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RIPEM

# When Mathematics is wrong and Law fails: calculation errors and their social implications in social security processes

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***Abstract:*** This article addresses mathematical calculation errors in social security law and their social implications. Its objective is to identify cases that contain calculation errors and their incidence, and to analyze the social impacts arising from calculation errors in the cases. The research is based on Critical Mathematical Education advocated by Skovsmose. The approach is qualitative, exploratory in nature, and is documentary research. The data were produced from the Oracle database. The analyses showed that in 2023 approximately 1.4% of the cases processed in this court had calculation errors, which is one of the reasons for the slowness of the process. The conclusion is that such errors result in delays in granting the benefit and consequently bring social implications, exposing the insured to social vulnerability, affecting human dignity.

***Keywords***: Calculation Error. Social Justice. Critical Mathematics Education.

## Quando a Matemática erra e o Direito falha: erros de cálculo e suas implicações sociais em processos previdenciários

***Resumo:*** O artigo aborda os erros de cálculos matemáticos no direito previdenciário e suas implicações sociais. Seu objetivo é identificar processos que possuem erros de cálculos e a sua incidência, e ainda analisar os impactos sociais oriundos dos erros de cálculo nos processos. A pesquisa está alicerçada na Educação Matemática Crítica defendida por Skovsmose. A abordagem é qualitativa, de natureza exploratória e se trata de uma pesquisa documental. Os dados foram produzidos a partir do banco de dados *Oracle*. As análises mostraram que em 2023 aproximadamente 1,4% dos processos tramitados nesta vara tinham erro de cálculos, sendo um dos motivos para a morosidade processual. A conclusão é que tais erros incorrem em demora na concessão do benefício e consequentemente trazendo as implicações sociais, expondo os segurados à vulnerabilidade social, afetando a dignidade humana.

***Palavras-Chave***: Erro de Cálculo. Justiça Social. Educação Matemática Crítica.

## Cuando las Matemáticas se equivocan y el Derecho falla: errores de cálculo y sus implicaciones sociales en los procesos de seguridad social

***Resumen***: El artículo aborda los errores de cálculo matemático en la legislación de seguridad social y sus implicaciones sociales. Su objetivo es identificar procesos que presentan errores de cálculo y su incidencia, así como analizar los impactos sociales derivados de errores de cálculo en los procesos. La investigación se basa en la Educación en Matemática Crítica defendida por Skovsmose. El enfoque es cualitativo, de carácter exploratorio y de investigación documental.

Los datos fueron generados a partir de la base de datos Oracle. Los análisis arrojaron que en 2023 aproximadamente el 1,4% de los casos tramitados en este juzgado tuvieron errores de cálculo, siendo uno de los motivos del retraso procesal. La conclusión es que tales errores resultan en retrasos en el otorgamiento del beneficio y en consecuencia traen implicaciones sociales, exponiendo a los asegurados a una vulnerabilidad social, afectando la dignidad humana.

***Palabras clave***: Error de Cálculo. Justicia Social. Educación en Matemática Crítica.

## 1 Introduction

Social security law encompasses social rights grounded in the principle of equality, aiming to guarantee individuals the material conditions necessary for a dignified existence and forming essential prerequisites for the exercise of citizenship. The provision of material resources and the implementation of practical conditions that enable the effective enjoyment of fundamental freedoms are integral to the normative core of the Democratic Rule of Law.

Nevertheless, Brazil's socioeconomic reality reveals a deep-seated social inequality that prevents many citizens from fully exercising their rights. The central challenge concerning social rights lies in their efficacy and effectiveness – particularly in the implementation of social policies and the enforceability of these rights by public authorities in the face of economic and political constraints. As Nassar (2014) observes, the aging process affects multiple spheres of Society – social, economic, political, and cultural – giving rise to specific demands from this growing demographic. Old age is often viewed with fear and uncertainty, as it represents the inevitable and natural course of every human life. It entails inherent physical and social vulnerabilities, leading to social withdrawal, especially in contemporary societies where economic productivity, physical strength, and the idealization of youth are central to social status.

In addition to Nassar's (2014) analysis of aging, it is important to recognize that challenges related to social rights affect all age groups. These challenges expose structural inequalities and their consequences, which intensify vulnerability and undermine human dignity. Many of these issues are embedded within the operations of Brazil's *Instituto Nacional do Seguro Social*[1] (INSS), where numerous factors allow for critical analysis. This research seeks to identify processes within the INSS that contain calculation errors, examine their frequency, and analyze the resulting social impacts.

From this perspective – focused on the exposure of human suffering and institutional failure – calculation errors in the social security system, the core issue of this study, emerge as significant contributors to social vulnerability and violations of human dignity. Such errors, often resulting from the actions of various institutional actors, reveal systemic weaknesses in an apparatus meant to protect society's most vulnerable. This study aims to investigate the root causes of these inequities through a critical lens that interweaves mathematics, justice, and citizenship.

To this end, Critical Mathematics Education (CME), as proposed by Skovsmose (2014), serves as the theoretical framework. CME enables a critical examination of mathematics as both a tool of control and a potential means of social emancipation. It provides the foundation for reflecting on how mathematical errors – frequently dismissed as mere technicalities – can, in fact, have profound consequences for human dignity, particularly in contexts marked by social

[1] The Brazilian government agency responsible for managing Social Security in the country. It administers a range of benefits, including retirement, pensions, sick leave, and maternity leave, for Brazilian workers and other insured individuals.

and economic vulnerability.

## 2 Mapping Research on Mathematics and Law

This article adopts an interdisciplinary perspective that connects the fields of mathematics and law. The process of mapping aims to analyze the intersections between these two areas and identify both the contributions and the existing gaps in the current body of research. To achieve this, a search was conducted in the *Biblioteca Digital Brasileira de Teses e Dissertações*[2] (BDTD) to map studies focused on these topics. The analysis was limited to theses and dissertations produced by graduate programs at Brazilian institutions between 2018 and 2023. In addition to this, relevant literature, including journal articles and other academic publications, was also reviewed.

The results of this mapping are presented below. It is important to note that any duplicate studies—i.e., those retrieved under more than one descriptor or database—were counted only once to avoid redundancy. The goal was to identify research that directly links mathematics and law. The search used the following descriptors: "*matemática+direito", "direito* and *matemática", "direito* and *erros de cálculos*[3]*".*

Under the descriptor "*matemática+direito",* two dissertations and one thesis were identified. Although these few studies used the descriptor, they did not present a consistent definition or unified understanding of the intersection between the two disciplines. In general, these studies reflect a multidisciplinary approach, focusing on the relationship between mathematics and law within curricular documents. They highlight students' learning rights as outlined in official texts such as the *Parâmetros Curriculares Nacionais*[4] – PCN, the *Pacto Nacional pela Alfabetização na Idade Certa*[5] – PNAIC, and the *Base Nacional Comum Curricular*[6] – BNCC.

The second descriptor, *"direito* and *matemática"* initially returned 675 results, including 520 dissertations and 155 theses. However, when filtered by the subject *"direito"* on the platform, only 10 studies remained. These works addressed topics such as access to justice, public civil action, causality in legal contexts, banking law, law and economics, tobacco regulation, ombudsman services, evidence, liability, and civil responsibility. None of these studies were included in this analysis, as their content did not align with the research objectives of this article.

Under the descriptor *"direito* and *erros de cálculos",* 32 studies were found – 24 dissertations and 8 theses. Of these, three addressed the following legal topics: evidence-based law, the right to health, and judicial sentencing. These, too, were excluded for not aligning with the focus of this research.

Despite these various search efforts, the dissertations and theses available in the BDTD did not correspond to the central theme of this article, as the legal aspects examined in those studies primarily focused on education laws and policies, rather than the intersection between mathematics and law. In response, this article turned to scholarly literature and scientific articles that highlight the important role of mathematics education in fostering critical thinking. Mathematics education, in this context, is understood as transformative – it reshapes how individuals approach problems, make decisions, and interact with the world around them. Through critical engagement, mathematics can contribute to meaningful social change in both students' lives and society at large.

[2] Brazilian Digital Library of Theses and Dissertations.
[3] Mathematics + law; law and mathematics; law and calculation errors.
[4] Brazilian Curricular Parameters.
[5] Brazilian Pact for Literacy at the Right Age.
[6] Brazilian Common Curricular Base.

## 3 Calculation Errors in Social Security Law

A calculation error subject to correction refers to arithmetic mistakes, the inclusion of undue amounts, or the omission of values that should have been considered in the calculation. In this context, a calculation error encompasses any discrepancy that deviates from what is established in official normative guidelines and procedural manuals and is therefore eligible for correction. When such errors go uncorrected, they can result in irreparable harm.

The misuse of mathematics through calculation errors can lead to significant injustices, often causing irreversible damage. This is no different in the legal field, where mathematics is an integral part of the daily work of judges, prosecutors, lawyers, and other legal professionals. It is frequently employed to strengthen legal arguments, particularly using percentages or statistical data to support a decision. Mathematics also plays a critical role in determining the value of claims or amounts owed in legal proceedings, including the calculation of interest, monetary adjustments for past periods, and sentencing in jury trials worldwide.

> Wherever we look, we are surrounded by numbers. Advertising, news, commerce, information, weather forecasts, investments, and risk assessments – all of these and more are conveyed to us through probabilities and statistics. The issue, however, is that these figures are not always used to inform. Just as often, they are used to mislead: to manipulate, to intimidate, or to guide us down deceptive paths – cloaked in the cold authority of numbers and formulas. (Schneps & Colmez, 2014, p. 7, *our translation*)

In this context, it is essential to recognize that mathematics, while undeniably a vital tool for society, can also become – when misapplied – an instrument capable of destroying dreams and life projects, generating debt, eroding human dignity, deepening social vulnerability, fueling the darkest impulses of the human condition, and even depriving individuals of their freedom. It is therefore critical that we develop the ability to discern whether the numbers presented to us communicate legitimate information or are being manipulated for harmful ends.

*The Instituto Nacional de Seguro Social* (INSS) is the autonomous agency that manages the granting of social benefits in Brazil, and unfortunately, it is this agency that is responsible for most of the various errors that often cause sleepless nights for those who need to access its services. These errors can be related to a variety of reasons: system failures, errors in administrative procedures, or even confusion on the part of the insured person when requesting the benefit. These errors can generally be caused by access problems, incorrect documentation submission, calculation errors, and data cross-referencing errors, since the processes are automated. The point is that beneficiaries, who are most affected, deal with these situations but are unclear about their causes, or even how to resolve them.

Among the recurring errors attributed to the INSS, the research will analyze calculation errors that severely harm the beneficiary. These errors include: the correctness of the link in the *Cadastro Nacional Informações Sociais*[7] (CNIS), resulting in an incorrect or mistaken calculation of the benefit that may lead to a decrease in the value of the benefit; the value of the contribution; the error in the calculation of the *Renda Mensal Inicial*[8] (RMI), special time, which often means that the beneficiary who worked in a risky situation, despite gathering all the required documentation, does not have his special service time computed, and ends up having a loss with contributions classified as common time; the non-inclusion of the time away

[7] Brazilian Social Information Registry.
[8] Initial Monthly Income.

from the INSS.

When such errors occur, they often lead to social disruption. Although the social security agency provides mechanisms to address these issues, the delays are excessive, the automated systems are unable to cope with the overwhelming demand, and administrative appeals filed for corrections are frequently ineffective. As a result, beneficiaries are left at the mercy of a sluggish bureaucratic process or are forced to seek judicial intervention through constitutional remedies such as writs of mandamus or other legal actions.

The reality is that most beneficiaries are in urgent need and cannot afford to wait – hunger can be fatal. This is one of the most critical factors contributing to social vulnerability and the erosion of human dignity, compelling individuals to endure unimaginable circumstances merely to secure the bare minimum for survival. Therefore, it is essential to promptly identify calculation errors and other procedural failures within the agency and to expedite the necessary corrections, especially given that we are dealing with individuals facing multiple forms of social disadvantage.

For example, below is a demonstration of a model initial petition for RMI review, demonstrating the calculation error committed by the agency, taken from the Jusbrasil website, on 04/16/2024.

> In theory, adding the period not recorded in the plaintiff's CNIS[9], given that such amounts still require monetary correction and are proven by the presentation of all attached pay stubs, we have a total of R$813,765.37 (eight hundred and thirteen thousand, seven hundred and sixty-five reais and thirty-seven centavos), from which the arithmetic average of the 80% highest contributions should be used, according to the law, since the least significant factor does not apply in this specific case. For the sole purpose of clarifying the discrepancy between the plaintiff's RMI and reality, the plaintiff has 191 months of contribution salary in the basic calculation period, not 173, as stated in the concession letter. Furthermore, for purposes of calculating the RMI, the sum of the real PBC[10] and the accrued salary should be subtracted by 20%, as per the attached "demonstrative" table. However, it is worth noting that the author implemented the AGE requirement on May 26, 2016, and has been a member of Social Security since August 1, 1976. Therefore, the period that makes up his PBC is 243 months, its calculation basis is July 1994 to November 2016, which counts 191 (one hundred and ninety-one) months with contribution salaries, as shown in the attached table of months and values. The agency's error is that, in addition to not having computed the months and salaries described above in the calculation base period, for an unknown reason, it added approximately 14 months, with lower values, which culminated in the author's retirement value being unfair, which must be redone. (Jusbrasil, 2024, our translation)[11]

The understanding presented here is that the situation described has significant social consequences, particularly due to calculation errors committed by the INSS. It is well-known that the agency serves highly vulnerable individuals who often feel compelled to accept the calculations as presented, since they urgently need the payments and lack the financial resources to hire accountants or lawyers to pursue the necessary corrections. This situation generates a sense of injustice for all parties involved, as there remains uncertainty about whether the amounts received truly correspond to what is owed.

[9] Brazilian Register of Social Security Numbers
[10] Continuous Benefit Payment.
[11] Access on: jusbrasil.com.br/modelos-pecas/revisao-de-rmi/1596516923 on 16/04/2024 at 20:30h

## 4 Critical Mathematics Education

Society is constantly evolving, particularly in technological terms, which has made it easier for students to access a wide variety of content. However, mere access to diverse content does not guarantee a critically informed education that fosters citizens' critical thinking skills. Consequently, researchers have increasingly focused on finding solutions to ensure that students and citizens not only learn the technical aspects of the subjects they study but also engage with their critical dimensions.

Ole Skovsmose, a leading figure in the development of critical thinking in mathematics education, introduced Critical Mathematics Education (CME) in the 1970s, which gained broader recognition throughout the 1980s. His work primarily addressed the political dimensions of mathematics education, questioning the vested interests underlying curriculum design and the ways the subject is taught and assessed in classrooms.

One of the central themes in Skovsmose's work is democracy. He argues that democracy is not limited to institutional structures concerning the distribution of rights and duties; it also involves the existence of competence within society. If mathematics continues to be taught devoid of a democratic perspective, it risks becoming merely another instrument of domestication within a technology-driven society (Skovsmose, 2014).

It is important to recognize that we live in a mathematized society. A simple and easily observed example is shopping at a supermarket: products are placed in a cart, which is then taken to the checkout. An electronic device operated by the cashier calculates the total amount due. A credit card is used, and with a few finger movements, the purchase is completed.

At first glance, it may seem that no mathematics is involved in shopping. However, upon closer examination of the technologies used in this process, one finds a significant presence of advanced mathematics: items are encoded with machine-readable codes; these codes are linked to a database containing prices for all products; prices are summed; credit cards are scanned; the corresponding amounts are debited from linked bank accounts; security protocols are enforced; and encoding and decoding schemes are implemented throughout.

Skovsmose (2014) notes that technological development is fundamentally rooted in imagination. This applies to all forms of design – whether of machines, objects, tools, production systems, or others – and to decision-making processes. Mathematically based technological imagination permeates all these domains.

According to Skovsmose (2014), simulations and decision-making occur continuously across diverse sectors, including sales, production planning, large and small enterprises, and all economic actors in society. An evident example of pricing grounded in mathematical models can be found by browsing a newspaper and examining mobile phone service offers. Prices are often not explicitly displayed due to factors such as complex payment plans. This form of pricing exemplifies technological imagination supported by mathematics, whose effects permeate our daily lives.

The modern conception of mathematics, which extols mathematical rationality and positions teachers as true ambassadors of mathematical knowledge, is being replaced by a critical conception that recognizes mathematics as integral to all forms of human action. These actions vary widely in nature and serve diverse interests. In this regard, mathematics is not an abstract ideal; rather, it is embedded in everyday activities and technological projects.

Skovsmose (2014) raises important concerns regarding critical mathematics, urging us to reflect on every manifestation of mathematical rationality. It is essential to critically examine

mathematics in all the forms it takes. The author acknowledges that such critical reflection is invariably accompanied by a broad and profound set of uncertainties – Critical Mathematics Education (CME) is no exception, nor is the articulation of its concerns.

According to Cardoso (2017), drawing on Skovsmose's (2014) ideas, mathematics education should aim to equip individuals with the knowledge and technological skills necessary to build a truly democratic society. In envisioning such an education, it is crucial to understand that mathematics education must foster democratic competencies and that mathematics itself is a fundamental condition for education to effectively promote democracy. This requires challenging the ideology of certainty and striving to develop mathematical, technological, and reflective knowledge through project-based activities that address real-world problems, acknowledging that technology cannot be overlooked since society is inherently technological and mathematics is a product of technology.

Santos (2017) emphasizes that CME envisions a mathematics education that goes beyond mere numbers and problem-solving. It challenges the traditional beliefs in mathematics' "exactness" and "rationality" and promotes its use as a tool to support social justice, equality, the emancipation of ideas, and other values fundamental to advancing democracy both inside and outside the classroom. This approach to mathematics also encourages reflection, evaluation, and critical questioning of mathematics' role in society.

This article is grounded in Ole Skovsmose's (2014) theoretical framework of CME, which posits that mathematics education aimed at developing democratic competence – through the cultivation of mathematical, technological, and reflective knowledge – contributes to the formation of more critical citizens who promote social justice.

According to Lima (2023), these concepts offer a new perspective not only on mathematics education but also on mathematics itself. Traditionally considered a science of abstraction and rigor, mathematics is often viewed merely as an "instrument" for other sciences or practical everyday applications. As a result, its social role is seldom acknowledged, and it is rarely associated with ethical considerations.

This article highlights the nuances in the interaction between Skovsmose's (2014) theory and its social implications, particularly in relation to calculation errors identified in the study's data. The social consequences of these errors are profound, as they exacerbate social vulnerability and undermine human dignity.

Skovsmose (2014) points out that mathematics is frequently applied to collective decision-making contexts, such as public policy, economics, and science. While these decisions affect many lives, the mathematical models employed can obscure the human and social dimensions, presenting issues predominantly from a technical standpoint. In other words, mathematics can be used to justify decisions without fully considering their social and human consequences. The uncritical use of mathematical and statistical models, without proper attention to their assumptions and limitations, can mask deeper societal problems.

Central to this article are sixteen individuals who suffered the consequences of reliance on standardized models, pre-prepared reports, and material errors—be they calculation errors or others. Those responsible for resolving these errors often overlooked the social vulnerability of beneficiaries, many of whom sought government assistance to secure the minimum level of human dignity guaranteed by the *Constituição Federal Brasileira*[12] (CFB).

Lima (2023) reiterates that CME offers a renewed vision not only for mathematics

[12] Brazilian Federal Constitution.

teaching but also for mathematics itself. The theory draws attention to the dual nature of technological advances, including those in mathematics, which can produce both positive and harmful outcomes, thus demanding ethical and social justice considerations. Skovsmose's (2014) work also stresses the importance of constructing meaning in mathematics education. He argues that traditional mathematics education tends to prioritize technical skills and mechanistic problem-solving, often neglecting the social context in which these skills operate. He advocates for a more critical and reflective approach that enables students to understand mathematics' societal role and ethical applications.

This theoretical stance aligns closely with the issues identified in this research. The analyses of cases revealed a mechanistic approach that failed to account for the degree of social vulnerability and disregarded the human dignity of individuals navigating the process of securing benefits essential to alleviating their daily economic hardships. According to Skovsmose, CME should not merely prepare students for the labor market but should also foster critical and conscientious citizenship. By recognizing how mathematics can be used to manipulate data and influence decisions affecting people's lives – as illustrated by cases such as Sally Clark and the individuals in this study – students become more aware of the social implications of mathematical knowledge and are empowered to engage in discussions about social justice, thereby forming critical citizens conscious of their societal roles.

## 5 Method

Given the nature of the objectives outlined in this article, the research adopts an exploratory methodology**,** aimed at understanding and examining a phenomenon or issue of interest. The goal is to gain initial and broader insight into a topic that is relatively underexplored. This may involve literature review, interviews, observations, and other qualitative data collection methods.

This study is qualitative in nature, as it deals with well-defined empirical cases while also revealing recurring patterns across seemingly individualized situations. Personal issues, when observed systematically, emerge as social phenomena that warrant public and academic attention, contributing to the understanding of broader historical and social contexts.

The research is also characterized as documentary**,** as it involves the analysis of non-scientifically treated materials such as reports, newspaper articles, magazines, letters, films, recordings, photographs, and other publicly available documents. The focus is placed on a specific aspect of the study, aiming to interpret and understand the messages conveyed through these materials.

To structure the empirical phase of the study, the leadership of the 1st Federal Court of Marabá was initially contacted to request access to the Oracle database, a leading convergent and multi-model database management system. The court responded affirmatively, granting access to the data for the year 2023, provided that all data protection guidelines outlined by Brazil's General Data Protection Law were strictly observed.

After compliance with legal requirements, the court authorized the use of 1,127 case files**,** including their respective case numbers. These cases were retrieved and examined to identify procedural issues that resulted in calculation errors. The following documents were analyzed in detail: initial petitions, medical reports, social assessments, judgments, appeals, accounting opinions, objections, and certificates of *Requisição de Pequeno Valor*[13] (RPV).

Following document analysis, a table was created to code the identified errors.

[13] Small value request.

Information was organized into columns including: case ID, sex, age, place of birth, occupation, procedural motivation, ICD code, results of physical and mental examinations, medical records, medication, case duration, current status, documents reviewed, case progress, type and description of material error, responsible party, other associated errors, origin of the error, direction of the error, initial benefit value, corrected amount, difference, final value, and affected beneficiary.

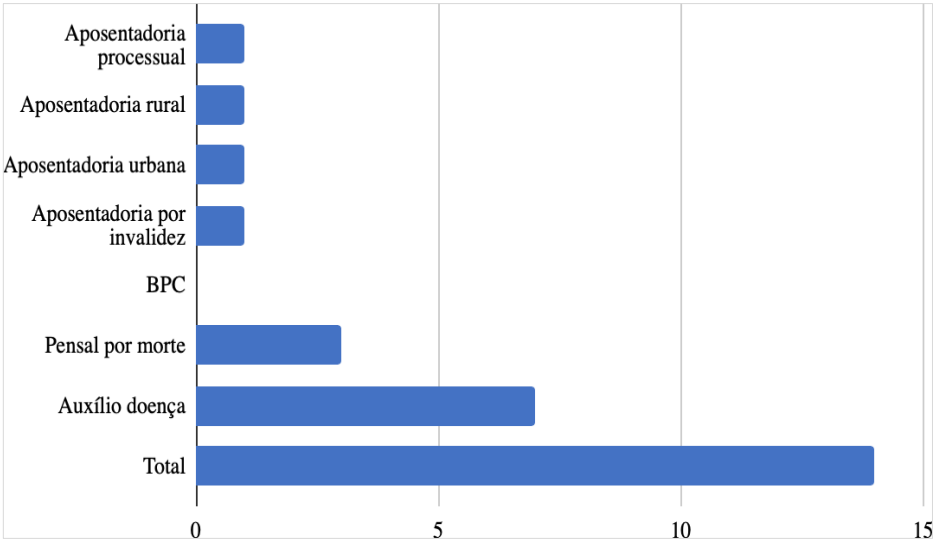
Sixteen cases with material calculation errors were identified. The data were organized using Microsoft Excel, with cases anonymized using coded identifiers to ensure confidentiality. Columns were used to systematically organize all relevant variables.

With the data organized, the article proceeded to analyze the findings using graphs and tables, categorizing the types of errors, highlighting those that resulted in underpayment to beneficiaries, and projecting the financial impact of these errors over a ten-year period.

## 6 Results and Discussion

Initially, we can identify that among the analyzed cases, 10 (62.5%) beneficiaries are male and six (37.5%) are female. Regarding the professions, the following were identified: delivery assistant, general services, unemployed, electrical engineer, student, farmer, driver, unemployed, painter, and cowboy. Regarding the procedural motivation, the frequency of these is presented in Graph 1.

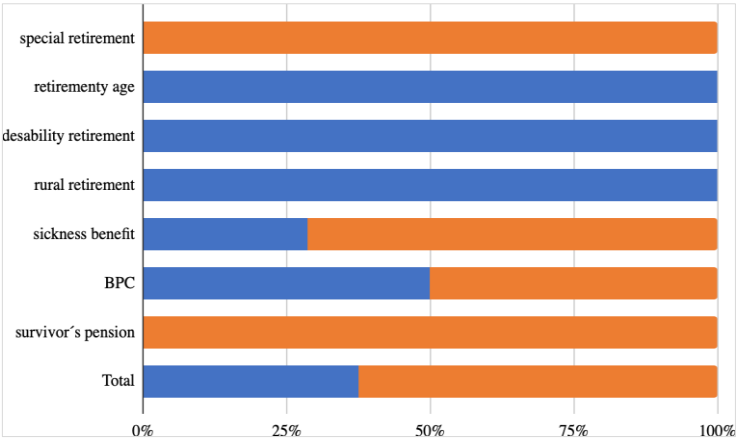
**Graph 1**: Procedural motivation




**Source:** survey data

The Graph 1 shows the types of lawsuits that INSS beneficiaries filed with the courts to enforce their rights. As can be seen, sickness benefits received the most requests, with seven lawsuits, corresponding to 43.7% of the total number of lawsuits with material errors.

**Graph 2:** Distribution of procedural motivation by gender




**Source:** survey data

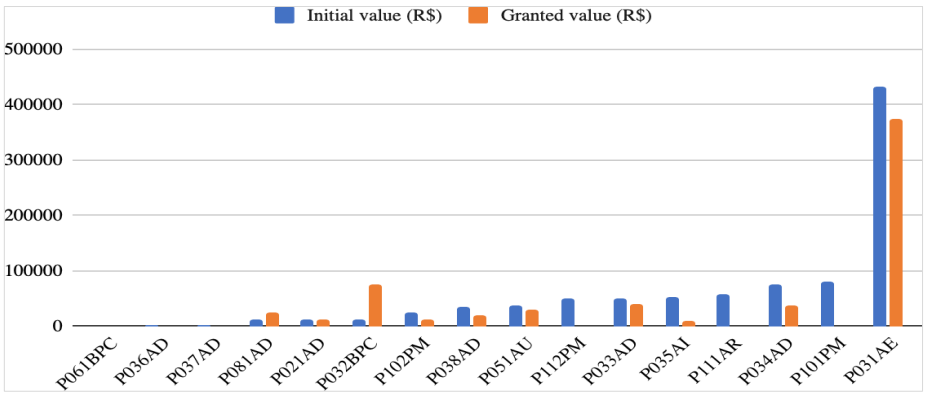
The Graph 2 analyzes the procedural motivations by gender. Men dominate claims related to sickness benefits and are predominant in survivor's pension requests.

Skovsmose (2014) makes it clear that we should be wary of pre-packaged models, closed-ended mathematical interpretations, and the assumption that we are dealing with absolute truths. The data presented here are examples for reflection and critical analysis, as this is a calculation sector with its own manual for guidance and is governed by judgments and rulings that are prone to errors. Despite being corrected, they harm beneficiaries who suffer from all types of social ills, exposing them to social vulnerability, as they threaten human dignity when their right to a benefit is curtailed.

Among the types of material errors observed in the survey, calculation errors were the most prevalent, at 87.5%, followed by nomenclature and numbering errors, at the same percentage (6.3%). The data has the potential to develop solutions to mitigate material errors, exercising reflective knowledge, as suggested by Skovsmose (2014), as it involves important decision-making to achieve social justice.

It is important to describe the types of material errors found in the analyses, highlighting that two sources of errors were detected in the analyzed cases. The first identifies the court's accounting department as responsible for 79% of the errors, and 29% of the errors indicate the INSS (National Institute of Social Security) as the second source of material errors.

**Graph 3:** Relationship between the claimed/initial value and the awarded amount




**Source:** survey data

The graph shows a clear discrepancy between the claimed (initial) value and the amount

awarded, with the claimed value being consistently higher. Notably, case P031AE stands out, presenting a significantly higher initial value compared to the other cases.

**Table 1:** Errors made in the processes

| Processes | Initial value (R$) | Granted value (R$) | Difference (R$) | Final value (R$) |
|---|---|---|---|---|
| P061BPC | 484,8 | | | 484,8 |
| P036AD | 1.202,24 | | | 1.202,24 |
| P037AD | 1.225,23 | | | 1.225,23 |
| P081AD | 10.745,97 | 24.976,33 | 14.230,36 | 10.745,97 |
| P021AD | 12.006,32 | 11.156,35 | 849,97 | 12.006,32 |
| P032BPC | 12.845,87 | 74.697,24 | 61.851,37 | 12.845,87 |
| P102PM | 23.846,89 | 12.219,79 | 11.627,10 | 23.846,89 |
| P038AD | 34.808,82 | 18.419,32 | 16.389,50 | 34.808,82 |
| P051AU | 36.057,95 | 29.378,18 | 6.679,77 | 36.057,95 |
| P112PM | 49.755,82 | | | 49.755,82 |
| P033AD | 50.250,20 | 39.715,66 | 10.534,54 | 50.250,20 |
| P035AI | 52.656,21 | 9.506,65 | 43.149,56 | 52.656,21 |
| P111AR | 57.483,67 | | | 57.483,67 |
| P034AD | 75.890,87 | 36.098,40 | 39.792,47 | 75.890,87 |
| P101PM | 79.200,00 | | | 79.200,00 |
| P031AE | 433.155,44 | 373.624,75 | 59.530,69 | 433.155,44 |
| Total | 931.616,30 | 629.792,67 | 264.635,33 | 931.616,30 |
| Media | 58.226,02 | 62.979,27 | 26.463,53 | |

**Source:** survey data

An analysis of Table 1 identified a total of 16 material errors, 10 of which resulted in reduced benefit amounts for various reasons. Notable cases include errors such as the omission of monetary adjustments, interest on arrears, and proportional 13th-month salary (P021AD); incorrect final payment date (P034AD); and inconsistencies in the RMI (Monthly Initial Benefit) and final amounts (P033AD and P051AU). These issues would have caused financial losses to the beneficiaries had legal representatives not intervened. Other errors included unaccounted deductions (P035AI), spreadsheet inaccuracies (P102PM), and incorrect data regarding FGTS[14] balances (P031AE). Additionally, omissions of attorney fees or applicable fines were observed in cases such as P061BPC, P036AD, and P037AD. In all instances, the diligence of the legal teams was crucial in preventing financial harm to the claimants.

The dichotomy of *wonders and horrors* in the application of mathematics, as described by Skovsmose (2014), is particularly relevant to the analysis of material errors. The “wonders” stem from the existence of a standardized, accessible, and well-structured calculation manual within the judicial system, which facilitates the accurate computation of various amounts

[14] The FGTS – *Fundo de Garantia por Tempo de Serviço*, unemployment fund for social security, is a fund created to provide financial stability to formally employed workers. The fund is formed by monthly deposits made by the hiring company into a *Caixa Econômica Federal* bank account linked to the employer. Contributions are mandatory, and the amount cannot be deducted from the employee's salary.

established in rulings and court decisions. The "horrors," however, emerge when these same calculations are performed incorrectly, resulting in financial, emotional, and social harm—and ultimately, in social injustice.

Table 2 presents a detailed case-by-case analysis to examine the social impacts arising from calculation errors in social security proceedings.

**Table 2:** Description of Mr. João's process

| Data | Description |
|---|---|
| Gender | Male |
| Age | 48 |
| Naturality | Marabá/PA |
| Profession | He doesn`t work |
| procedural motivation | BPC – *Benefício de Prestação Continuada* - continuous benefit |
| ICD code | 10 Q 66.8 - Other congenital foot deformities. |
| Physical and mental examination | The examinee presented himself for the examination dressed appropriately, demonstrating good hygiene, good general condition, globally oriented, cooperative, good understanding and reasoning, attention and concentration within normal limits, and preserved memory. We noted<br>no delusions or hallucinations. |
| Medical opinion | Conferring total and permanent incapacity only for the performance of work activities that require physical effort / frequent and precise mobility of both lower limbs / orthostatic position<br>— walking for a prolonged period. |
| Treatment | Physiotherapy, orthoses, Casting or Ponseti Method, Surgery. |
| Duration | 68 months |
| Status | It finished |
| Documents analyzed | Initial petition, medical report, sentence, unnamed appeal, judgment, accounting opinions, objection, RPV issuance certificate. |
| Processing of the case | The case was initiated in the 1st court of Marabá but was subject to a double degree of jurisdiction in Belém. |
| Material error | Calculation error |
| Error description | Due to the error in the initial payment date, the final amounts were at odds with the ruling. |
| Responsible | Judgment calculation sector |
| Other errors | It didn`t have |
| Source of error | Judgment calculation sector |
| Error direction | For more |
| Initial value | R$12.845,57 |
| Granted value | R$74.697,24 |
| Difference | R$61.851,37 |

| | |
|---|---|
| Final value | R$12.845,57 |
| Harmed | Public treasury, if it weren't for the observation of the lawyer in the case. |

**Source:** Oracle database

João, a fictitious name assigned to the beneficiary described in the case above, is a person with a disability diagnosed with ICD-10 code Q66.8 (Other congenital deformities of the foot). Congenital foot deformities can arise from various causes, ranging from genetic factors to environmental conditions during pregnancy. According to Baumfeld (2024), the symptoms of such deformities vary depending on their severity and type. These conditions can lead to chronic pain in the foot, ankle, and leg due to bone misalignment and joint overload, making everyday tasks significantly more difficult. Moreover, the compensatory gait associated with clubfoot can affect posture, potentially resulting in complications in the spine, hips, and knees, and causing pain in multiple regions of the body.

As a result of these impairments, João consistently struggled to stand, walk, or perform any form of physical exertion, rendering him unable to work or carry out basic daily activities. He was unable to provide for himself or his family and thus began a long struggle to obtain social security benefits from the INSS. On February 23, 2015, he filed an initial administrative request for sickness benefits, which was denied on the grounds of a "conflicting opinion from the medical examiner."

Subsequently, in a renewed attempt, João filed a lawsuit for the BPC on April 16, 2015. However, the request was denied once again, this time on the grounds that “there is no incapacity for life and work.”

After these unsuccessful attempts, João turned to the judiciary, seeking recognition of his rights. He brought the case to court, arguing that the agency’s decision was inconsistent with the principles of fair law, the Federal Constitution, and current Social Security legislation. It is important to emphasize that João, suffering from a chronic and disabling condition, was unjustifiably denied benefits – a situation that directly violates the principle of human dignity enshrined in Article 1, item III, of the Brazilian Constitution. Considering this, the presiding judge issued a partially favorable ruling, arguing that more than two years had passed between the initial administrative request and the lawsuit filing – an interval in which the agency could have reassessed the claimant’s social and medical conditions.

Following the decision, João’s attorney filed an appeal, which unfortunately did not reverse the ruling. The original decision was upheld, confirming the granting of the BPC benefit, though without altering the filing date of the administrative request. The case was then forwarded to the court’s accounting department for the calculation of retroactive amounts. However, an error occurred: the accountant incorrectly entered the initial payment date, leading to discrepancies in the final benefit amount. The attorney submitted objections, requesting a rectification of the calculations and the issuance of the RPV. These proceedings resulted in a delay of seven months before the retroactive amounts were finally disbursed.

This case clearly demonstrates that certain conceptions of mathematics – as an exact, infallible science detached from social and human contexts – fail to hold up under critical scrutiny. The calculation errors harmed João, delayed the provision of his rightful welfare benefits, and contributed to social injustice. This outcome challenges the idea that mathematics is purely objective and neutral, revealing instead that its application can produce significant and harmful consequences when uncritically accepted.

In this sense, the notion of mathematics as a cold and absolute science must be

deconstructed. It becomes essential to question mathematical outcomes, particularly when they are embedded in legal or bureaucratic processes. As Skovsmose insightfully argues, mathematics education must open space for critical reflection – inviting new possibilities and expanding the understanding of mathematics beyond its technical dimension.

> Reflections can be associated with profound ethical considerations regarding actions and, thus, can gain a philosophical connotation. However, it is also important to consider everyday reflection, the simple act of turning one's thoughts to the actions one takes. (Skovsmose, 2014, p. 92, *our translation*)

Mathematical errors in social security calculations can have significant implications for beneficiaries and for social justice. Reflecting on these errors involves considering both the technical aspects and the legal and social contexts in which they occur. Here, we highlight Skovsmose's (2014) discussion of the importance of mathematics' social and political role, which can be used, for example, as an instrument of social inclusion, potentially creating both wonders and horrors. In this regard, the case analyzed is a horror show, as it involves a 68-month legal process, with the potential beneficiary being a person with a congenital disability.

For Skovsmose (2014), human dignity and social justice are central concepts, especially in his reflections on mathematics education. The author advocates an approach to mathematics that aligns with the struggle for social justice and the recognition of human dignity, which is closely linked to the recognition of the individual as an independent being, capable of making decisions and acting based on their own worldview. Mathematics education, in this context, should not be seen merely as a means of imparting technical knowledge, but also as a tool to promote personal and social development. Thus, human dignity is not something to be given but rather earned through active participation in society and social institutions.

Human dignity is an extremely important and urgently needed principle, as it constitutionally guarantees human beings the minimum necessary to ensure subsistence. This research demonstrated that the principles of human dignity have been thrown down the drain, leaving human beings without prospects, waiting for a decision, for a mistake to be corrected, which, for those experiencing hunger or need, lasts an eternity.

The data analysis revealed that the highest incidence of errors occurred in the sickness benefit process, where the difficulties are greater and more painful, because in such moments, physical and psychological weakness substantially affects any human being. Given the barriers imposed by the INSS, there is the smoke of some irregularity, which denies the benefits requested administratively, without any accurate and humane analysis of the conditions of those who need so much assistance and who are in search of the much-talked-about human dignity.

In the hope of obtaining social security benefits, many individuals turn to the “lady of justice” – a symbol of renewed hope. In their pursuit of human dignity, beneficiaries submit requests for sickness benefits, praying for a prompt response so that their dignity might be acknowledged and restored through the approval of such benefits. It is important to note that the data presented in this article indicate that sickness benefits were the most affected by calculation errors. The court’s accounting department – whether directly or indirectly – bears responsibility for these inaccuracies, which significantly delay the realization of human dignity through the timely granting of benefits.

The situations faced by the 16 beneficiaries analyzed in this study – individuals who have spent months, or are still engaged, in legal battles to secure a benefit that ensures at least the minimum standard of dignity guaranteed by the Brazilian Constitution – are consistently

worsened by their exposure to social vulnerability. This vulnerability is deeply intertwined with the population's broader socioeconomic conditions, including factors such as income, education, healthcare access, employment opportunities, state-provided services, and the potential for social mobility.

According to Skovsmose (2014), social vulnerability is closely tied to both access to, and the nature of, mathematics education. He advocates for a more inclusive and critical approach – one that enables students, especially those most at risk, to use mathematical knowledge as a means of inquiry and empowerment. This kind of education fosters a deeper understanding of mathematics and its real-world applications, allowing students to critically examine the social and economic structures that reinforce inequality and exclusion.

To address this marginalizing reality, public policies must be thoughtfully designed and integrated to mitigate the effects of social vulnerability. These efforts should emphasize the promotion of inclusion and equitable social well-being. Confronting such a multifaceted issue requires a multidisciplinary approach – ranging from the strengthening of the social safety net to the creation of opportunities that support individual autonomy and self-determination.

Reducing social vulnerability is therefore an urgent and collective task, one that must involve government institutions, civil society, and other sectors. Only through concrete and sustainable action can we ensure that vulnerable individuals attain a life marked by the minimum conditions of human dignity, equitable access to opportunity, and genuine participation in building a more just society.

## 7 Final Considerations

This article aimed to identify processes containing calculation errors and assess their incidence, as well as analyze the social impacts arising from these errors, highlighting their causes, consequences for beneficiaries, and broader social implications. The research revealed that material errors in social security benefits represent a recurring and detrimental issue for beneficiaries, with most errors originating in the court's calculation department and the local government agency.

The analysis underscored the social repercussions of calculation errors in INSS benefits, demonstrating how flaws in value calculations can negatively affect beneficiaries and their families. Although recalculation is a technical procedure, it directly impacts beneficiaries' quality of life by compromising their financial security and often exacerbating social vulnerability – particularly among the elderly, people with disabilities, and workers exposed to higher social risks. These impacts amount to violations of human dignity, a constitutional principle that is thus summarily disregarded.

The findings indicate that such errors are not merely administrative mistakes but symptomatic of deeper systemic deficiencies in a system meant to guarantee social protection fairly and efficiently. Furthermore, lack of transparency in communications with beneficiaries and protracted legal proceedings intensify the social harm caused by calculation errors, resulting in emotional distress, financial losses, and months-long delays in resolution. Ultimately, these errors generate significant financial insecurity and diminish beneficiaries' quality of life, perpetuating social vulnerability in its many dimensions and obstructing the attainment of the fundamental human dignity they seek.

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