Use of Mathematics in Daily Life: A Review of Practical Applications, Mathematical Literacy and Emerging Trends

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Abstract

Mathematics is often associated with classroom exercises, examinations and advanced scientific theory, yet its practical role extends across almost every part of ordinary life. People use mathematical ideas when they manage money, compare prices, estimate travel time, measure ingredients, interpret health information, plan household resources, understand probabilities, use digital devices and make decisions from data. This review examines the role of mathematics in daily life by synthesizing literature on mathematical literacy, financial numeracy, measurement, statistics, technology, health, transportation, household management, employment and civic decision-making. The review adopts a broad conception of mathematical literacy in which individuals formulate, employ, interpret and evaluate mathematics in real-world contexts. Recent international work, particularly the OECD PISA 2022 mathematics framework, emphasizes that mathematical literacy is not limited to calculation; it includes reasoning, modelling, data interpretation and the informed use of mathematical tools. Recent studies also indicate a close relationship between mathematical knowledge and financial behaviour, while digital technologies have increased the need for quantitative and statistical reasoning. The paper argues that mathematics should therefore be understood as a practical language for organizing information, estimating quantities, managing uncertainty and supporting rational decisions. The review concludes that strengthening connections between school mathematics and authentic daily-life situations can improve mathematical literacy and help learners become more confident users of quantitative information.

Keywords: mathematics, daily life, mathematical literacy, numeracy, financial literacy, statistics, measurement, mathematical modelling, technology

1. Introduction

Mathematics is one of the most widely used forms of human reasoning. Its applications are visible not only in mathematics, engineering and the natural sciences, but also in routine activities such as shopping, cooking, budgeting, travelling, construction, communication and personal planning. Much of this use is informal: an individual may calculate a discount without naming the operation as percentage arithmetic, estimate the amount of paint required for a wall without explicitly writing an area formula, or compare two loans without describing the process as mathematical modelling. Such examples demonstrate that mathematics is embedded in everyday decision-making.

The contemporary idea of mathematical literacy goes beyond the ability to perform arithmetic operations. The OECD defines mathematical literacy as the capacity to reason mathematically and to formulate, employ and interpret mathematics in a variety of real-world contexts [1,2]. The PISA 2022 framework identifies quantity; uncertainty and data; change and relationships; and space and shape as major content areas, while personal, occupational, societal and scientific situations provide contexts in which mathematics is applied [2]. This approach is particularly relevant to daily life because citizens increasingly encounter numerical claims, graphs, percentages, probabilities and digital information.

Recent literature also illustrates the practical nature of mathematics. A 2024 review of everyday uses of mathematics reports applications in budgeting, cooking, shopping, planning, decision-making and governance [3]. A recent review of mathematical and statistical tools similarly emphasizes the routine and often unconscious use of mathematical ideas [4]. Research on financial literacy has further shown that mathematical knowledge and financial knowledge are

associated with financial behaviour [5]. These findings support a broader view of mathematics as a life skill rather than only an academic subject.

2. Objectives of the Review

- To examine major ways in which mathematical concepts are used in everyday activities.
- To connect elementary and advanced mathematical ideas with practical situations.
- To review the role of mathematical literacy in financial, technological, health and civic decisions.
- To identify the contribution of statistics, probability and mathematical modelling to modern daily life.
- To discuss implications for mathematics education and the development of practical numeracy.

3. Methodology of the Review

This paper is a narrative literature review. Relevant recent publications, international assessment frameworks and scholarly sources concerning mathematics, numeracy, financial literacy, statistical reasoning and real-world applications were examined. Priority was given to recent sources published from 2020 onward, while foundational references were retained where they provide important conceptual definitions. Sources were organized thematically into personal finance, shopping and household management, measurement and construction, time and travel, health, statistics and probability, digital technology, work and business, and civic life. The synthesis is descriptive rather than a meta-analysis; consequently, the paper does not estimate a pooled effect size.

4. Mathematics in Personal Finance and Household Budgeting

Personal finance is one of the clearest areas in which arithmetic, percentages and algebra are used. Household budgeting requires addition and subtraction of income and expenditure, comparison of planned and actual spending, and calculation of proportions. If monthly income is I and expenditure is E, the monthly balance can be represented as $B = I - E$. When expenditure is divided into categories, the percentage share of category i is $(E_i/E) \times 100$. Such simple expressions help households identify major spending categories and evaluate changes over time.

Interest calculations provide another important application. Simple interest can be represented by $I = Prt$, whereas compound interest can be expressed as $A = P(1+r)^n$, where P is the principal, r is the periodic interest rate and n is the number of periods. These formulas are relevant when individuals compare savings products, loans, deposits and repayment schedules. The practical importance of such knowledge is supported by recent research linking mathematical and financial knowledge with financial behaviour [5]. In India, research using household-level data has also examined the association between financial literacy and financial inclusion and notes that basic arithmetic, percentages and interest calculations form part of financial literacy measurement [6].

Digital finance has made numerical reasoning even more relevant. Online banking, digital payments, credit products, investment platforms and mobile applications present users with balances, transaction histories, fees, rates and percentages. Recent cross-country evidence suggests that financial literacy can influence how effectively individuals benefit from financial technologies [7]. Therefore, mathematics is not only useful for traditional cash transactions; it is also part of responsible participation in a digital financial environment.

5. Shopping, Discounts, Taxation and Consumer Decisions

Shopping involves comparison, estimation and percentage calculations. A discount of d percent on a marked price P produces a discount amount of $Pd/100$ and a sale price of $P(1-d/100)$. When two products are sold in different package sizes, unit-price calculation is necessary for a fair comparison. Consumers may also need to compare prices before and after taxes, delivery charges or promotional offers.

Mathematical reasoning becomes especially important when advertisements present information selectively. A statement such as “20% extra” or “30% off” requires the consumer to identify the correct reference quantity. Successive discounts should not generally be added directly: a 10% discount followed by a 20% discount produces a final price of

0.9 × 0.8 = 0.72 of the original price, equivalent to a 28% total reduction. Such examples demonstrate why percentage literacy is a practical component of consumer decision-making.

6. Measurement, Geometry and Construction

Measurement is fundamental to domestic and professional activities. Length, area, volume, mass and temperature are used when purchasing furniture, selecting floor tiles, estimating paint, measuring cloth, cooking food and storing materials. Geometry supplies the formulas required for these tasks. For a rectangular room of length L and width W, the floor area is LW. The amount of flooring material needed depends on this area plus an allowance for cutting and wastage.

Construction and home improvement require more sophisticated geometry. Pythagorean relationships help determine unknown lengths, trigonometry is used for slopes and heights, and scale drawings connect measurements on plans to actual dimensions. Even when software or calculators perform the numerical work, users need mathematical understanding to enter appropriate quantities and interpret the output. This illustrates an important feature of modern mathematical literacy: technology can perform computation, but the user remains responsible for modelling the situation correctly [2].

7. Time Management, Travel and Navigation

Time calculations are used continuously in daily routines. People calculate durations, departure times, arrival times and schedules. If a journey has distance D and average speed v, travel time can be estimated by t = D/v, subject to real-world factors such as traffic, stops and road conditions. Unit conversion is also essential: speeds may be reported in kilometres per hour while distances and time intervals may be represented in other units.

Navigation applications illustrate the combination of geometry, coordinate systems, optimization and computation. Modern route-planning systems use mathematical models to estimate travel times and select routes under changing conditions. The user's role is not necessarily to perform the underlying algorithms but to understand quantities such as distance, estimated time, speed, fuel consumption and alternative routes. Thus, mathematical literacy enables meaningful interpretation of technology-generated information.

8. Mathematics in Cooking, Nutrition and Household Management

Cooking is a practical setting for ratios, proportions, fractions, percentages and measurement. Recipes frequently require scaling. If a recipe serves n people and the required quantity of an ingredient is q, then for m people the proportional quantity is q(m/n), assuming the recipe scales linearly. Fractions are also used when measuring ingredients, while temperature conversion and timing involve additional numerical reasoning.

Nutrition labels introduce percentages, units, ratios and comparison. Consumers may compare energy, protein, sugar, sodium or other quantities per serving or per 100 g. If serving sizes differ, direct comparison may be misleading unless the quantities are normalized. This is a simple but important example of mathematical reasoning: the numbers themselves are not enough; the unit and reference quantity must also be considered.

9. Mathematics in Health and Personal Well-Being

Mathematics has many practical roles in health-related contexts. Individuals may track body mass, exercise duration, heart rate, fluid intake, sleep duration or medication schedules. Ratios, averages, percentages and unit conversions are commonly encountered. For example, body mass index is calculated as BMI = mass/(height)^2 when mass is measured in kilograms and height in metres. The formula is useful as a screening measure, but mathematical literacy also requires understanding that a calculated value is not a complete description of an individual's health.

Statistics is particularly important in interpreting health information. Risk may be expressed as an absolute probability, relative risk or percentage change, and these forms can lead to different impressions if their denominators are ignored. Understanding sample size, uncertainty, averages and variation helps individuals interpret claims more carefully. The

OECD mathematical literacy framework explicitly includes uncertainty and data as a major domain because citizens increasingly need to evaluate quantitative information [2].

10. Statistics and Probability in Everyday Decision-Making

Statistics is perhaps the most important branch of mathematics for interpreting modern information. Newspapers, websites, social media, government reports and commercial platforms routinely present averages, percentages, charts and probability statements. A mathematically literate person should be able to identify the population represented by a statistic, distinguish a sample from a population, interpret percentages correctly and recognize that an association does not automatically establish causation.

Probability supports everyday reasoning under uncertainty. Weather forecasts, insurance, reliability, games, medical screening, financial risk and quality control all involve uncertain events. If an event has probability p, its expected occurrence over repeated trials can be described statistically, but a probability is not a guarantee. Understanding this distinction helps prevent common reasoning errors such as interpreting a 70% probability of rain as certainty or assuming that a low-probability event cannot occur.

The importance of data reasoning is reflected in contemporary mathematical literacy frameworks. The PISA 2022 framework emphasizes uncertainty, variation and the evaluation of data-based arguments [2]. It also connects mathematical literacy with critical thinking, information use, systems thinking, communication and reflection. These competencies are highly relevant to the everyday information environment.

11. Mathematics, Digital Technology and Artificial Intelligence

Digital technology has changed how mathematics is encountered. Calculators, spreadsheets, statistical packages, navigation systems, recommendation engines and artificial intelligence tools perform calculations that were previously completed manually. Nevertheless, the increased availability of computation does not eliminate the need for mathematics. Instead, it shifts some emphasis from routine calculation toward formulation, interpretation, verification and modelling.

The PISA 2022 mathematics framework explicitly recognizes mathematical tools, including digital technologies, and highlights computational thinking in problem-solving [2]. A user may employ a spreadsheet to calculate a household budget, a graphing application to visualize data or an AI system to generate a numerical analysis. In each case, mathematical understanding remains necessary to choose appropriate variables, check assumptions, detect unreasonable results and communicate conclusions.

AI also increases the importance of quantitative verification. Automatically generated numerical statements may contain incorrect assumptions, inappropriate units or calculation errors. Mathematical literacy therefore becomes a form of quality control. Users who understand estimation, order of magnitude, percentages and basic statistical reasoning can more effectively evaluate machine-generated outputs.

12. Mathematics in Employment, Business and Entrepreneurship

Almost every occupation uses mathematics to some degree. Retail workers manage stock and prices; technicians measure dimensions; farmers estimate inputs and yields; teachers calculate marks and interpret assessment data; healthcare workers use measurements and rates; and managers analyze budgets and performance indicators. Business decisions frequently involve percentages, ratios, growth rates, break-even analysis and forecasting.

For a simple business, profit can be represented as revenue minus cost. If fixed cost is F, variable cost per unit is c, selling price per unit is p and the number of units sold is x, then profit is $\pi(x) = px - (F + cx)$. The break-even quantity, when $p > c$, is $x = F/(p-c)$. Although actual businesses require more complex models, this elementary expression illustrates how algebra can support practical decisions about pricing and production.

Entrepreneurship also depends on estimation. A prospective entrepreneur may estimate market size, operating costs, expected sales and cash flow. Errors in assumptions can affect decisions, which is why sensitivity analysis and scenario

calculations are useful. Mathematics provides a structured way to compare possible outcomes rather than relying entirely on intuition.

13. Mathematics in Agriculture and Rural Life

Agriculture provides numerous applications of mathematics. Farmers estimate field area, seed requirements, fertilizer quantities, irrigation volumes, crop yield and market prices. Ratios and unit conversions are especially important because recommendations may be stated per hectare, acre, kilogram or litre. Geometry is used in field measurement, while statistics can be used to compare yields and assess variation.

For example, if a fertilizer recommendation is r kilograms per hectare and a field has area A hectares, the approximate requirement is rA kilograms, subject to the recommendation and actual agricultural conditions. Similar proportional reasoning is used for seed quantity and irrigation. These examples show that practical mathematics is relevant not only in urban digital environments but also in agriculture and rural livelihoods.

14. Mathematics in Science, Engineering and Everyday Technology

Many technologies used by ordinary people are based on mathematical models. Electricity, telecommunications, cameras, GPS, computer graphics, medical imaging and weather prediction rely on combinations of algebra, geometry, calculus, probability, statistics and numerical methods. Users may not perform these calculations themselves, but they benefit from mathematical systems every day.

At the same time, mathematical modelling connects abstract concepts to observable phenomena. A model simplifies reality by identifying important variables and relationships. For example, population growth, traffic flow, epidemic spread, energy consumption and financial growth can all be represented by mathematical models. The usefulness of a model depends on its assumptions and the quality of the data used. Therefore, modelling requires both mathematical technique and critical interpretation.

15. Mathematics and Civic Life

Citizens encounter mathematics in taxation, public budgets, population statistics, economic indicators, election statistics, environmental reports and policy information. Understanding percentages, rates and graphs helps individuals interpret public information. For example, a percentage change must be interpreted relative to a baseline, while a per-capita measure differs from a total quantity. These distinctions can substantially affect interpretation.

Mathematical literacy therefore has a civic dimension. The OECD describes mathematical literacy as contributing to informed judgements and participation in society [1,2]. A citizen who can examine numerical evidence, identify uncertainty and compare quantities is better positioned to understand quantitative claims. This does not require advanced mathematics in every situation; often, careful elementary reasoning is sufficient.

16. Mathematics Education and the Need for Real-Life Contexts

The practical applications reviewed above have implications for mathematics teaching. If learners encounter mathematics primarily as symbolic manipulation disconnected from experience, they may fail to recognize its relevance. Real-life contexts can help students understand why percentages, ratios, equations, geometry and statistics matter. A 2024 study on everyday uses of mathematics recommends stronger integration of real-world applications and practical learning [3].

The PISA 2022 results provide an additional educational perspective. Across OECD countries, 69% of students reached at least Level 2 in mathematics, a level at which students begin to demonstrate the ability to use mathematics in simple real-life situations [1]. However, only about one in five students reported that they were frequently asked in class to interpret mathematical solutions in the context of a real-life challenge [8]. This suggests an opportunity to increase authentic problem contexts in mathematics education.

Classroom activities can include household budgeting, shopping comparisons, travel planning, measurement projects, data surveys, probability experiments, agricultural calculations and small-business models. Such activities can develop

not only procedural fluency but also interpretation, reasoning and communication. Technology can be incorporated through spreadsheets, graphing tools and programming, provided students remain responsible for explaining the mathematics behind the results.

17. Challenges in Applying Mathematics in Daily Life

Despite its ubiquity, practical mathematical reasoning can be difficult. Common challenges include misunderstanding percentages, ignoring units, confusing average with typical value, interpreting probability as certainty, overlooking sample size and accepting numerical claims without examining their source. Digital platforms may also present complex information in simplified interfaces, hiding assumptions from users.

Another challenge is mathematics anxiety or low confidence. When individuals believe that mathematics is only for specialists, they may avoid quantitative decisions or rely on others without checking the reasoning. Practical mathematics education should therefore emphasize understandable representations, estimation, multiple solution strategies and meaningful contexts. The goal is not to turn every citizen into an advanced mathematician but to develop sufficient quantitative confidence for responsible everyday decisions.

18. Emerging Directions

The future role of mathematics in daily life is likely to become more data-intensive. Connected devices, digital finance, automated decision systems, artificial intelligence and personalized services generate and process large amounts of quantitative information. This development creates a growing need for statistical literacy, data visualization skills, probabilistic reasoning and computational thinking.

At the same time, mathematics education is increasingly expected to prepare learners for situations in which digital tools are available. The PISA 2022 framework recognizes that mathematical tools and computational thinking are part of contemporary problem solving [2]. Future mathematical literacy should therefore combine foundational arithmetic and algebra with data reasoning, modelling, estimation and the ability to validate computational results.

19. Discussion

The review shows that mathematics operates at several levels in daily life. At the first level, basic arithmetic supports routine calculations. At the second level, geometry, algebra and measurement support practical tasks such as construction, travel and budgeting. At the third level, statistics and probability support reasoning under uncertainty. At the fourth level, mathematical modelling and computational methods support complex technological and societal systems.

These levels are interconnected. A household budget may require arithmetic and percentages; a loan decision adds compound interest; a comparison of financial products introduces uncertainty and risk; and a digital financial application may use algorithms and statistical models in the background. Thus, daily-life mathematics is not a separate collection of tricks but an integrated form of quantitative reasoning.

Recent literature also indicates that mathematical literacy should be connected to financial and digital literacy. Evidence from financial research suggests that mathematics and financial knowledge jointly relate to financial behaviour [5], while research on India highlights the importance of basic arithmetic and interest calculations in financial literacy [6]. This supports curriculum approaches in which mathematical concepts are taught through meaningful financial and social contexts.

20. Conclusion

Mathematics is an essential part of daily life, even when its presence is not explicitly recognized. Budgeting, shopping, cooking, measurement, travel, health information, agriculture, business, technology and civic participation all involve mathematical ideas. Arithmetic supports routine calculations; algebra represents relationships; geometry supports measurement and construction; statistics and probability help interpret uncertainty; and mathematical modelling connects real-world situations with structured reasoning.

The modern concept of mathematical literacy appropriately emphasizes the ability to formulate, employ, interpret and evaluate mathematics in real-world situations [1,2]. The increasing use of digital tools does not reduce the need for mathematical understanding. Instead, it increases the importance of choosing appropriate models, interpreting outputs, checking assumptions and recognizing uncertainty. Recent evidence concerning financial and digital literacy further demonstrates the practical value of quantitative knowledge [5–7].

For education, the central implication is clear: mathematics should be taught not only as a system of procedures but also as a language for understanding and managing everyday situations. Real-life tasks, data-based investigations, financial examples, measurement activities and technology-supported modelling can help learners connect mathematical concepts with their own experiences. Developing such mathematical literacy can contribute to more informed personal decisions, effective participation in society and readiness for a data-rich future.

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Appendix A. Examples of Mathematical Concepts Used in Daily Life

Daily-life situation	Mathematical concept	Typical calculation/model	Practical purpose
Household budget	Arithmetic, percentages	Balance = income − expenditure	Control spending
Loan/savings	Interest, algebra	A=P(1+r)^n	Compare financial outcomes
Shopping	Percentages, ratios	Sale price = P(1−d/100)	Compare offers
Cooking	Fractions, proportion	$q_2=q_1(m/n)$	Scale recipes
Room/flooring	Geometry	Area = length × width	Estimate materials
Travel	Rate, unit conversion	t=d/v	Plan journeys
Health data	Ratios, averages	Mean = Σx/n	Summarize measurements
News/data	Statistics	Percentage/rate, variation	Interpret evidence
Risk	Probability	P(A) between 0 and 1	Reason under uncertainty
Business	Algebra	Profit = revenue − cost	Plan operations

Note: The equations in this appendix are simplified educational models. Real-world applications may require additional assumptions, constraints, uncertainty analysis and domain-specific information.