

Mathematics: a vital tool in everyday life

Matemática: uma ferramenta vital na vida cotidiana

Matemáticas: una herramienta vital en la vida cotidiana

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Resumo: Este artigo examina criticamente o papel central da matemática na vida cotidiana e suas implicações para a educação contemporânea. Com base em uma revisão de literatura que inclui autores como Duval, Boero, Freudenthal e Gerdes, o estudo explora como a matemática apoia a tomada de decisões, fortalece o pensamento crítico e atua em diversos domínios, como finanças pessoais, saúde, tecnologia e gestão do tempo. A análise destaca qu'as percepções negativas sobre a disciplina frequentemente resultam de práticas de ensino descontextualizadas, focadas na aplicação mecânica de regras, em vez da compreensão conceitual. Ao enfatizar a importância de abordagens pedagógicas contextualizadas e ancoradas em situações reais, o artigo demonstra que o desenvolvimento precoce de habilidades matemáticas favorece o sucesso acadêmico e a autonomia intelectual. Por fim, argumenta que tornar a matemática mais acessível e significativa é essencial para preparar cidadãos capazes de interpretar o mundo, resolver problemas complexos e participar plenamente de uma sociedade cada vez mais orientada por dados e pela tomada racional de decisões.

Palavras-chave: Análise Educação Matemática; Aplicações Cotidianas; Pensamento Crítico.

Abstract: This article critically examines the central role of mathematics in everyday life and its implications for contemporary education. Drawing on a literature review that includes authors such as Duval, Boero, Freudenthal, and Gerdes, the study explores how mathematics supports decision-making, strengthens critical thinking, and operates across various domains such as personal finance, health, technology, and time management. The analysis highlights that negative perceptions of the discipline often stem from decontextualized teaching practices that focus on mechanical rule application rather than conceptual understanding. By emphasizing the importance of contextually grounded pedagogical approaches, the article demonstrates that early development of mathematical skills fosters academic success and intellectual autonomy. Ultimately, it argues that making mathematics more accessible and meaningful is essential for preparing citizens capable of interpreting the world, solving complex problems, and fully participating in a society increasingly shaped by data and rational decision-making.

Keywords: Mathematics Education; Daily Applications; Critical Thinking.

Resumen: Este artículo examina críticamente el papel central de las matemáticas en la vida cotidiana y sus implicaciones para la educación contemporánea. Basándose en una revisión de la literatura que incluye autores como Duval, Boero, Freudenthal y Gerdes, el estudio explora cómo las matemáticas apoyan la toma de decisiones, fortalecen el pensamiento crítico y operan en diversos ámbitos, como las finanzas personales, la salud, la tecnología y la gestión del tiempo. El análisis destaca que las percepciones negativas sobre la disciplina suelen derivarse de prácticas de enseñanza descontextualizadas, centradas en la aplicación mecánica de reglas en lugar de la comprensión conceptual. Al enfatizar la importancia de enfoques pedagógicos contextualizados y basados en situaciones reales, el artículo demuestra qu'el desarrollo temprano de habilidades matemáticas favorece el éxito académico y la autonomía intelectual. Finalmente, sostiene que hacer que las matemáticas sean más accesibles y significativas es esencial para preparar a ciudadanos capaces de interpretar el mundo, resolver problemas complejos y participar plenamente en una sociedad cada vez más orientada por los datos y la toma racional de decisiones.

Palabras llave: Educación Matemática; Aplicaciones Cotidianas; Pensamiento Crítico.

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1 Introduction

Mathematics, often perceived as abstract and complex, is nevertheless an essential pillar in the daily life of modern humans. It transcends the boundaries of academic disciplines and merges into everyday activities such as managing a household budget, cooking, or using advanced technologies. According to PISA (2018), a fundamental understanding of mathematics is essential for individuals to fully participate in a digitized society, where numerical data, algorithms, and probabilities increasingly shape decisions.

This is what has happened and still happens with mathematics education, as this teaching is generally theorized, distancing itself from the world of life, failing to maintain a connection with real life, to refer to context, and to consider the concrete subject. Thus, mathematics becomes an abstraction that occurs when, in the school's math problems, what interests the teacher the most [...] is not the effort to solve the problem [...] but rather the application of a formula, an algorithm, or a predetermined operation based on the chapter in which the problem is located or the school grade [...] (DANTES, 2017, p.63).

The importance of mathematics lies not only in its practical application but also in its ability to structure critical and analytical thinking. As Boero (2001) states, solving mathematical problems develops a habit of rational and logical reasoning that can be transferred to various contexts, such as decision-making, risk management, or strategic analysis. This cognitive aspect is fundamental, as it helps citizens capable of navigating the complexity of contemporary challenges.

Although mathematics is present in nearly every aspect of daily life, many individuals continue to view it as difficult, abstract, or disconnected from their real-world experiences. This perception often stems from educational approaches that emphasize rules and procedures without demonstrating their relevance to everyday situations. As a result, many people develop anxiety or resistance toward mathematics, which limits their ability to understand concepts and solve problems effectively. In addition, inequities in learning environments and limited access to engaging pedagogical tools reinforce the gap between those who feel confident with mathematics and those who see it as inaccessible.

In this context, it becomes essential to rethink how mathematics is taught and integrated into human activities. This study aims to highlight the practical importance of mathematics in daily decision-making processes, such as managing personal finances, navigating technology, planning, or analyzing information. By emphasizing real-life applications and the development of analytical skills, the objective is to present mathematics not as a purely theoretical discipline, but as a universal tool that supports problem-solving, strengthens critical thinking, and enhances individuals' ability to engage meaningfully with the modern world.

2 The Practical and Everyday Applications of Mathematics

In the domestic sphere, mathematics appears in seemingly trivial activities. For instance, the simple act of cooking involves calculations of proportions, time, or temperature, thus demonstrating its ubiquitous role (GERDES, 1996). Similarly, in the financial field, mathematics has become a crucial tool to evaluate interest rates, plan investments, or analyze credit offers. These examples show that mastering basic mathematics is not only useful but essential for making informed decisions in daily life. On a professional level, mathematics stands out as a universal language used across various sectors such as engineering, medicine, business, and architecture. For instance, healthcare professionals use statistics to interpret medical test results and evaluate treatments (HOLMES, 2016). In industry, mathematical algorithms help optimize supply chains and create predictive models. These examples confirm Bishop's (2017) assertion that mathematics is not merely a school subject, but a key to understanding and transforming the world.

Although mathematics permeates virtually every aspect of daily life, a considerable portion of the population continues to perceive it as inaccessible, anxiety-inducing, or disconnected from reality. This paradox raises a fundamental question: *how can a discipline that structures human reasoning, shapes modern technology, and supports essential decisions still be perceived as distant or intimidating?* Research suggests that the roots of this difficulty lie primarily in the way mathematics is taught and experienced. Duval (2006) argues that learners often encounter mathematics as a sequence of abstract rules and symbolic manipulations, detached from meaningful contexts. This disconnect limits comprehension and fosters “mathematics anxiety,” a phenomenon also noted by Vinner (1997), who highlights the tension between formal instruction and students' intuitive representations.

3 Cognitive, Educational, and Technological Dimensions of Mathematics

Educational inequalities further intensify this challenge. In many instructional environments, teachers lack both the training and the pedagogical tools needed to link mathematical concepts to students' lived experiences. This imbalance contributes to persistent gaps in achievement and confidence. Boaler (2016) emphasizes that traditional, procedure-centered instruction restricts students' engagement, whereas approaches that encourage exploration, collaboration, and creative problem-solving lead to deeper conceptual understanding. Similarly, Brazilian researchers such as D'Ambrosio (2005) underline the importance of ethnomathematical perspectives, which value learners' cultural practices and everyday reasoning as legitimate forms

of mathematical thinking, an essential dimension for democratizing access to the discipline.

To overcome these barriers, mathematics education must evolve toward approaches that integrate real-life situations and cognitively rich experiences. Freudenthal (1973) demonstrated that meaningful learning emerges when students encounter mathematics as a human activity rooted in reality rather than as a static body of knowledge. Contemporary research also highlights the value of digital and interactive tools; according to Hoyles and Noss (2003), technology can expand learners' mathematical awareness by making abstract structures visible and dynamic. This perspective aligns with recent Brazilian studies (Borba & Villarreal, 2010) showing that digital environments help students develop mathematical reasoning through exploration and visual representation.

In light of these findings, the purpose of this study is to demonstrate that mathematics, far from being merely theoretical, is a practical, indispensable tool embedded in everyday activities such as budget management, technological use, transportation planning, health decisions, and strategic reasoning. By analyzing existing research, the article aims to highlight the concrete applications of mathematical ideas and their influence on critical thinking, problem-solving, and informed decision-making. Ultimately, the goal is to contribute to a reimagining of mathematics as an accessible and empowering discipline, one capable of transforming challenges into opportunities and enabling individuals to engage more confidently with the complexities of modern life.

The scientific literature emphasizes that mathematics is far more than a set of rules or calculations: it represents a universal language that enables us to describe, analyze, and understand the world. Tall (2013) notes that mathematics forms a coherent system structuring human thought, capable of translating natural phenomena, organizing information, and supporting decision-making. This universal dimension, as explained by Devlin (2000), allows individuals and societies to share common references, whether in measurement, financial calculations, or time systems. Even when it appears abstract, mathematical structure always finds concrete applications in daily life, as Hardy (1940) had already argued.

Several studies show that this omnipresence of mathematics is often ignored or underestimated. Mosvold (2005) highlights that the most ordinary activities buying goods, cooking, organizing one's schedule, comparing prices, or simply planning a trip, rely on implicit mathematical reasoning. Personal finance management illustrates this clearly: creating a budget, understanding loan mechanisms, interpreting interest rates, or planning an investment all require

mastery of operations such as percentages, addition, division, and simple or compound interest calculations (TERLEY, 2020).

The rise of contemporary technologies further reveals the centrality of mathematics. The work of Salman Bin Sami Khan and Reema Salman (2020) shows that technological tools search engines, social networks, navigation systems, and communication platforms, are built on complex mathematical algorithms. GPS systems, for example, rely on geometric and trigonometric calculations to determine the most efficient routes, while cryptography, essential to cybersecurity, depends on the properties of prime numbers and encryption functions.

Health and science constitute another domain where mathematics plays a decisive role. Interpreting medical results, calculating dosages, modeling disease spread, or producing medical images such as MRI scans require sophisticated statistical and algorithmic tools. The COVID-19 pandemic highlighted the importance of mathematical models in predicting the evolution of the virus and guiding political and health decisions.

In art and music, mathematics contributes to the construction of forms, proportions, rhythms, and harmonies. The golden ratio, frequently used in architecture and painting, demonstrates how a mathematical relationship can produce a particular aesthetic effect. Likewise, musical creation relies on numerical structures that organize tempo, intervals, and sound patterns. The field of transportation also benefits from mathematical modeling. Whether in route planning, schedule management, road design, or speed calculation, mathematics ensures the safety and efficiency of mobility. Radar systems, for instance, are based on the relationship between time, distance, and speed, supported by vector and kinematic calculations (Adult Education Center, 2013). In the professional world, mathematics strengthens organizations' strategic capacities. It enables the analysis of market trends, demand forecasting, inventory management, and the development of data-driven management strategies. According to Salman Bin Sami Khan and Reema Salman (2020), mathematics operates as a genuine "science of behavior," influencing choices and emotions related to success, loss, and measurable performance.

Finally, several authors highlight the contribution of mathematics to the development of critical thinking. Ahmad argues that mathematical learning promotes logical analysis, structured reasoning, and rigorous problem-solving skills essential across all areas of modern life. This importance justifies the need for early exposure to mathematical concepts. As Sharma (2025) explains, teaching mathematics from the earliest years of schooling not only prepares students for

academic success but also equips them to interpret and navigate everyday challenges. Overall, the literature converges on the idea that mathematics is an indispensable tool for understanding, organizing, and transforming reality. Its constant presence in human life, whether visible or implicit, confirms its structuring role in individual, technological, and social practices.

Mathematics is also used in cooking and baking in daily life activities. Cooking often requires measuring the weight of the items or counting the number of ingredients, which are mathematical problems. Even the cooking times are based on mathematics and depend on the weight of the component, i.e., if further time is necessary for more weight, the time again needs to be calculated. In baking, the precise amount of flour, cake bread weight in grams, etc., is used based on pan size and ingredient density. Here, weight and density play a vital role, which is again a mathematical concept. Apart from this, to bake a cake, the infra-red radiation of the oven is placed in terms of Fahrenheit and time duration, which needs to be explored. Therefore, cooking and baking are also surrounded by mathematical problems (TERLEY, 2020).

Building on this understanding of mathematics as a universal language embedded in everyday practices, its relevance becomes even more evident when examined through specific domains such as health, the arts, transportation, and strategic decision-making. In the health sciences, mathematics is indispensable for interpreting clinical results, calculating dosages, and modeling epidemics. During the COVID-19 pandemic, predictive models were crucial for anticipating the virus's spread and planning public health responses an aspect widely highlighted by Brazilian researchers like Barreto et al. (2020). Even technologies such as MRI scanners depend on advanced mathematical algorithms to reconstruct detailed internal images, showing that mathematical structure directly shapes scientific accuracy.

Mathematics also plays a prominent role in creative expression. Artists draw on geometric principles to build harmonious compositions, while musicians rely on ratios and rhythmic patterns to structure sound. The golden ratio, frequently analyzed in Brazilian aesthetic studies (DUARTE, 2016), illustrates how numerical relationships can enhance visual and musical beauty. In transportation, mathematical models optimize mobility systems, route planning, and safety mechanisms. Whether in calculating vehicle speed, designing roads, or programming traffic lights, mathematics ensures efficiency and coherence. Engineering studies in Brazil (SILVA; RODRIGUES, 2016) emphasize that algorithmic planning is essential for modern logistics and fuel-efficient travel. Finally, mathematics strengthens strategic decision-making in the business world. Companies use quantitative analysis to forecast demand, evaluate risks, and guide management policies. As Corrêa and Caon (2012) argue, mathematical modeling is central to organizational planning, enabling firms to rationalize their choices and anticipate market dynamics.

Mathematics helps us to understand the order and relation of structures that include measurements and counting and describes all the different shapes and motions of things. It tells us how to manage anything with the help of numbers. Mathematics also generates emotions in you for various situations by receiving numbers as a result of your life's ups and downs. All in the form of numbers, it enhances our feelings for the achievements of goals, sometimes to be happy, and gives us motivation towards the target if we get lower values. It teaches us right or wrong, good or bad, more or less, high or low, gain or loss, etc. And yes, mathematics is a Science. Science of behavior, Science of motivations, Science of outcomes, and Science of numbers (KHAN; SALMAN, 2020, p.51).

According to Afaq Ahmad, mathematics strengthens our skills in critical thinking and problem-solving. It teaches us to structure our reasoning, analyze data, and draw logical conclusions. These skills are essential not only in scientific fields but also in everyday life. The omnipresence of mathematics in our daily lives is undeniable. Whether managing our finances, using technology, making decisions, or creating art, mathematics is an indispensable tool. Its importance goes far beyond the classroom, influencing nearly every aspect of modern life. By recognizing this presence, we can better appreciate its role and use it more consciously and effectively.

4 Early Mathematics Education and Its Long-Term Impacts

Teaching mathematics from an early age is a central topic in contemporary educational debates. The key question is why this instruction is essential from the very first years of schooling. Mathematics is not merely a set of abstract rules and calculations, but a fundamental language that helps structure thinking, solve problems, and understand the world around us (SHARMA, 2021). According to several studies, early exposure to mathematical concepts prepares students not only to succeed in scientific subjects but also to navigate daily life more effectively.

Hence, individuals need to understand the nature of mathematics and its relation to life in order to use it in their everyday lives. Mathematics will make sense to students who understand the numerous advantages of mathematical knowledge and know the place of math in daily life as a discipline, its various areas of application, and what they could achieve by using math in their lives. For such students, studying math will be more fun, which will undoubtedly affect their academic performance (HAYAL, 2018, p. 63).

The early years of schooling are crucial for the development of children's cognitive abilities. Mathematics helps stimulate logical and critical thinking. According to Piaget (1970), children go through stages of cognitive development where their ability to understand abstract concepts, such as numbers and spatial relationships, gradually develops. By exposing children to these concepts early on, their later learning is facilitated, providing them with a solid foundation to tackle more complex tasks.

Mathematics education develops problem-solving skills in children. From a young age, children face simple mathematical challenges that require them to find logical solutions. This process fosters a methodical and rigorous approach to life's challenges. According to the National Council of Teachers of Mathematics (NCTM, 2000) report, problem-solving skills lie at the heart of mathematics teaching and constitute essential competency for adults in modern society.

The reason why mathematics is the only and biggest educational phenomenon is that it is used in various non-mathematical contexts in a wide variety of ways. It is widely used in all basic sciences (mathematics, physics, chemistry, biology, and astronomy) and their areas of application (medicine, pharmaceuticals, agriculture, food industry, etc.), as well as technology, all branches of engineering, and such fields as commerce, economics, business administration, industry, accounting, military, etc. It is used in any area you can think of, including banking, finance, manufacturing and industry, electrical-electronics and communication technologies, transportation, roads and bridges, defense industry, astronomy and space studies, meteorology and geography (HAYAL, 2018, p. 61).

Research shows that children who acquire strong math skills in elementary school generally perform better in other academic areas. For example, the study by Duncan et al. (2007) demonstrated that early math skills are good predictors of future academic success, including in non-mathematical subjects. Mathematics is indeed a predictor of overall school achievement because it requires intellectual rigor and the ability to organize and analyze information.

Mathematics is omnipresent in daily life, from managing personal finances to understanding statistical information in the media. Teaching mathematics from an early age helps children develop practical skills that will be essential throughout their lives. The ability to understand concepts of time, money, measurement, and proportions is a vital skill for everyday life. Early exposure also helps strengthen children's confidence in using mathematics in their daily activities.

5 Final Considerations

In conclusion, this analysis clearly shows that mathematics is far more than a set of rules, procedures, or abstract calculations. It functions as a structuring language that is essential for understanding, organizing, and transforming reality. The literature reviewed demonstrates that the presence of mathematics in everyday life, whether in personal finance, health, technology, mobility, time management, or artistic expression, is neither marginal nor incidental; rather, it fundamentally shapes the ways individuals interpret the world and make informed decisions.

However, this pervasive presence contrasts with the persistent difficulties experienced by many learners, difficulties often linked to decontextualized teaching practices focused on rote

memorization and mechanical application. As emphasized by Duval, Boaler, Freudenthal, and other researchers, genuine mathematical understanding requires pedagogical approaches that connect abstract concepts to lived experiences, culturally meaningful contexts, and intellectually rich activities. In this sense, early and contextualized integration of mathematics into formal education emerges as a crucial condition for fostering cognitive development, critical thinking, and intellectual autonomy.

Recognizing the transversal role of mathematics, therefore means acknowledging its contribution to shaping modern citizens capable of reasoning, anticipating, evaluating risks, interpreting data, and solving complex problems. Strengthening mathematics education from the earliest years is not only an academic priority but also a social and scientific imperative. To make mathematics truly meaningful and accessible to all, it is necessary to rethink pedagogical practices, encourage active exploration, foster modeling processes, integrate interactive technologies, and anchor mathematical knowledge in cultural relevance.

Ultimately, this work invites us to conceive mathematics education as a dynamic process centered on meaning-making, creativity, and the progressive construction of logical thinking. Forming learners who understand, appreciate, and apply mathematics in their daily lives is, in reality, preparing citizens capable of navigating the challenges of an increasingly complex, technological, and data-driven world. Mathematics is therefore not merely a school subject; it is a tool for understanding reality and a powerful driver of intellectual empowerment.

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