International Journal of Financial Management and Economics

P-ISSN: 2617-9210
E-ISSN: 2617-9229
IJFME 2025; 8(1): 130-138
www.theeconomicsjournal.com
Received: 14-12-2024
Accepted: 19-01-2025

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Relationship between numeracy skills and financial literacy: A review

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DOI: https://www.doi.org/10.33545/26179210.2025.v8.i1.464

Abstract
The management of financial resources requires the capacity to interpret numerical information and the capacity to utilize financial knowledge. Numeracy is the ability to comprehend, use, and interpret numbers in a variety of circumstances and financial literacy is the capacity to apply knowledge and competence to make financial decisions. This study aims to examine the relationship between numeracy skills and financial literacy. A comprehensive review of literature has been conducted to provide insight into the theoretical framework that has been done so far on numeracy skills and financial literacy and also summarizes the findings based on various financial decisions concerning numeracy skills. The findings show that many empirical evidences indicate a high correlation between numeracy skills and financial literacy. Numerical abilities play an important role in enhancing financial literacy. More numerate people are more financially literate and make wise financial decisions. Numerous institutions, governments, policymakers, and schools should provide tools and initiatives to increase numeracy skills and raise financial literacy among people of all ages.

Keywords: Financial literacy, numeracy, numeracy skills, financial decisions, financial knowledge, cognitive ability

Introduction
People all across the world conduct financial transactions even on a routine basis. Those who possess money management skills tend to be more capable of making informed financial choices in their lives regarding spending, savings, investing, borrowings, etc. In addition, a nation's ability to thrive and grow largely rests on each person's capacity to acquire and manage financial resources. The development of the economy of any country depends on sound financial management. The efficient growth and utilization of financial resources are the main goals of financial management. Financial competence is a requirement for managing finances. To attain financial competence, efficient financial decision-making is required, and decision-making requires key processes: the capacity to interpret numerical information and utilize financial knowledge. Numeracy is the ability to comprehend, use, and interpret numbers in a variety of circumstances and financial literacy is the capacity to apply knowledge and competence to make financial decisions.

Numeracy is a cognitive ability to work with numbers. Numeracy can be defined as understanding and application of mathematical content to manage the mathematical demands of various situations in life (OECD, 2016) [54]. People often need knowledge of basic mathematical calculations like percentages and complex mathematical calculations like compounding of interest to make rational financial choices like retirement planning, getting loans, making investments, evaluating financial products, managing financial resources, and so on. On the other hand, financial literacy is the ability to make wise judgments about one's finances through information, skills, and comprehension of numerous financial concepts. It includes several aspects of personal finance-related topics, including debt management, retirement planning, investing, saving, and budgeting.

Numeracy skills and financial literacy are necessary for the sustainable development of the nation and financial inclusion. People need to have a foundational understanding of finance to function in society in present times (Kim, 2001) [36]. Numeracy can ease everyday decisions regarding financial problems such as mortgages, personal loans, travel costs, etc.

(Ghazal *et al.*, 2014) [27]. both numeracy skills and financial literacy are necessary in the decision-making process whether it comes to buying, selling, or managing financial resources. Thus, it is necessary to understand the relationship between numeracy and financial literacy so that the proper policies can be framed for the enhancement of numeracy skills to improve financial literacy.

Methodology

The study is descriptive, qualitative, and based on secondary data. To fulfill the objective, research papers published in various peer-reviewed journals of Google Scholar (https://googlescholar.com), Elsevier (https://sciencedirect.com), and J-gate (https://jgateplus.com) databases were reviewed. The keywords "Financial literacy," "Financial decisions," "Numeracy skills," and "Numeracy" were used for relevant literature. The search includes all the relevant literature up to 2023.

Literature Review

A review of the literature provides insight into the theoretical framework and an attempt has been made to present a review of literature available on the subject to provide a glimpse of the studies done so far on the topic of numeracy skills and financial literacy. A comprehensive literature review has been performed to investigate the relationship between numeracy skills and financial literacy. The later section also summarizes the findings based on various financial decisions concerning numeracy skills.

Relationship between Numeracy Skills and Financial Literacy

Earlier studies demonstrated the relationship between numeracy skills and financial literacy. A lot of research suggests that having a solid mathematical background is essential for making well-informed financial decisions (Gerardi *et al.*, 2013; Lusardi, 2012) [26, 39]. Hastings *et al.* (2013) [30] stated that financial literacy refers to "knowledge of financial products, knowledge of financial concepts, having the methodical skills of numeracy necessary for effective financial decision making, and being engaged in certain activates such as financial planning." Numeracy skills are needed for the most fundamental day-to-day financial calculations. This takes the form of fundamental computations related to the price of purchasing items, paying bills, calculating interest and discounts, etc. Addition, multiplication, subtraction, and division are fundamental operations, and at a higher level, numeracy includes the understanding of financial statements or other accounting information, the time value of money, risk analysis, etc.

Financial literacy will certainly be affected by the lack of math abilities. While financial literacy entails the knowledge of financial concepts and goods, numeracy is a more fundamental skill that applies to many areas beyond finance, particularly risk-taking decisions. Thus, according to Almenberg and Widmark (2011) [3], financial literacy is knowledge-based, while numeracy is skill-based and closely associated with cognitive abilities, specifically the capacity to interpret numerical data and carry out basic calculations. This perspective treats numeracy as a separate concept as proposed by Hung *et al.* (2011) [32]. Wood *et al.* (2020) [71] also stated that numeracy is considered a basic number skill and is a distinct construct that is related to and supports financial literacy. Hence, the financial decision-making process involves a large number of simple and complex calculations, and a lack of numeracy skills leads to poor financial decision-making (Gerardi *et al.*, 2010) [25].

In this perspective, the following Table 1 shows the findings of knowledgeable existing studies on the relationship between numeracy and financial literacy along with the nature of respondents, measures that are used for numeracy and financial literacy and statistical analysis followed in these empirical studies.

Most of these studies are conducted with adults and elderly people in England (Banks & Oldfield, 2007) [5], Sweden (Almenberg & Widmark 2011; Skagerlund *et al.*, 2018) [3, 62], India (Cole *et al.*, 2011; Balakrishna & Virmani, 2019) [10, 4], Indonesia (Cole *et al.*, 2011; Sagita *et al.*, 2022) [10, 59], Thailand (Grohmann *et al.*, 2015) [28], America (McArdle *et al.*, 2009; Agarwal & Mazumdar 2013; de Bassa Scheresberg 2013; Gerardi *et al.*, 2013; Stevens 2017; Peters *et al.*, 2019) [51, 1, 12, 26, 66, 56] and Canada (Storozuk & Maloney, 2023) [67]. However, some of them are conducted by taking students and youth population into consideration in America (Lusardi *et al.*, 2010) [50], Germany (Erner *et al.*, 2016) [14], India (Jayaraman *et al.*, 2018) [35]; Colombia (Muñoz-Murillo *et al.*, 2020) [52], France (Darriet *et al.*, 2020) [11], and Philippines (Indefenso & Yazon, 2020) [33].

Cole *et al.* (2011) [10] do not distinguish numeracy and cognitive abilities while some studies used numeracy as a subpart of cognitive ability (such as Lusardi *et al.*, 2010; McArdle *et al.*, 2009; Agarwal & Mazumdar, 2013) [50, 51, 1].

For numeracy, each study uses a different kind of measure, however, the English Longitudinal Study of Ageing (ELSA) questionnaire and Berlin Numeracy Test are repeatedly used in few studies. The 2002 ELSA questionnaire includes six questions and successively more complex numerical calculations. The Berlin Numeracy Test (BNT) is a new statistical numeracy and risk literacy test developed by Cokely *et al.* 2012 [9]. This test includes four questions and is formulated for an educated and high-ability population.

The big three financial literacy questions are commonly adopted to determine financial literacy in most studies. Lusardi and Mitchell (2006) [40] and Lusardi and Mitchell (2008) first created these questions for the 2004 Health and Retirement Survey (HRS) which was further used in various surveys both domestically and internationally. These three questions are referred to compound interest rate, inflation, and risk diversification. Further, the correlation and regression analysis are used as statistical analysis to determine the relationship between numeracy and financial literacy.

Moreover, a study conducted on 1200 households in Ahmedabad, Gujarat, India suggests that financial education is ineffective when making financial investment decisions that call for numerical calculations (Carpena *et al.*, 2011) [6]. Cole *et al.* (2016) [72] proposed that training in mathematics enhances investment income, credit management, and involvement in the financial markets while personal finance courses do not influence financial behavior. Skagerlund *et al.* (2018) [62] challenged the idea that financial education initiatives have no impact on the financial behavior of consumers. Despite educational measures, people remain financially illiterate. This outcome may be accounted for by the impact of a third variable that has been undervalued, numeracy may be involved, which is also mentioned by

Fernandes *et al.* (2014) [18].

OECD (2019) [55] also reports that only 2.4% of students on average across 79 countries and economies achieved level 6 of performance, the highest level of performance described by PISA in mathematics. These students possess sophisticated mathematical thinking and reasoning skills. The level 2 or above students are capable of understanding and recognizing the mathematical representation of a fundamental problem, such as the comparison of the total distance traveled by two distinct routes and the conversion of prices into a foreign currency. However, more than 50% of students received scores below this level of proficiency in 24 different countries and economies which indicates the need to increase the level of mathematics (or numeracy) skills.

Hence, the findings of these empirical studies reveal a significant link between numeracy and financial literacy. More numerate people are more financially literate and make wise financial decisions. Numeracy is the key component of financial literacy. Thus, numerical abilities play an important role in enhancing financial literacy.

Table 1: Research studies related to the relationship between numeracy and financial literacy

Sr. No.	Researcher/s (Year)	Country	Respondents	Numeracy Measure	Financial Literacy Measure	Statistical Analysis	Findings
1	Banks and Oldfield (2007) [5]	England	2002 wave of the English Longitudinal Study of Ageing (ELSA), a survey of 11,392 English individuals aged 50 and over on 29 February 2002.	Six numeracy questions in the 2002 ELSA questionnaire	Self-declarative questions related to knowledge about pensions	Probit regression analysis	The findings suggest that people with greater numeracy levels are more financially literate when it comes to their personal retirement planning. Compared to their more numerate counterparts, the less numerate groups are less likely to know the important aspects of their pension plan.
2	McArdle, Smith and Willis (2009) [51]	America	Health and Retirement Survey (a nationwide survey of Americans who are more than 50 years old) and Cognitive Economics survey (Cog Econ) N=942 (59% are females, and the average age is 68 years old)	Three simple mathematical questions	24 questions related to financial knowledge in the form of true/false and confidence	Regression prediction models	All parts of cognitive abilities related to numerical abilities, such as computation, number series, and numeracy, are highly predictive of better financial literacy. These findings also suggest that numerical abilities facilitate wealth accumulation.
3	Lusardi, Mitchell and Curto (2010) [50]	America	Wave 11 of the 1997 National Longitudinal Survey of Youth (a nationwide sample of young individuals in the United States) fielded in 2007-2008 when respondents were 23-28 years old (N = 7,138 respondents)	Armed Services Vocational Aptitude Battery (ASVAB) score is used in place of cognitive ability which is based on four subtests: mathematical knowledge, arithmetic reasoning, word knowledge, and paragraph comprehension.	Lusardi and Mitchell (2006) [40] and Lusardi and Mitchell (2008) [42]	Multivariate Analysis	Results show that there is a strong correlation between cognitive ability and financial literacy. Higher cognitive levels are associated with significantly more correct response rates of financial literacy.
4	Almenberg and Widmark (2011) [3]	Sweden	N = 1302 Swedish adults (men and women, 49.2 and 50.8 percent respectively), with a mean age of 43.9 years	2002 ELSA questionnaire (Banks & Oldfield, 2007) [5]	6 basic Financial literacy questions formulated by Annamaria Lusardi and Olivia Mitchell for the Health Retirement Survey and the American Life Panel (Lusardi & Mitchell, 2006; Lusardi & Mitchell, 2007) [40, 41]	CFA Model and Probit Regression	According to the CFA model, the two latent variables—financial literacy and numeracy—are distinct aspects of ability. The correlation between two latent variables suggests a strong positive relation between numeracy and financial literacy. This strengthens the argument for the significant relationship between financial literacy and numeracy. Moreover, findings reveal that while financial literacy and numeracy are both favourably associated with stock market involvement, only numeracy is positively associated with the housing market.

5	Cole, Sampson and Zia (2011) [10]	India and Indonesia	Rural Indian respondents with the mean age of 41 years (N = 1496, out of which 54% are females); Indonesian adults with a mean age of 42 years (N = 3360, out of which 51% are females)	Eight mathematics questions	Four questions, out of which three questions were similar to those of Lusardi and Mitchell (2006) [40]	OLS regression Model	The authors do not distinguish between numeracy skills and cognitive ability, and results indicate that respondents with higher cognitive ability perform significantly better on every financial literacy question in both countries.
6	de Bassa Scheresberg (2013) [12]	America	Data from the 2009 National Financial Capability Study, N = 4,468 young adults aged 25-34 (50% of participants are males)	Self-confidence measure	3 basic financial literacy questions (Lusardi & Mitchell, 2011a) [44]	Multivariate analysis	According to this study, respondents who are confident in their mathematical ability or who score highly on financial literacy make better financial decisions. They are more inclined to have a retirement plan or precautionary savings. Financial literate people are also less inclined to be in high-cost debt situations.
7	Agarwal and Mazumder (2013) [1]	America	Data from Health and Retirement Survey (HRS) consist of more than 22,000 Americans who are over 50 years	3 mathematical questions for numeracy under cognitive measures	Financial outcomes include total wealth, total financial wealth and the percentage of stock ownership (McArdle *et al.*, 2009) [51]	Linear probability regressions	The numeracy aspect of the cognitive measures is significantly linked with the financial outcomes and managing money.
8	Gerardi, Goette and Meier (2013) [26]	America	339 borrowers (50% males and the average age is 47 years) that took out subprime mortgages in 2006 and 2007	Five questions from the ELSA questionnaire (Banks & Oldfield, 2007) [5]	Two basic questions related to interest rate and inflation (Lusardi & Mitchell, 2009) [43, 47]	Ordinary Least Squares (OLS) regression model	The results demonstrate that a strong association exists between numerical ability and mortgage default but financial literacy is not associated with mortgage delinquency. Moreover, the findings indicate that numerical ability and financial literacy are positively correlated.
9	Grohmann, Kouwenberg and Menkhoff (2015) [28]	Thailand	Middle-class people with a mean age of 35 years (N = 530, 48% women)	Cole *et al.* (2011) [10]	Three questions as per Lusardi and Mitchell (2014) [46] and one question related to institutional knowledge	OLS regression model	The results indicate that higher numeracy is significantly related to better financial literacy. Moreover, their study shows that financial literacy has a direct relation to the number of assets (portfolio diversification), but numeracy is insignificant.
10	Erner, Goedde-Menke and Oberste (2016) [14]	Germany	1416 Tenth-grade students, out of which 48.9 percent are male students	Grades in mathematics	Lusardi and Mitchell (2009) [43, 47]	Mixed linear model	Basic financial literacy is positively related to mathematical skills but not sophisticated financial literacy. Basic financial literacy requires numeracy, but sophisticated financial literacy requires declarative knowledge within a more contextual framework.
11	Stevens (2017) [66]	America	N = 84 American adults aged from 18 to 64 with a mean age of 43.9 years (43 are females)	Berlin Numeracy Test (BNT) by Cokely *et al.* (2012) [9] for numeracy and the Cognitive Reflection Test (CRT) by Frederick (2005) [20] for cognitive skills	Twenty questions by Knoll and Houts (2012) [38] and three financial questions used by FINRA	Multiple linear regression	The results show that BNT scores (numeracy) have a statistically significant relationship with financial literacy scores when examined separately in separate univariate regression models. However, in a model that combines both variables CRT and BNT, then only the CRT Score is statistically significant with financial literacy
12	Jayaraman, Jambunathan	India	586 High school students (457	Lusardi and Mitchell	Compound interest/inflation section	Linear mixed	Both models give consistent results and findings show a

	and Counselman (2018) [35]		females and 129 males) of grades 10th, 11th, and 12th, aged from 14 to 18 years old	(2007) [47] and Lusardi and Mitchell (2017) [49]	uses Lusardi and Mitchell (2017) [49], investing section uses Lusardi and Mitchell (2017) [49], borrowing section uses the Financial Industry Regulatory Authority 2009 National Financial capability study and Jump$tart survey and insurance section use Chen and Volpe (1998) [7] and Jump$tart survey	model and ordered logistic regression model	significant relationship between low numeracy and poor financial literacy, and between high numeracy and better financial literacy among participants.
13	Skagerlund, Lind, Strömbäck, Tinghög and Västfjäll (2018) [62]	Sweden	2063 Swedish adults (51% women and 49% men) with a mean age of 49 years	Schwartz *et al.* (1997) [60] and Berlin Numeracy Test (BNT), developed by Cokely *et al*. (2012) [9]	Lusardi and Mitchell (2014) [46] and Van Rooij *et al.* (2012) [70]	OLS regression model	They discovered that the best indicator of financial literacy is numeracy.
14	Balakrishna and Virmani (2019) [4]	India	Forest Dependent Communities (FDCs) (called Vana Samrakshana Samithis [VSS] in regional Telugu language), N = 149 VSS members with 52% females and a mean age of 52 years old	Questions on addition, subtraction, multiplication, proportions, and probability are appropriate for samples with low educational attainment as demonstrated by Gaurav and Singh (2012) [24]	Van Rooij *et al.* (2011) [69]	Ordinal logistic model	Findings show that higher numeracy among VSS members is linked to higher financial literacy.
15	Muñoz-Murillo, Alvarez-Franco and Restrepo-Tobón (2020) [52]	Colombia	195 college students (55% males) from Universidad EAFIT, a Colombian private university	Berlin Numeracy Test (BNT) by Cokely *et al.* (2012) [9] for numeracy and Cognitive Reflection Test (CRT) by Frederick (2005) [20] for cognitive skills	Six questions related to interest compounding, inflation, and debt literacy. Interest questions are as per the 2015 edition of the OECD and INFE's Toolkit for measuring Financial Literacy, one debt literacy question as per Lusardi and Tufano (2015) [48]	OLS regression analysis	The results indicate that there is a connection between numeracy and financial literacy. However, when cognitive abilities are taken into account, numeracy becomes insignificant with financial literacy. Further, findings demonstrate that people with greater cognitive abilities have a greater understanding of finance.
16	OECD (2019) [54]	79 countries	Approximately 7,10,000 students (15 years old) completed the PISA 2018 assessment	Change and relationships, Space and shape, Quantity, Uncertainty, and data are 4 broad areas of mathematics	Four content areas for financial literacy are money and transactions, planning and managing finances, risk and reward, and financial landscape	-	OECD explained that a basic understanding of mathematics, including the four operations of addition, subtraction, multiplication, and division using whole numbers, decimals, and common percentages, is required for the financial literacy assessment. However, mathematical abilities are not necessary when using formulas to solve financial problems in financial literacy assessment.
17	Peters, Tompkin, Knoll, Ardoind, Reinhard and Meara (2019) [56]	America	4,572 respondents from the Understanding America Study (UAS), (42.9% male and 57.1% female, mean age = 48.5 years)	Waller *et al.* (2013) [73] measures objective numeracy and Fagerlin *et al.* (2007) [17] measures numeric confidence	To access financial outcomes, questions are related to - Credit Card, Payday Loans, Money Management and Affording Bills, Investments and Retirement, and Avoided Major Financial Stressors. Knol and Houts (2012) [38] and Houts and Knoll (2019) [31] measure financial knowledge.	Multiple linear regression analysis	Their study demonstrates that the best financial outcomes were seen with high levels of objective numeracy and high levels of numeric confidence. It was not the best combination to have a low ability with high confidence (numerically overconfident) or high ability with low confidence (numerically underconfident). Furthermore, both objective numeracy and numeric confidence have a positive

							simple correlation with financial knowledge.
18	Indefenso and Yazon (2020) [33]	Philippines	N = 563 students in grades 9th and 10th from Masaya Integrated National High School (MINHS) and Laguna Science Integrated High School (LSIHS)	The 40-item test was adapted from the Numeracy Inventory Tool for Laguna Learners (NIT2L) and the five-item test by Siniguian (2017) [66]	Financial literacy is measured through financial knowledge, financial behavior, and financial attitude. Five questions about financial knowledge were taken from the Standards and Poors' Global Financial Literacy Survey, and seven more questions were taken from the De Bock *et al.* (2019) [13] study; a five-item test for financial behavior and financial attitude.	Correlational Research Design	A strong positive correlation exists between numeracy and financial literacy among students. Moreover, financial literacy is also positively associated with problem-solving skills.
19	Darriet, Guille, Vergnaud and Shimizu (2020) [11]	France	96 participants (44 females and 52 males) aged 24.6 years on average	Specific measure (ratios)	3 basic financial literacy questions (Lusardi & Mitchell, 2014) [46]	Ordinary least squares (OLS) regression Model	The Pearson correlation reveals a positive correlation between numeracy and financial literacy. However, the findings of their overall study indicate that financially literate people are less prone to money illusions, but there is no indication that it impacts numeracy.
20	Sagita, Putri, Zulkardi and Prahmana (2022) [59]	Indonesia	A systematic review based on 274 papers on the Scopus database between 1994 and 2022, along with a survey conducted on 15 junior high school mathematics instructors at several Yogyakarta junior high schools.	In a survey, responses were collected from mathematics teachers	The financial literacy knowledge survey for teachers includes two components (teacher experience and accessibility of financial resources) based on the 2018 financial literacy survey (OECD, 2019) [55]	Bibliometric analysis for systematic review and Percentages for survey	The findings provide strong evidence of the correlation between mathematical knowledge and financial literacy.
21	Storozuk and Maloney (2023) [67]	Canada	Canadian residents (n = 241, out of which 141 are females) between 18 and 69 years old	10-item Brief Mathematics Assessment 3 (BMA-3) by Steiner and Ashcraft (2012) [65]	20-item full-form Financial Knowledge Scale (FKS) by Knoll and Houts (2012) [38]	Multiple Regression Analysis	Numeracy is significantly related to both mathematical and conceptual financial knowledge. However, their findings indicate that raising numeracy may only help some subconstructs when it comes to financial literacy. For example, there is no evidence that numeracy and financial behavior or financial confidence are related.

Numeracy and Various Financial Decisions

Numeracy has an impact on various financial decisions. In today's labor market, numeracy skills are also becoming significant (Gal *et al.*, 2020). People who are less numerate are less likely to plan for retirement (Alessie *et al.*, 2011) [2] and do not accumulate wealth (Lusardi & Mitchell, 2011a) [44]. People with advanced numeracy skills own stocks and mutual funds (Christelis *et al.*, 2010) [8], more likely to participate in the stock market and homeownership (Almenberg & Widmark, 2011) [3], and pension funds (Fornero & Monticone, 2011; Klapper & Panos, 2011; Song, 2020) [19, 37, 63]. Numeracy skills are also linked with mortgage delinquency (Gerardi *et al.*, 2010) [25]. Those who are less numerate cannot make rational decisions and mostly indulge in the high cost of borrowing (Stango & Zinman, 2009) [64]. Lusardi & Tufano (2009) [64, 47] discover that people who are more debt literate or understand the fundamentals of debt are more likely to repay their credit cards entirely, whereas people with lower numeracy skills are more likely to incur costs or turn to expensive borrowing options such as payday lenders, pawn shops, rent-to-own stores, etc.

Table 2 summarizes the findings of existing research studies on the relationship of numeracy with various financial decisions. The majority of existing research studies reveal that there is a significant relationship between numeracy skills with various financial decisions. In contrast, few studies show that numerical abilities have an insignificant relationship with the knowledge of pension plans (Gustman *et al.*, 2012) [29], portfolio diversification (Grohmann *et al.*, 2015) [28], and high-cost methods of borrowings (de Bassa Scheresberg, 2013) [12].

Table 2: Research studies related to the relationship of numeracy with various financial decisions

Financial decisions	Relation to numeracy skills	Researchers
Retirement planning	▪ Respondents with an ability to perform complicated calculations like interest compounding are more likely to plan for retirement. ▪ Numerate people follow more formal techniques like financial advisors, retirement seminars, and calculators. ▪ People with higher confidence in their math are more likely to have retirement plans or emergency savings	Banks and Oldfield (2007) [5] Lusardi and Mitchell (2007) [41] Lusardi and Mitchell (2011b) [45] Alessie *et al.* (2011) [2] de Bassa Scheresberg (2013) [12] Antony *et al.* (2020) [74]
Mortgage default	▪ Numerical aptitude is highly correlated with mortgage delinquency. ▪ Those who demonstrate poorer numeracy are more likely to be in arrears on their mortgage payments or to have gone through foreclosure. ▪ High numerate people are more discomfort with mortgage debt.	Gerardi *et al.* (2010) [25], Gerardi *et al.* (2013) [26], Thorp *et al.* (2023) [68]
Own stocks and mutual funds	▪ Numeracy is positively correlated to stock ownership. ▪ Inclination to invest in stocks, whether directly through the stock market or indirectly through mutual funds is highly correlated with numeracy.	Almenberg and Widmark (2011) [3] Christelis *et al.* (2010) [8] Van Rooij *et al.* (2011) [69] Agarwal and Mazumder (2013) [1]
Contribution to pension funds	▪ Numeracy is correlated with knowledge and understanding of pension plans. ▪ Understanding of compound interest leads to an increase in pension contributions. ▪ The likelihood of participation in private pension plans is higher for people who can perform interest rate computations.	Banks and Oldfield (2007) [5] Fornero and Monticone (2011) [19] Klapper and Panos (2011) [37] Song (2020) [63]
	▪ Numeracy is not the strong determinant of pension knowledge	Gustman *et al.* (2012) [29]
Wealth accumulation	▪ People with high numeracy accumulate more wealth. ▪ People with good numeracy tend to retain a steady level of wealth, while participants with low numeracy tend to decumulate wealth. ▪ Higher numeracy individuals get more personal wealth in real life compared to lower numeracy individuals.	Lusardi and Mitchell (2011a) [44] Agarwal and Mazumder (2013) [1] Estrada-Mejia *et al.* (2016) [15] Estrada-Mejia *et al.* (2020) [16]
Cost of borrowing	▪ Numerate people understand the fundamentals of debt. ▪ Less numerate people indulge in high-cost methods of borrowing.	Lusardi and Tufano (2009) [47] Stango and Zinman (2009) [64] Gathergood, and Disney (2011) [22]
	▪ There is no statistically significant relation between self-assessed math knowledge and high-cost borrowing behavior.	de Bassa Scheresberg (2013) [12]
Investment portfolios	▪ Numeracy skills are strongly correlated with investment portfolios. ▪ There is a strong correlation between numeracy skills and losses from under-diversification.	Banks and Oldfield (2007) [5] Christelis *et al.* (2010) [8] Gaudecker (2015) [23]
	▪ Numeracy is insignificant with portfolio diversification.	Grohmann *et al.* (2015) [28]

***Source*:** Compiled by authors

Conclusion

The significant increase in product complexity and several alternatives to satisfy a particular financial need (Jariwala & Sharma, 2011) [34] has necessitated the need for higher financial literacy to make better financial decisions. In turn, better financial literacy and decisions result in improved financial well-being. The need for financial literacy is becoming more widely acknowledged. Recent developments in financial products, the complexity of the financial markets, and changes in social, economic, political, and demographic issues have all increased the need to improve financial literacy. Personal financial literacy is defined as "the ability to use knowledge and skills to manage financial resources effectively for a lifetime of financial well-being" by the President's Advisory Committee on Financial Literacy (2008) [58] and one of the most important abilities needed to properly manage financial resources is the capacity to perform both simple and complex mathematical computations, such as calculating compound interest and percentages.

The literature review states that people often have to make decisions by using numeracy skills to avoid financially adverse consequences. Highly numerate people are proficient in processing accurate meanings from numerical information which assists them in choosing better alternatives as compared to the less numerate individuals (Peters *et al.*, 2006) [57]. The financial decisions require numerous basic and complex calculations. Since numeracy is necessary for comprehending concepts like interest rates and loans as well as for budgeting, saving, and investing, it is strongly related to financial literacy.

The implication of the study is that there is a strong positive relation between numeracy skills and financial literacy and empirical evidence indicates that numeracy plays a significant role in determining financial literacy and financial decisions. People with high numeracy skills can choose better financial outcomes as compared to low numerate people. Numerous institutions, governments, policymakers, and schools should provide tools and initiatives to increase the level of numeracy skills and raise financial literacy among people of all ages.

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