

Statistical literacy and school management: interpretations on educational indicators and affirmative action

Alfabetización estadística y gestión escolar: interpretaciones sobre indicadores educativos y acciones afirmativas

Littératie statistique et gestion scolaire : interprétations des indicateurs éducatifs et des actions affirmatives

Letramento estatístico e gestão escolar: interpretações sobre indicadores educacionais e ações afirmativas

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Abstract

This article discusses the results of an investigation that analyzed public school administrators' perceptions of educational indicators and affirmative actions from a statistical literacy perspective. The study articulates data from a scoping review of the literature, a questionnaire developed using Google Forms and applied primarily to school administrators in the states of Pernambuco and Paraíba, as well as visits conducted in two public schools—one regular urban school and another located in a quilombola community. This is a mixed-methods study involving quantitative analysis of closed-ended questions and qualitative analysis of open-ended questions and field observations, which were examined using content analysis techniques. The results reveal the need for a more structured implementation of affirmative actions and greater awareness of their legal foundations. The potential of educational indicators to support effective school practices is also highlighted, although challenges in integrating data

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into school management persist, requiring strategies to ensure their effective use in decision-making. School visits confirm weaknesses in the critical use of data and point to challenges related to administrators' statistical training and the consolidation of democratic management practices. It is concluded that strengthening the statistical literacy of school administrators is a strategic element for promoting social justice and educational equity in public schools.

Keywords: Statistical literacy, Educational indicator, Affirmative action.

Resumen

Este artículo presenta los resultados de una investigación cuyo objetivo fue analizar las percepciones de gestores de escuelas públicas sobre indicadores educativos y acciones afirmativas desde la perspectiva del letramiento estadístico. El estudio articula datos provenientes de una revisión de alcance de la literatura, de un cuestionario elaborado en Google Forms y aplicado principalmente a gestores escolares de los estados de Pernambuco y Paraíba, así como de visitas realizadas a dos escuelas públicas: una urbana regular y otra ubicada en una comunidad quilombola. Se trata de una investigación de enfoque mixto, con análisis cuantitativo de las preguntas cerradas y análisis cualitativo de las preguntas abiertas y de las observaciones de campo, ambos abordados mediante la técnica de análisis de contenido. Los resultados evidencian la necesidad de una implementación más estructurada de las acciones afirmativas y de una mayor concienciación sobre sus bases legales. También se destaca el potencial de los indicadores educativos para sustentar prácticas eficaces en las escuelas, aunque persisten desafíos en la integración de los datos a la gestión escolar, lo que exige estrategias que garanticen su uso efectivo en la toma de decisiones. Las visitas a las escuelas confirman fragilidades en el uso crítico de los datos y evidencian desafíos relacionados con la formación estadística de los gestores y con la consolidación de prácticas de gestión democrática. Se concluye que el fortalecimiento del letramiento estadístico de los gestores escolares constituye un elemento estratégico para promover la justicia social y la equidad educativa en las escuelas públicas.

Palabras clave: Alfabetización estadística, Indicador educativo, Acciones afirmativas.

Résumé

Cet article présente les résultats d'une recherche visant à analyser les perceptions des responsables d'écoles publiques concernant les indicateurs éducatifs et les actions

affirmatives à partir des principes de la littératie statistique. L'étude articule des données issues d'une revue de portée de la littérature, d'un questionnaire élaboré via Google Forms et appliqué principalement à des gestionnaires scolaires des États de Pernambuco et de Paraíba, ainsi que de visites réalisées dans deux écoles publiques : une école urbaine régulière et une autre située dans une communauté quilombola. Il s'agit d'une recherche à méthode mixte, comprenant une analyse quantitative des questions fermées et une analyse qualitative des questions ouvertes et des observations de terrain, traitées à l'aide de la technique d'analyse de contenu. Les résultats révèlent la nécessité d'une mise en œuvre plus structurée des actions affirmatives et d'une plus grande sensibilisation à leurs fondements juridiques. Le potentiel des indicateurs éducatifs pour soutenir des pratiques scolaires efficaces est également mis en évidence, bien que des défis persistent quant à l'intégration des données dans la gestion scolaire, ce qui requiert des stratégies garantissant leur utilisation effective dans la prise de décision. Les visites dans les écoles confirment des fragilités dans l'usage critique des données et mettent en évidence des défis liés à la formation statistique des gestionnaires ainsi qu'à la consolidation de pratiques de gestion démocratique. Il est conclu que le renforcement de la littératie statistique des gestionnaires scolaires constitue un élément stratégique pour promouvoir la justice sociale et l'équité éducative dans les écoles publiques.

Mots-clés : Littératie statistique, Indicateur éducatif, Actions affirmatives.

Resumo

Este artigo discute os resultados de uma investigação que buscou analisar as percepções de gestores de escolas públicas sobre indicadores educacionais e ações afirmativas a partir dos princípios do letramento estatístico. O estudo articula dados provenientes de uma revisão de escopo da literatura, de um questionário elaborado no Google Forms, aplicado majoritariamente a gestores escolares dos estados de Pernambuco e da Paraíba, além de visitas realizadas a duas escolas públicas, uma urbana regular e outra localizada em uma comunidade quilombola. Trata-se de uma pesquisa de abordagem mista, com análise quantitativa das questões fechadas e análise qualitativa das questões abertas e das observações de campo, que foram tratadas com a técnica de análise de conteúdo. Os resultados revelam a necessidade de implementação mais estruturada de ações afirmativas e maior conscientização sobre suas bases legais. Destaca-se também o potencial dos indicadores para embasar

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práticas eficazes nas escolas, embora desafios na integração dos dados à gestão escolar ainda persistam, exigindo estratégias que garantam seu uso efetivo na tomada de decisões. As visitas às escolas confirmam fragilidades na utilização crítica dos dados e evidenciam desafios relacionados à formação estatística dos gestores e à consolidação de práticas de gestão democrática. Conclui-se que o fortalecimento do letramento estatístico de gestores escolares constitui um elemento estratégico para a promoção de justiça social e de equidade educacional nas escolas públicas.

Palavras-chave: Letramento estatístico, Indicador educacional, Ações afirmativas.

Letramento estatístico e gestão escolar: interpretações sobre indicadores educacionais e ações afirmativas

Introduction

In the basic education curriculum in Brazil, statistics is part of the mathematics curriculum contents, linked to learning expectations from the early years of elementary school, according to the National Common Curriculum Base (Base Nacional Comum Curricular—BNCC) (Brasil, 2018). BNCC recommendations associate the learning of statistics with probability; however, the document does not explicitly mention statistical literacy.

Statistical literacy is a complex process that requires articulations between elements of knowledge (literacy skills, mathematical, statistical, and context knowledge, and critical questions) and dispositional elements (beliefs, personal attitudes, and critical stances) (Gal, 2002). These articulations, according to Gal (2002), are fundamental for people to understand information critically, make decisions, and identify inconsistencies in the data.

Literacy practices are uncommon among school managers and infrequent in initial or continuing education courses. For example, although managers recognize the importance of information for decision-making, they do not usually rely on processes of information search, access, evaluation, and organization (Pereira, 2018). The literacy perspective lacks depth and concrete proposals for its implementation in management formative courses. There is a need to investigate managers' literacy levels, given the importance of these professionals in advancing quality in public schools. The focus of this research lies in analyzing public school managers' perceptions of the educational indicators used to monitor affirmative actions, in light of the statistical literacy framework.

The concept of educational indicators is broad and incorporates a variety of data related to the school community. Understanding them is crucial to improving the functioning of educational institutions. However, the potential of statistical information has not been fully explored by managers and formulators of social programs (Jannuzzi,

2005). We recognize the need for managers to be statistically literate and able to critically analyze data on educational indicators.

Understanding educational indicators, based on public statistics, is essential for school management committed to quality and social justice. These instruments quantitatively express the conditions for implementing the policies and support decision-making, action monitoring, and evaluation of school performance (Jannuzzi, 2018). By incorporating indicator analysis into their management practices, schools can better meet the needs of their students and communities. Thus, we emphasize the importance of investigating how school management addresses these issues in school spaces. In particular, we focus on the challenges of promoting affirmative policies.

Affirmative policies have played a crucial role in promoting ethnic and racial diversity in the school environment. Based on the principle of equity of the Federal Constitution (Brasil, 1988), these policies aim to correct historical inequalities and promote the inclusion of marginalized groups, especially Black and Indigenous peoples, in educational institutions, thereby generating significant repercussions for the support and appreciation of students' ethnic-racial diversity.

In the field of educational public policies, universalist approaches have proved insufficient to address racial inequalities. This scenario is exacerbated by the absence of specific indicators for students in greater social vulnerability, which limits the equitable distribution of resources and compromises the effectiveness of affirmative actions (Tripodi, Delgado, & Januário, 2022). Added to this is the lack of conceptual clarity in educational indicators, which carry multiple meanings beyond their metric aspects. The Basic Education Development Index (Índice de Desenvolvimento da Educação Básica — Ideb), for example, although widely disseminated and used in educational management, is an indicator crossed by significant margins of uncertainty (Travitzki, 2020) and methodological limitations that weaken its ability to apprehend the complexity of educational processes developed in education systems (Oliveira Júnior, Minori, & Frota, 2019).

The growing appreciation of statistical data, as a basis for the formulation and evaluation of educational public policies, highlights the need for school managers to develop skills in statistical literacy. In this context, it is relevant to investigate how

these professionals understand and use indicators in their practice, particularly in implementing affirmative actions in the school environment. Given that such actions are supported by legal frameworks and aim to include historically marginalized groups, understanding the interfaces among educational indicators, statistical literacy, and inclusion policies is fundamental to strengthening the effectiveness of school practices. Thus, this research is justified by the need to expand on these aspects, identifying potentialities and challenges that can inform education and management strategies more aligned with social justice and educational equity.

Understanding and using educational indicators are essential for school management focused on quality and social justice. Public statistics provide information and can generate knowledge for various management processes, such as evidence-based decision-making, school performance evaluation, equity promotion, and transparency and accountability. By incorporating indicator analysis into their management practices from a statistical literacy perspective, schools can better meet the needs of their students and community by promoting quality and equitable education.

School managers' proposals must be achievable and politically acceptable in the school context, regardless of their intentions (Vieira, 2007). In this sense, understanding and using social and educational indicators as tools for educational action can help inform decision-making by focusing on the realities of schools.

The research data discussed in this article constitute an excerpt from a broader postdoctoral study, guided by the following problematizations: How can educational indicators be articulated with the perspective of statistical literacy? How do school managers understand educational indicators and affirmative action policies? To what extent can situations of use of educational indicators enhance managers' statistical literacy? And how can the analysis of social indicators related to affirmative action policies contribute to enhancing school managers' critical decision-making based on statistical literacy?

Within the scope of this excerpt, the article aims to analyze public school managers' perceptions of educational indicators and affirmative actions in light of the

principles of statistical literacy. In specific terms, we seek to: delimit the concept of educational indicators in the literature, highlighting their relationships with possibilities of statistical literacy; describe the perceptions of public school managers about educational indicators, affirmative actions and elements of statistical literacy; and identify situations of use of indicators by managers in the evaluation and monitoring of affirmative action policies in the contexts of a regular public school and in a quilombola community.

The research questions and objectives were investigated through a literature review, a questionnaire, and visits and observations in two schools. The data generated through this process were analyzed using a mixed-methods approach, culminating in the synthesis of qualitative and quantitative data.

In addition to this introduction, we deepened the concept of statistical literacy, focusing on Gal's (2002) model. Next, we describe the methodology and the results obtained, and present the final considerations.

Statistical literacy: theoretical foundations for the critical reading of indicators

Understanding, analyzing, and interpreting statistical information are key decision-making skills in an increasingly technological, data-driven world. However, this data, disseminated almost instantaneously, comes from both reliable and questionable sources, which can result in distortions and lead to misinterpretations. Thus, from the perspective of statistical literacy, statistical teaching and learning processes are necessary to stimulate critical analysis among teachers, students, and school managers.

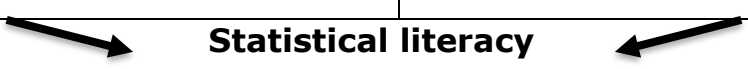
Statistical literacy goes beyond simple knowledge of statistical concepts and formulas. It is a skill that empowers people to interpret and critically evaluate data to make decisions and to actively participate in society. Some indications that the person has some level of statistical literacy are evident when they argue and question based on data, identify biases and statistical manipulations, and understand the limitations and uncertainties inherent in the data.

In the educational field, it is essential to conceive the teaching of statistics as a process aimed at promoting the critical understanding of data that show trends and transformations in relevant social issues. Gal (2002) presents the statistical literacy

model (Figure 1) as a complex process that integrates elements of knowledge and elements of disposition.

Figure 1

Statistical literacy model (Gal, 2002)

Knowledge elements	Dispositional elements
Literacy skills Statistical knowledge Mathematical knowledge Context knowledge Critical questions	Beliefs and attitudes Critical posture
 Statistical literacy	

Note. Adapted from Gal (2002, p. 4).

In the statistical literacy model proposed by Gal, understanding and interpreting statistical information require not only statistical knowledge but also access to other knowledge bases: literacy skills, mathematical knowledge, and contextual awareness. However, the critical evaluation of statistical information (after its understanding and interpretation) also depends on additional elements: the ability to access fundamental issues and adopt a critical stance, which, in turn, is supported by certain beliefs and attitudes. These cognitive and subjective components, according to the author, do not constitute fixed categories, but an articulated and dynamic system, context-sensitive, whose interaction is a condition for the construction and mobilization of statistically literate behaviors. This mobilization does not occur spontaneously; it requires teaching approaches that enhance it.

Literacy skills refer to the general reading, interpreting, and communication competencies necessary to access and make sense of statistical information presented in different formats, such as written texts, oral communications, tables, graphs, and other forms of representation. According to Gal (2002), these skills allow us to locate relevant information, which is fundamental because statistical information circulates

predominantly in everyday reading contexts, such as the media, institutional documents, and public reports.

Mathematical and statistical knowledge, according to Gal (2002), corresponds to the mastery of basic mathematical and statistical concepts, ideas, and procedures that provide the foundations for the understanding of statistical information, such as familiarity with descriptive statistics concepts; reading and interpretation of graphs and tables; notions of probability and uncertainty, among others. This knowledge is not conceived in technical or specialized terms, but rather as a functional set that enables citizens to interpret and evaluate statistical information across different social contexts.

More recently, Gal (2019, 2021) reinforces the point that knowledge of context is fundamental to statistical literacy. For this researcher, it is the context that stimulates people to seek knowledge, not just the data itself. Knowledge of the context is essential to avoid detached readings of reality and to recognize that data and indicators are not neutral, but produced in specific situations, with clippings, methodological choices, and social consequences.

Thus, Gal (2021) advocates an approach that uses real data and connects instructional content to meaningful contexts. This contextualized learning enhances engagement and promotes a deeper understanding of statistical concepts.

Critical issues serve as a central mechanism for evaluating statistical information, allowing the subject to go beyond superficial understanding and to exercise informed, reflective judgment. Gal (2002) points out that they involve questioning, such as: Who produced the data and for what purpose? How was the data collected and analyzed? What information was omitted or highlighted? Are the conclusions justified by the data presented?

The dispositional elements, in turn, contribute to the mobilization and articulation of the elements of knowledge. Critical posture, according to Gal (2002), is configured as an active and questioning attitude towards data, essential for citizen participation in information-saturated societies, while beliefs and attitudes concern the conceptions that people build about statistics, about the social role of data, and about their own ability to understand and evaluate them. Such beliefs can either foster or hinder

engagement with statistical information, directly influencing the willingness to question, interpret, and use data in a reflective and socially responsible manner.

Critical education is fundamental for the construction of a democratic and participatory society. Statistical literacy, according to the model proposed by Gal (2002), plays an important role in this process, enabling the analysis of statistical information with discernment and the recognition of manipulations and distortions, thereby providing better-informed decision-making opportunities. By promoting statistical literacy, people have more opportunities to understand and critically engage in the analysis of complex issues.

Since statistical education is an area of research, studies are needed to deepen the ways of mobilizing the elements highlighted by Gal (2002) in schools. In our previous studies, linked to the Group of Mathematics and Statistics Education (Grupo de Educação Matemática e Estatística—GPEME) of the Federal University of Pernambuco, we have already been able to build evidence of the importance of the elements of knowledge for the interpretation of statistical data presented through graphs (Carvalho, Nunes, & Campos, 2008; Gomes, Carvalho, & Monteiro, 2011). A relevant conclusion from these studies was that the type of relationship between the data and the type of data representation influences interpretations, as well as the need to better address cognitive and intuitive demands in the classroom. These studies address graphs, tables, students' prior knowledge, and teaching perspectives, which can be considered ways of presenting social indicators.

Statistical literacy is not limited to understanding concepts and representations; it also involves the ability to interpret, problematize, and use data in real-world decision-making contexts. In this sense, within the scope of school management, it is essential to understand how data are mobilized to guide educational practices and policies. In the following section, we discuss the role of educational indicators and their relevance to school management, highlighting their potential and challenges in supporting more informed, context-specific decision-making.

Educational indicators and their relevance for school management

The promulgation of the 1988 Constitution in Brazil was a milestone in research on school management, and this process was stimulated, above all, by the democratization of education and the decentralization of power through the elections of school principals (Brasil, 1988). Democratic management expresses a *public value* in policies and management; however, implementation and political conditions tend to be neglected in research because they focus on management practice (Vieira, 2007).

According to the Law of Guidelines and Bases of Education (Lei de Diretrizes e Bases da Educação-LDB) (Brasil, 1996), the school task is to take care of the promotion of teaching and learning and, for this to happen, it is necessary to build the political-pedagogical project, favor school-community integration, and promote the management of material, human, and financial resources.

School management, therefore, is a complex task that involves various aspects, from the management of financial and human resources to the development of effective pedagogical strategies organised around a political-pedagogical project built with the participation of the school community. A key element discussed in this article is public school managers' understanding and use of educational indicators.

Jannuzzi (2018) considers social indicators to be measures that use public statistics to assess problems of social interest, thus contributing to dimensioning the planning, monitoring, and evaluation of public policies by technicians and managers at the federal, state, or municipal levels. Educational indicators encompass a range of data on the school community and play an important role in understanding and improving the functioning of educational institutions. An example is the demographic census, a rich source of data for constructing indicators. However, the potential of statistical information does not seem to have been fully explored by managers and formulators of social programs (Jannuzzi, 2005).

More recently, in a lecture within an interinstitutional discipline encompassing postgraduate courses in mathematics education, linked to the Federal University of Pernambuco (UFPE), University of Campinas (Unicamp) and State University of Santa Cruz (UESC), Jannuzzi (2023) highlights the importance of statistical information for the formulation of public policies. Surveys and data sources collect statistics and

information that will be transformed into indicators. This problematization highlights the indicators as models of representation of reality and how statistical information is at the center of public policy formulations.

Statistical information is the input for constructing social indicators, providing technicians and public managers with a representation of reality and playing a fundamental role in assessing the quality of education and in evidence-based decision-making (Jannuzzi, 2018). Indicators on various aspects of education are important, including academic performance, access to educational resources, and cultural inclusion, among others. Census data, for example, constitute a comprehensive tool for collecting demographic, socioeconomic, and educational data. They offer information that can guide broader public policies and/or specific educational proposals in different communities.

In 2022, the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística-IBGE) conducted for the first time a demographic census on the quilombola ethnic-racial group based on the theme: "Quilombola Brazil: How many are we? Where are we?" (IBGE, 2022). Quilombola schools play a role in preserving culture, promoting education and strengthening quilombola communities. However, ensuring the quality of education in these schools is a complex challenge. Custódio and Foster (2019), for example, highlight that state education systems in the country use teaching materials that superficially address the historiography of Black Brazilians. In addition, the materials produced reflect the lack of involvement of quilombola communities in the process.

Teaching materials are among the resources widely used by schools to support teaching and learning. When these materials make ethnic-racial issues invisible, they contribute to perpetuating structural racism, impacting the processes of inclusion within the school curriculum.

Community involvement in school decisions is another fundamental aspect for the development of democratic intercultural coexistence in schools. As collective subjects in a social movement, quilombolas subscribe to and demand democratic intercultural coexistence with various socio-political groups, and present legitimate, valuable, and

pertinent epistemologies that cannot be ignored, especially in the educational field (Weissmann, 2018). Quilombola communities, therefore, play a fundamental role in preserving Afro-Brazilian culture, history, and traditions. It is necessary for school managers to promote the community's dialogue with the school, based on recognition of their struggles and challenges, to enable the intertwining of quilombola culture and the school curriculum.

Understanding the indicators begins with the recognition that a school is not an isolated entity, but an integral part of a community. It is affected by socioeconomic, cultural, and demographic factors that can vary significantly from one region to another. Social indicators, such as birth rate, average family income, parental education level, and crime rates, provide information about the context in which the school is located.

By using social indicators, school managers can gain a more concrete view of the needs and challenges their students face. This allows them to make evidence-based decisions about resource allocation and the development of specific policies and programs. For example, if indicators reveal a high rate of truancy in a given region, managers can implement strategies to improve student retention, such as tutoring programs or social interventions. In addition, indicators play an important role in guiding the evaluation of school performance and promoting equity in education. By identifying inequalities in student achievement based on indicators such as socioeconomic status, race, or gender, managers can take steps to reduce such disparities to ensure that all students have equal opportunities.

Methodology

The research adopted a mixed-methods approach that referred to the production of qualitative and quantitative data. This methodological option was implemented to deepen the research object and involved a review of the scope of the literature, followed by a questionnaire and visits to two schools. Then, we will describe in more detail the methodological aspects of each research strategy carried out.

The scope review (Mun et al., 2018; Cordeiro & Soares, 2019) was conducted to investigate the delimitation of an educational indicator and its interfaces with statistical literacy, and to explore the main concepts and relationships underlying the field of

study. This type of review is suitable for this purpose, as the field of research in focus is broad, allowing, therefore, for the gathering of various types of evidence and the showing of how they were produced.

The searches were conducted in the database of the *Portal de Periódicos da CAPES* between 2019 and 2024. It was determined that the publication type would be only national articles from peer-reviewed journals available online. The main search descriptors were: *educational indicator*, *literacy*, *statistical literacy*, *statistics*, and *statistical education*. They were combined, and it was decided to use the Boolean AND connector, available in the search engine of the *CAPES periodicals portal*. Inclusion criteria were: publications within the defined period; articles published in journals; articles focused on the area of education, social sciences or multidisciplinary; and articles whose search terms were present in the title, abstract and/or keywords.

We identified 51 articles after combining the descriptors. Then, we analyzed the abstracts of the articles found and those that did not meet the inclusion criteria were removed. At the end of this procedure, 17 articles were selected for full reading. However, we excluded five articles because their publication dates fell outside the period specified for this review, even though they were listed by the *CAPES Portal*. Thus, only 12 articles were considered for full reading, and will be discussed in more detail in the section entitled *Statistical literacy and educational indicators: a scope review*.

The scope review enabled the identification of key concepts, including understanding of educational indicators, use of data in school planning, interpretation of graphs, and dimensions of statistical literacy. Based on these elements, we defined the thematic axes and constructed the questionnaire items, ensuring theoretical-methodological alignment and content validity, and enabling the production of data consistent with the research objectives.

The questionnaire was prepared using Google Forms and began with a text that presented the research objectives, invited participants to contribute voluntarily, and explained the ethical aspects of the study, including informed consent and confidentiality. The questionnaire link was made available to teachers and researchers

working in basic education schools, who adopted email and WhatsApp group dissemination strategies to reach potential respondents. Data collection took place between October 2024 and January 2025. At the end of this process, we obtained responses from 57 participants, distributed as follows: 37 school managers, 10 pedagogical coordinators, 5 deputy managers, and 5 other professionals who did not identify themselves. The instrument totaled 20 questions (2 open and 18 closed) organized around the following thematic axes: sociodemographic profile of the participants (gender, age, function, education, and type of school and its location); knowledge about affirmative actions and educational indicators (perceptions about affirmative actions and how it has been implemented in the school curriculum, use of indicators to guide affirmative actions, understanding of educational indicator and use in school planning), as well as aspects associated with statistical literacy in the context of school management (use of statistical graphs and indicators presented through graphs). The data were collected between October 2024 and January 2025.

They were analyzed **descriptively** through the mechanisms of organization and systematization of responses provided by Google Forms. Initially, the responses of each participant were extracted from the platform and organized into tables structured by groups of questions, which enabled comparative visualization and the identification of response patterns.

The open questions, referring to how affirmative actions have been implemented in the school curriculum and to perceptions of the educational indicator, were submitted to qualitative analysis using content analysis, as proposed by Rodrigues and Brito (2025). The analytical process involved floating reading and exploration of the material, followed by interpretation of the results, a stage in which the categories were analysed and articulated to the dimensions of statistical literacy. The results of the questionnaire are discussed in the section entitled *Educational indicators, affirmative actions, and statistical literacy in school management*.

We visited two public schools, one municipal school located in Recife and the other in Goiana, in the quilombola community of São Lourenço. Field diary notes and systematic observation scripts were used as instruments to cover the following aspects: institutional context and school structure; management practices related to affirmative

action; and the use of educational indicators and evidence of statistical literacy. The visits were carried out in June and July 2025. The data obtained were analyzed according to the themes observed.

These visits resulted from the questionnaire, which showed trends, gaps, and varying levels of understanding among participants regarding educational indicators, the use of data in school planning, the interpretation of graphs, and the dimensions of statistical literacy. These findings signaled the need to deepen the analysis in a real context, as highlighted in the *sectionEducationalindicators, affirmative actions, and statistical literacy in school management: some evidence*.

Then, we present and discuss the findings based on each research strategy.

Statistical literacy and educational indicators: a scope review

The 12 articles selected for full reading are distributed in Table 1 in relation to the descriptors and types of educational indicators.

Table 1
Number of articles by descriptors and types of indicators

Descriptors	Types of educational indicators	Number of articles
Educational indicator <i>and</i> literacy	Functional Literacy (INAF)	01
Educational indicator <i>and</i> statistical literacy	Indicators on the COVID-19 pandemic	01
Educational indicator <i>and</i> statistics	Basic Education Development Index (Índice de Desenvolvimento da Educação Básica— Ideb),	04
Educational indicator <i>and</i> statistical education	National High School Exam (Exame Nacional do Ensino Médio—Enem)	01
	Indicator of Adequacy of Reading Spaces (IAEL)	01
	Formative indicators	02
	Age-grade distortion	01
	Democratic management of public schools	01

Table 1 presents the distribution of the articles analyzed by the descriptors used and the types of educational indicators addressed, highlighting the diversity of approaches in the field. By combining the descriptors in various ways, we identified 12 articles that cover 9 types of indicators. In terms of frequency, studies that use the Basic Education Development Index (Índice de Desenvolvimento da Educação Básica—Ideb) stand out, with four occurrences, followed by those that address formative indicators, with two. The other indicators are one-off, with only one article each. This scenario suggests a concentration of studies on more consolidated indicators, such as Ideb, while revealing the still incipient exploration of other relevant indicators in the educational context.

Continuing this characterization, the articles were organized into four analytical axes based on a content analysis perspective. Studies that discuss factors that condition the availability and quality of data predominate, totaling six articles. Then, we identify studies focused on the construction and redefinition of indicators, with three occurrences. The axes related to the evaluation of public policies and the teaching of mathematics and statistics are less representative, with two and one articles, respectively. This organization highlights not only the thematic distribution of the productions but also possible research gaps and trends in the area.

The results reveal the complexity involved in using educational indicators, especially synthetic indicators such as Ideb. Several studies point out that such indicators have low explanatory power when analyzed in isolation, revealing a weak correlation with variables, such as financial investments (Oliveira Júnior et al., 2019), school inputs, and pedagogical processes (Dutra, Coelho, & Dutra, 2019). In addition, methodological limitations related to the definition of indicators, the standardization of procedures and the reliability of data are highlighted, aggravated by regional, contextual and institutional inequalities (Travitzki, 2020; Soares, Soares, & Santos, 2023). The quality of the data collected is another factor that directly impacts the accuracy of educational indicators; thus, incomplete, outdated, or incorrect data can distort the results and affect the use of indicators as a parameter for analyzing the quality of education (Barbosa, Conrado, & Belusci, 2023; Menezes, Bento, & Garcia, 2023). Problems in data collection and availability, such as those observed in SAEB, according to Menezes, Bento, and Garcia (2023), can lead to institutional exclusion and render certain groups and territories invisible in educational diagnoses.

Regarding the construction of indicators, the studies analyzed (Souza, 2019; Marcom & Kleinke, 2021; Miranda, Braga, & Cavalcanti, 2022) propose new indicators

or redefine existing ones, seeking greater alignment between measure and concept. Still, even when technically sophisticated, indicators tend to favor the quantitative dimension, with little incorporation of the social, cultural, and political context in which data are produced and interpreted. This trend reinforces recurrent criticism in the literature about the importance given to the measure, to the detriment of the educational phenomenon that is intended to be understood.

The studies aimed at evaluating public policies (Santos & Mendes, 2019; Schwerz, N.N.M. Deimiling, C.V. Deimiling, & Silva, 2020) show that educational indicators are widely used to support management and planning decisions but remain largely restricted to specialists and managers. There is a distance between the indicators and the school community, which limits the school community's formative, critical, and democratic potential.

Regarding the teaching of mathematics and statistics, only the study of Samá, Cazorla, Velasque, Diniz, and Nascimento (2022) explicitly establishes the articulation between indicators and statistical literacy when exploring data from the COVID-19 pandemic as a pedagogical resource, in order to promote the formulation of critical questions and the contextualization of statistical concepts. The article discusses how teachers can explore this scenario, drawing on the teaching knowledge base proposed by Shulman, with an emphasis on statistical, pedagogical, and curriculum knowledge. From six teaching cases built with real data, resources, and strategies involving indicators (such as lethality and mortality rates), simulations, and different forms of graphical representation are presented. From this perspective, the central role of statistical literacy stands out, understood as the ability to interpret, question, and attribute meaning to information, linking mathematical knowledge to the social context.

From the analysis, we observed that, although educational indicators are widely used to monitor and evaluate the quality of education, their interpretation remains mostly technical, decontextualized, and inaccessible. The absence of a debate on statistical literacy limits the critical understanding of these indicators and weakens their educational and social potential. The scope review, therefore, demonstrates the need for research and practices that articulate educational indicators and statistical literacy, in order to favor contextualized, critical and socially responsible analyses, expanding the participation of the school community and the citizen in the educational evaluation processes.

Given this scenario, it is pertinent to advance the discussion to a perspective that integrates educational indicators with other structuring dimensions of school management. In this sense, the next section addresses the relationships among educational indicators, affirmative actions, and statistical literacy, in order to understand how these elements can be articulated in the construction of more equitable, critical, and contextualized practices within the scope of school management.

Educational indicators, affirmative actions, and statistical literacy in school management

The outcomes from the questionnaire are organized around the defined thematic axes: sociodemographic profile of the participants, knowledge about affirmative actions and their relationship with educational indicators, as well as aspects associated with statistical literacy in the context of school management.

Regarding the sociodemographic profile, the study included 57 professionals, predominantly school managers (64.9%), followed by pedagogical coordinators (17.5%), vice managers (8.8%), and other professionals on the school team (8.8%). There is a significant female predominance (89.5%), reflecting a historical trend in education. As for the type of school where they work, the vast majority indicated performing their duties in a regular public school (70.2%), followed by 17.5% in a full-time school. Only five participants (8.8%) work in quilombola schools and two (3.5%) in Indigenous schools. Most schools are located in Pernambuco (71.9%), with the highest concentration in the municipality of Igarassu. The other schools are located in Paraíba (28.1%), most of which are in João Pessoa.

Most participants entered the position by invitation (50.9%), indicating a culture of recommendation and internal recognition in schools, while a smaller portion reported admission by selection (22.8%), election (14%), or public examination (5.3%). Such a configuration suggests a certain fragility in the democratic processes of choosing school management and the possible influence of local political-administrative factors.

Most participants have recent experience in the function, with concentrated experience between one and five years, which may indicate rotation in management positions, possibly associated with the duration of municipal mandates. As for education, the predominance of undergraduate studies in pedagogy (64.9%) stands out, consistent with the nature of the functions performed, alongside other teaching degrees that can contribute to the diversity of perspectives in school management. Most have a *lato sensu* graduate degree (56.1%), indicating investment in continuing

education, although the percentage of master's degree holders remains low, which may suggest limitations in access, incentives, or conditions for a more in-depth academic education.

The axis related to knowledge of affirmative actions contributes to understanding the use of statistical literacy by highlighting a scenario marked by greater conceptual and practical appropriation of these actions by managers, in contrast to the still-incipient use of educational indicators. Although most participants positively assess their level of knowledge and report the recurrent implementation of affirmative actions, especially through pedagogical projects, we note that such initiatives tend to develop without being articulated with quantitative data and evidence. This gap limits the incorporation of statistical literacy, since the critical use of information could qualify the planning, monitoring, and evaluation of these actions, evidencing a dissociation between their implementation and the use of evidence.

This trend is confirmed in the analysis of the level of detail in the participants' answers. While many are restricted to the generic mention of projects or include this type of initiative, others have greater specificity, indicating the title of the project: "This year, we developed the project unveiling invisibility: the role of books in the valorization and recognition of the black community" (Manager, regular public school, Igarassu-PE); "Through actions of the identity project" (Manager, Indigenous school, Maringá-PB); and "In addition to working with skills in the school curriculum, there is the promotion of a specific project entitled Educação Antirracista" (Manager, full-time public school, João Pessoa-PB). From the perspective of statistical literacy, this movement reveals different levels of elaboration and systematization of practices: more generic responses indicate superficial appropriation, while more detailed ones suggest greater organization and communication of actions, approaching more reflective practices and potentially articulable to the use of data.

Regarding knowledge of the legal framework for affirmative action, mentions were scarce and, when present, remained predominantly at the normative level. Although one of the reports evidences the incorporation of such legislations into the curriculum, we observe, from the perspective of statistical literacy, the absence of the use of data and indicators to support, monitor, or evaluate the actions developed. This aspect highlights the fragility in how legal knowledge and evidence analysis connect, limiting the consolidation of data-driven management practices committed to equity.

Despite these limitations, the recurrence of the project approach indicates a recognition of the need to articulate different knowledge and actors in the school context. When conceived as research spaces, these projects can favor practices that require systematic planning, organization, and evaluation, enhancing the development of statistical literacy. In this sense, they enable data mobilization, representation, and interpretation in different contexts, approaching an investigative logic that involves not only the technical use of information but also the critical analysis of evidence, informed decision-making, and reflection on results, central elements for the consolidation of statistical literacy in school management.

When asked about **affirmative actions aimed at access and permanence of students in vulnerable situations**, participants mainly highlighted awareness campaigns and partnerships with external institutions. Actions such as curriculum adaptation, reception policies, and mentoring initiatives appeared less frequently. Among the main challenges pointed out, the lack of specialized technical support stands out, followed by the resistance of the school community, the scarcity of resources and the difficulty of understanding and relating educational indicators to the concrete needs of the school. This set of responses reveals a tension between recognizing the importance of affirmative actions and the structural and formative limitations to their effective implementation.

Regarding **knowledge about educational indicators and aspects of statistical literacy**, we noted that, although most participants positively evaluate the use of statistical data to guide affirmative actions, their understandings of the educational indicator are heterogeneous. A technical-quantitative view prevails, with 49% of occurrences associating it with the measurement of school quality and performance, such as in the definitions "*it serves to assign a statistical value to the quality of teaching (e.g., Ideb)*" and "*they are statistical data that measure the quality of teaching*", given by two managers of regular public schools located in Igarassu, PE, respectively. This understanding is articulated with the 25% that explicitly link the concept of educational indicators to external evaluations, directly mentioning Saeb, Saepe, and Ideb, which appear as almost self-sufficient responses, revealing a strong association between the indicators and standardized exams. This crossover suggests that the dominant representation is anchored in institutional metrics and in the logic of formal performance measurement.

From the perspective of statistical literacy, the results indicate a still limited appropriation, centered on the use of data as measurement instruments, with little

emphasis on critical and contextualized interpretation. The predominant association with standardized exams reinforces an initial level of literacy, marked by the recognition of the importance of data, but with weaknesses in their use for context analysis, understanding of inequalities and guidance of broader pedagogical practices.

On the other hand, 18% of the responses broaden the understanding by assigning to the indicators a diagnostic and strategic function, such as those referred to by a pedagogical coordinator and a manager of regular public schools located in Igarassu, PE, respectively: *"These are important data and I say essential to evaluate students' performance and diagnosis, so that we can outline strategies for advances"* and *"These are data that, when analyzed, contribute to school planning"*. However, only 5% explicitly mention the monitoring of inequalities, as in the answer given by a regular public school manager in Igarassu:

It is the information on school performance based on some indicators, such as learning or socioeconomic situation, for example: crossing the numbers on retention with the information on color or socioeconomic context... which will help us understand the source of the problem.

The answers indicate that, although there is familiarity with the instrumental and evaluative dimensions of the indicators, their mobilization for critical analysis of inequalities, central to affirmative actions, is still incipient, revealing formative potential in the field of statistical literacy applied to school management. There is also a reference to the relatively frequent use of statistical graphs, especially in pedagogical and management meetings, to deliver results and support decisions. However, a portion of the respondents reported using graphs only occasionally or expressed interest in using them more frequently, suggesting a need for specific formation.

In general, the results show that educational indicators are already incorporated into school management practices, mainly as instruments for monitoring and evaluation. However, its use remains predominantly technical and instrumental, with little exploration of its pedagogical and formative potential. The connections among indicators, context, and critical reflection remain incipient, which limits the appropriation of these data as knowledge and as a resource for promoting more critical educational practices aligned with the perspective of statistical literacy.

Given these findings, there is a need to deepen the understanding of how educational indicators can be articulated with more critical practices and committed to equity in the context of school management. The next section presents and discusses

empirical evidence that allows us to analyse the relationships among these elements seamlessly, seeking to explain possibilities and challenges for the consolidation of practices guided by statistical literacy.

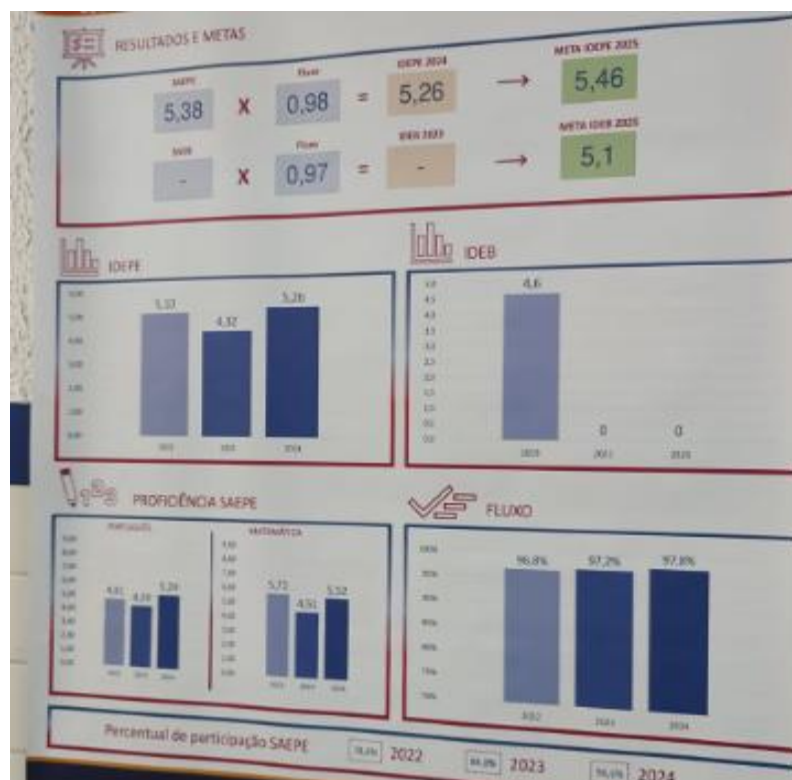
Educational indicators, affirmative actions, and statistical literacy in school management: some evidence

The observation at the municipal public school in Recife was conducted in June 2025. We were welcomed by the manager and a mathematics teacher of the final years of elementary school. It is located in an urban area and offers regular education in the early and late years of elementary school, youth, and adult education (YAE), and special education, including, at the time of the visit, a total of 476 students enrolled in different school stages.

We identified a banner with data on the educational indicators of the school displayed in the main corridor, opposite the teachers' room (Figure 3).

Figure 2

Banner with data on the results and goals of the regular school



The banner in Figure 3, when explaining goals for Idepe and Ideb, can be interpreted, in the light of statistical literacy, as an indication that the school mobilizes quantitative data to guide its management practices. The definition of numerical goals

reveals not only recognition of the importance of educational indicators but also the ability to interpret information from different evaluation systems and link it to the institutional context. In this sense, there is evidence of a dimension of statistical literacy related to the reading and understanding of indicators, as well as their use in school planning.

In addition, by distinguishing between Ideb and Idepe and establishing differentiated goals, the school demonstrates a more advanced level of statistical literacy, which involves the critical analysis of different data sources and an understanding of their purposes and limitations. This posture suggests an appropriation of the indicators not only as numbers to be reached but also as tools to support decision-making and the monitoring of pedagogical actions.

Finally, the definition of goals that are considered realistic yet challenging reinforces the dimension of statistical literacy focused on the reflective use of data, as it entails designing scenarios, establishing expectations, and monitoring results over time. However, for this potential to materialize, it is essential that the school advances in the consolidation of systematic practices of analysis and use of data, strengthening the statistical literacy of managers and teachers as a central element for improving the quality of education.

Therefore, the establishment of clear goals highlights the school's effort to promote quality education, demonstrating a strategic plan to improve educational outcomes and ensure the right to learn for all students. However, interpretations of the exposed indicators do not appear in the banner, which can make it difficult for students, teachers and, in general, the school community to understand and read. We consider that the banner itself, with the placement of these indicators, could be a learning tool about different contents related to the demonstrated indicators; that is, the placement of social indicators in graphic representations has pedagogical potential if it is articulated with the perspective of statistical literacy.

The school manager was well involved with the school community, developing an articulated work with the management team composed of the deputy manager, the pedagogical coordinator, and the mathematics teacher, who assists her with data analysis. Affirmative actions exist, but they are occasional and poorly linked with the indicators, which limits their impact. Thus, although there is an effort to monitor results, the lack of critical and inclusive use of indicators jeopardizes the construction of

statistical literacy and the effective linkage between data, equity, and school participation.

School management practices related to affirmative actions are characterized by specific initiatives and predominantly linked to specific projects. In the field of inclusion, we highlight, as mentioned, the existence of the SEA room (AEE, in the Portuguese acronym), equipped with pedagogical games and conducted by specialized techniques, showing attention to the schooling of special education target audience students. Regarding gender, race, and socioeconomic equity, the manager reports the sporadic holding of lectures, as well as the implementation of the Projeto Travessia [Crossing Project], supported by the Roberto Marinho Foundation and aimed at flow correction in the initial years of elementary school and in the 6th year. Such actions, however, are not configured as a structured institutional policy, being developed in a fragmented way.

In the context of valuing diversity and combating discrimination, the school joined a socio-emotional project implemented with greater intensity during the pandemic and participated in the federal program Escola e Adolescência [School and Adolescence], which includes affirmative dimensions. Teaching initiatives were also mentioned, such as a black consciousness project conducted by the history teacher and a proposal with a critical perspective developed by the science teacher, as well as the completion of coursework in elementary school. In general, the evidence indicates the presence of practices sensitive to the theme of diversity, but organized in an episodic way and dependent on individual initiatives or external adhesions, without systematic articulation to an institutional plan of affirmative actions guided by diagnosis and continuous monitoring.

The regular school needs more concrete, visible actions to strengthen democratic management, as recommended by Brazilian educational legislation and public school guidelines. Thus, although there is an effort to monitor results, the lack of critical and inclusive use of indicators jeopardizes the construction of statistical literacy and the effective linkage between data, equity, and school participation.

The observation at the quilombola school was conducted in July 2025 at a school located in the quilombola community Povoação de São Lourenço, in the district of Tejucupapo, municipality of Goiana, Pernambuco. Officially recognized as a remaining quilombo territory, the school plays an important role in valuing the cultural identity and traditional knowledge of the community.

Currently, the institution serves approximately 701 students, distributed across early childhood education, elementary school (early and late years), and YAE, with staff working morning, afternoon, and night shifts. The manager, who has recently been working at the school, is a mathematics teacher and is still in the process of getting familiar with the management tools. He also reported ignoring the internal dynamics of the school and the specific instruments and programs for quilombola schools (such as PDDE Equidade, PNEEQ and Parfor). However, he was highly motivated and committed to finding ways to develop democratic management that improves the quality of the school's pedagogical process.

The school has recently undergone renovation and expansion, replacing precarious structures with a modern building suited to the needs of the community. This improvement further strengthened the institution's role as a space for promoting citizenship, inclusion, and quilombola education. This new building has a large entrance hall and a main corridor, with a secretary, classrooms, SAE room, teachers' room, boardroom, and cafeteria. School settings reflect a commitment to the preservation and appreciation of Afro-Brazilian culture. Several posters featuring photos and information about Black women and men are displayed in the hall and the main corridor, produced for Black Consciousness Day 2022. Below each poster with the person's image, there is a text highlighting their characteristics. Other materials on display include a poster of the 1st Portuguese Language Exhibition [I Mostra de Língua Portuguesa] with the theme "Words that break the silence: identity and belonging" [Palavras que rompem o silêncio: identidade e pertencimento], the result of a collective work of the Portuguese language pedagogical team, based on cordel literature, as well as a poster board with photos entitled "Our Lived Experiences" [Nossas Vivências], which portrays moments of school and community life. Also in the hall is a photo of the school's patron, a white woman and former owner of the land where the unit was built, and a copy of the school's certificate of recognition as a quilombola institution.

Although the school shows advances in infrastructure and affirmative pedagogical actions, there are challenges in managing and valuing the territory's cultural and historical elements, which are fundamental to strengthening belonging and quilombola identity within the school community.

In general, the observation in this school identified, on the one hand, symbolic and cultural advances, such as projects that value the quilombola identity and the

reform of the building's infrastructure, but, on the other hand, reveals weaknesses in how management uses educational indicators. A newcomer manager who is unaware of specific instruments and programs for quilombola schools exposes a double problem: first, dependence on the manager to trigger public policies and school financing; and, second, the lack of institutional mechanisms that guarantee administrative continuity and continuing education.

There are no visible records of monitoring actions, such as performance indicators, in external evaluations. In addition, the political-pedagogical project is outdated, using the 2012 document as a reference. The strategies for evaluating affirmative actions are isolated and lack data to verify results. Thus, the school has cultural potential, but lacks management processes capable of integrating indicators and affirmative actions in a planning and monitoring cycle.

From the perspective of statistical literacy, the absence of systematic monitoring records, such as performance indicators in external evaluations, as well as the use of an outdated political-pedagogical project, show weaknesses in data-driven management. The strategies for evaluating affirmative actions, as they are one-off and devoid of quantitative evidence, limit the ability to analyze the results and monitor the impacts over time.

This scenario indicates an incipient level of statistical literacy, with little integration among the collection, analysis, and use of data in the planning and management cycle. Although the school has significant cultural potential, the absence of systematic processes that articulate educational indicators with affirmative actions compromises the development of more reflective practices, making it difficult to build contextualized analyses and make evidence-based decisions.

Final considerations

This article aimed to analyze the perceptions of public school managers about educational indicators and affirmative actions based on the principles of statistical literacy. From a mixed methodological approach, we sought to integrate the results of the review of the scope of the literature, the responses to a questionnaire, and the observations carried out in two public schools, one urban regular and the other located in a quilombola territory.

In general, the scope review reveals a significant gap in the literature regarding the use of educational indicators as pedagogical instruments and the incorporation of statistical literacy as an interpretative reference for these data. The results suggest that

educational indicators are already incorporated into the daily life of school management, mainly as instruments for monitoring and institutional evaluation. However, this use remains predominantly technical, instrumental, and guided by external goals, such as Ideb and Idepe, with little problematization of the social, cultural, and identity contexts that cross school realities. The absence of a focus on race, gender, disability, or socioeconomic condition limits the potential of indicators to support more consistent affirmative actions committed to educational equity.

As for affirmative actions, we observed that they are, to a large extent, developed through specific projects, often disconnected from systematic planning, monitoring, and evaluation processes. Although managers recognize the importance of these policies and, in many cases, indicate alignment with current legal frameworks, challenges remain, including a lack of technical support, conceptual fragility regarding educational indicators, and insufficient training in statistical literacy, as highlighted by Gal (2002).

The observations carried out in schools also demonstrate that democratic management and the circulation of data to the school community are poorly consolidated aspects, which restrict the potential of indicators as instruments of participation, transparency, and social justice. In this sense, strengthening the statistical literacy of school managers and teams in initial and continuing education processes is a fundamental condition for indicators to cease to be just control mechanisms and become tools for critical reflection, informed decision-making, and the promotion of equity.

Finally, the study contributes to the fields of mathematics education and educational management by highlighting gaps in both academic production and school practices regarding the incorporation of statistical literacy into the articulation between educational indicators and affirmative actions. The results indicate that the still predominantly technical appropriation of these indicators limits their potential as tools for critical analysis of inequalities and for informed decision-making. In this sense, investigations that explore formative proposals aimed at the development of statistical literacy of school managers are pointed out as developments for future research, as well as the design of practices that promote the critical, contextualized, and reflective use of data in pedagogical processes and democratic management, especially in contexts of greater social vulnerability, such as quilombola and Indigenous schools.

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