be understood as a dynamic and interactive process, in which knowledge emerges as a response to felt and experienced problems.

The choice of statistics, as a tool to interpret data, make informed decisions, and understand phenomena that directly affect them, made with the intention of enhancing students' understanding and favoring the construction of personal and collective meanings, as highlighted in Flash 3. This interface between the teaching of Statistics and the problems that are part of the students' objective reality favors the formation of critical, conscious and socially responsible citizens.

Therefore, by analyzing the real-life situations, presented in the LTS, which was made possible with ESDL and VH, the students began to realize that Mathematics is not just a set of abstract calculations, but rather an effective instrument for reading and intervening in the world. Subsequently, there are flashes that confirm this defense: *"I didn't even know that there was a part of Mathematics that was used to study things like data, and I also didn't imagine that, as they say, statistics helped us understand this kind of thing, like wildfires, and even less that it helped us prevent environmental problems"* (João, Episode 2, Flash 4).

Thus, the LTS made it possible for the teaching of Statistics to be redefined, transforming it into a space for dialogue between theory and practice, as well as between academic knowledge and the concrete challenges of everyday life. The teaching of Mathematics, in this scenario, proved to be a fundamental resource for understanding and transforming reality, allowing to understand learning as a living, active process that is deeply connected to social life.

5 Final considerations

During the planning of the LTS, which supported the writing of this article, it was decided to materialize it in the formats of ESDL and VH, seeking to integrate the teaching of Statistics to the social, cultural and environmental context of the students.

This choice was not accidental: emerging everyday situations offer a concrete bridge between scientific knowledge and the students' daily experiences, promoting learning that allows for the emergence of personal and social meaning.

The chosen theme was wildfires in the State of Goiás, a relevant environmental problem present in the lives of the subjects involved. By relating statistical content to a real and current problem, a suitable space was created for students to understand the importance of Statistics, because "[...] The problematization of emerging everyday situations allows educational practice the opportunity to place the student before the need to experience solving problems that are significant to them" (MOURA, 2016, p. 121).

Thus, the experiences lived by these students, in the Math Club, reveal that the coexistence of different individuals in a collective space fosters a broader understanding of the social role of mathematical knowledge.

By constructing collective responses to the triggering problems, present in the virtual story, the participants experienced a new understanding of the function of mathematical concepts and the important role of collaboration, that is, the negotiation of common goals and decision-making guided by shared objectives.

This required participants to be willing to listen, review their own positions and engage in collective actions, contributing to the professional development of all involved.

Thus, 'CluMat – UEG' presents itself as an alternative, based on overcoming the exacerbated individualism present in the teaching of Mathematics in Basic Education. In its place, it proposes an experience based on the approximation between subjects, on the recognition of the contributions of each one and on the valorization of collective work as a structuring element of learning to teach.

This proposal strengthens the conception that learning is a process that occurs in interaction with the other, within social practices, mediated by language and guided by common objectives. In this way, 'CluMat' is recognized as a collaborative and dynamic space, with a dialogical character between theory and practice, enabling the (re)signification of the actions that involve the teaching and learning processes of mathematical concepts.

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