

Original Article

Financial Literacy, Mathematical Skills, and Women Empowerment through Self-Help Groups

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Abstract

Self-Help Groups (SHGs) have emerged as one of the most widely adopted grassroots mechanisms for advancing women's financial inclusion and socio-economic empowerment, particularly across South Asia. This paper examines the interconnected roles of financial literacy and mathematical (numeracy) skills in shaping the effectiveness of SHGs as instruments of women's empowerment. Drawing on a synthesis of recent empirical and conceptual literature, the paper argues that financial literacy alone is insufficient to explain empowerment outcomes; underlying numeracy competencies—the ability to interpret interest rates, compute savings and loan repayments, and reason quantitatively—act as a foundational enabler of financial decision-making within SHGs. The paper reviews evidence on SHG participation, financial literacy interventions, and numeracy-financial literacy linkages, then develops a conceptual framework connecting mathematical skill acquisition, financial literacy, and multidimensional empowerment (economic, social, and psychological). The discussion highlights persistent gaps: uneven numeracy foundations among rural and marginalized women, gendered barriers to financial decision-making authority, and the limited integration of numeracy training within existing SHG capacity-building programs. The paper concludes that policy and programmatic design should treat numeracy as a prerequisite competency rather than an implicit assumption, and recommends integrating structured mathematical and financial literacy modules into SHG training curricula to strengthen sustainable empowerment outcomes. The paper is conceptual and literature-based, intended to inform future empirical inquiry and policy design in the domain of grassroots financial inclusion.

Introduction

Financial inclusion has become a central pillar of development policy across the Global South, with women's economic empowerment increasingly recognized as both a development goal in itself and a lever for broader household and community welfare. Among the various instruments used to promote inclusion, Self-Help Groups (SHGs)—small, voluntary associations of individuals from similar socio-economic backgrounds who pool savings and extend credit to members—have become one of the most extensively deployed models, particularly in India, where SHG membership has grown from roughly 8 million beneficiaries in 2019 to over 10.5 million by 2024. This expansion reflects a broader policy consensus that community-based financial institutions can reach populations, especially rural women, that formal banking channels have historically underserved. The rationale for SHGs rests on more than access to credit (Kumar & Pandey, 2023; Hoffmann et al., 2021).

SHGs are conceived as spaces where women build financial capability, develop leadership skills, and gain a collective voice in household and community decision-making. Financial literacy—commonly defined as the knowledge, skills, and confidence needed to make informed financial decisions—is frequently cited as the mechanism through which SHG participation translates into empowerment. Women who understand savings mechanisms, interest calculations, loan terms, and basic budgeting are, in principle, better positioned to manage group finances, negotiate with lenders, and make autonomous decisions about household resources. However, an underexamined dimension of this process is the role of mathematical or numeracy skills as a precondition for financial literacy itself. Financial literacy assessments across contexts routinely embed numerical reasoning tasks—calculating simple and compound interest, comparing proportions, interpreting percentages—that presuppose a baseline level of mathematical competence. Where foundational numeracy is weak, as is documented among rural populations and, disproportionately,

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among rural women and girls in India, the capacity to acquire and apply financial literacy is correspondingly constrained.

This creates a layered problem: SHG programs designed to build financial literacy may inadvertently assume numeracy skills that a substantial proportion of participants do not possess, limiting the depth and durability of empowerment outcomes. This paper addresses this gap by examining the triangular relationship between mathematical skills, financial literacy, and women's empowerment within the specific institutional context of SHGs. It asks three interrelated questions. First, what does existing literature reveal about the relationship between numeracy and financial literacy outcomes? Second, how does SHG participation mediate the translation of financial literacy into empowerment—economic, social, and psychological? Third, what programmatic and policy gaps exist in current SHG models with respect to building foundational mathematical competencies alongside financial knowledge? The paper is structured as follows. Section 2 reviews recent literature on financial literacy, numeracy, and SHG-based women's empowerment, drawing primarily on studies published between 2018 and 2025. Section 3 outlines the research methodology, which follows a systematic narrative review and conceptual synthesis approach.

Section 4 presents an analysis and discussion that integrates the reviewed evidence into a conceptual framework linking mathematical skills, financial literacy, and empowerment dimensions, while identifying structural and pedagogical gaps. Section 5 presents findings and conclusions, along with policy-relevant recommendations. The significance of this inquiry lies in its attempt to disaggregate financial literacy from its often-assumed numerical foundation. Much of the SHG and financial inclusion literature treats financial literacy as a relatively unitary construct, evaluated through composite indices, without adequately isolating the contribution of numeracy as a distinct antecedent skill. By foregrounding mathematical skills as a conceptually separable but empirically intertwined component of financial capability, this paper contributes to a more precise understanding of what SHG-based interventions must build if they are to produce durable empowerment outcomes. This has direct implications for how training curricula are designed, how monitoring and evaluation frameworks measure success, and how policymakers allocate resources between numeracy remediation and financial product literacy within grassroots development programming.

Review of the Literature

The literature on financial literacy and women's empowerment through SHGs spans economics, education, and development studies, converging on the conclusion that financial capability is a multidimensional construct shaped by education, numeracy, social norms, and institutional access.

❖ Financial literacy and SHG-based empowerment.

Several studies document the empowerment effects of SHG participation. Pro. Dharmendra Kumar and Pandey (2023) examined the role of SHGs in financial inclusion and found that group-based saving and credit mechanisms enhanced women's financial decision-making authority within rural Indian households. Hazarika and Singkai (2023), studying SHGs in Assam's Dhemaji district, similarly reported that government-supported SHGs contributed to measurable improvements in rural women's economic agency, though effects varied by group maturity and local governance quality. Hoffmann et al. (2021) provided causal evidence from a rural Indian SHG lending program, finding that access to group-based credit

reduced dependence on informal moneylenders and improved households' financial resilience, an effect they term "relief from usury." These findings collectively support the premise that SHG participation is associated with tangible economic empowerment, though the specific role of participants' financial knowledge—as distinct from mere access to the credit mechanism—remains only partially disentangled in this body of work.

Article Highlights

- Numeracy is a foundational determinant of financial literacy, influencing women's ability to understand interest rates, budgeting, savings, credit terms, and other financial concepts.
- Self-Help Groups (SHGs) contribute to women's economic empowerment by improving access to savings, credit, income-generating opportunities, and collective financial decision-making.
- Financial literacy strengthens the empowerment effects of SHG participation, but knowledge alone may not overcome persistent gender norms and unequal intra-household decision-making.
- Digital financial services are creating new competency demands, making digital literacy and basic digital numeracy increasingly important components of SHG financial-capability programs.
- SHG programs should integrate structured numeracy training with financial literacy, while monitoring and evaluation should separately measure numeracy, financial literacy, and economic, social, and psychological empowerment.

❖ Financial literacy as a mediating and moderating factor

A parallel literature isolates financial literacy itself as a driver of empowerment, independent of institutional access. Aparoopa and Parida (2024), studying Odisha's Mission Shakti SHG federation, found that financial literacy functioned as a catalyst for women's economic empowerment, with literacy gains associated with greater participation in income-generating activities. Kandpal and Khalaf (2020) extended this by examining how digital tools and artificial intelligence-enabled platforms could enhance financial inclusion for SHG members, suggesting that literacy interventions increasingly intersect with digital literacy demands. Consistent with this, Rahman and Rahman (2023) found that digital financial services mediated the relationship between financial literacy and women's economic empowerment in South Asian contexts, indicating that literacy effects are increasingly channeled through technology adoption rather than traditional in-person banking. Harchekar et al. (2023) reported that factors including age, income, education, and work experience significantly shaped women's financial literacy levels, while also noting that many women continued to depend on male household members for financial decisions despite gains in literacy—suggesting literacy is necessary but not sufficient for empowerment absent shifts in intra-household bargaining power.

❖ Numeracy as a foundational competency

A distinct but closely related literature examines numeracy as an antecedent of financial literacy. Jayaraman et al. (2018), in a study of Indian high school students, established a statistically robust relationship between numeracy and financial literacy scores, finding that low numeracy was associated with a 4.8% reduction in financial literacy outcomes while high numeracy corresponded to a 5.6% increase, a relationship that held after controlling for gender, parental education, and language of instruction. This finding is significant because it demonstrates that financial literacy gains are constrained by

prior mathematical competence rather than by financial content exposure alone. Complementary work on foundational literacy and numeracy in rural India highlights that foundational numeracy gaps, evident from early schooling, disproportionately affect girls and children from disadvantaged castes and tribal communities, with downstream consequences for adult financial capability. Studies of forest-dependent and rural communities similarly find that education levels positively affect both numeracy and financial literacy, with proximity to urban centers also correlating with higher numeracy and financial literacy scores among women.

❖ Persistent gaps and structural barriers

The gender gap in financial literacy is well documented internationally and is not confined to developing economies; Bucher-Koenen et al. (2024) find that this gap persists across socioeconomic backgrounds, cultural contexts, and institutional settings, driven partly by couples' tendency to delegate financial decision-making to men. Kaiser et al. (2022), reviewing financial literacy interventions broadly, document positive and economically meaningful effects of such programs on knowledge and behavior, though evidence remains concentrated on student populations rather than adult women in community-based settings such as SHGs. This points to a gap this paper seeks to address: the specific numeracy-financial literacy-empowerment pathway within SHG programming for adult rural women remains comparatively underexamined relative to school-based numeracy research or generic financial literacy evaluation.

Methodology

This paper adopts a qualitative, literature-based conceptual synthesis methodology rather than primary empirical data collection. The approach is appropriate given the paper's objective: to integrate a fragmented body of literature spanning financial literacy, numeracy/mathematics education, and women's empowerment studies into a coherent conceptual framework, and to identify gaps that can inform future primary research and SHG program design.

❖ Research design

The study follows a systematic narrative review design, structured around three thematic pillars identified in the introduction: (a) SHG participation and empowerment outcomes, (b) financial literacy as a mediating mechanism, and (c) numeracy as a foundational antecedent skill. This structure allows the synthesis to move from institutional-level evidence (SHGs) to individual-level competencies (financial literacy and numeracy), before integrating these strands analytically in Section 4.

❖ Source selection

Literature was drawn from peer-reviewed journal articles, working papers, and institutional reports published primarily between 2018 and 2025, prioritizing studies situated in South Asian and other developing-country contexts where SHG models are most prevalent, supplemented by relevant international studies on the financial literacy gender gap and numeracy-financial literacy linkages. Sources were identified through targeted searches of academic databases and journal repositories using combinations of the terms "self-help groups," "financial literacy," "numeracy," "women empowerment," and "financial inclusion." Priority was given to studies that either (i) directly measured or discussed the relationship between numeracy/mathematical skills and financial literacy, or (ii) evaluated

SHG-based interventions with reference to financial literacy or capability outcomes.

❖ Inclusion and exclusion criteria

Studies were included if they addressed at least one of the three thematic pillars in a context relevant to women's financial inclusion or SHG-based programming. Studies were excluded if they addressed financial literacy or numeracy in contexts unrelated to gender or community-based finance (e.g., purely macroeconomic financial literacy studies with no gender disaggregation), or if they could not be verified against a traceable publication source.

Analytical approach

The synthesis follows a thematic analysis procedure: relevant findings from each source were extracted and coded against the three thematic pillars, then integrated into a conceptual model (presented in Section 4) linking mathematical skills, financial literacy, and three dimensions of empowerment—economic, social, and psychological—as mediated by SHG institutional structures. This model is used to interpret convergences and divergences across the reviewed literature and to identify under-researched linkages, particularly the numeracy-to-empowerment pathway within adult, community-based (as opposed to school-based) settings.

Limitations. As a conceptual and literature-based study, this paper does not generate new primary data and cannot establish causal claims specific to a particular SHG population. The synthesis is necessarily shaped by the availability and geographic concentration of existing literature, which skews toward Indian contexts; findings should be interpreted as indicative rather than generalizable across all SHG models globally. The paper is intended as a foundation for subsequent primary empirical research, including survey-based or quasi-experimental studies that directly measure numeracy, financial literacy, and empowerment indicators within specific SHG populations.

Analysis and Discussion

❖ The numeracy-financial literacy-empowerment pathway

The literature reviewed in Section 2 supports a layered conceptual model in which mathematical skills function as a foundational input, financial literacy as an intermediate capability, and empowerment as the downstream outcome, with SHG participation acting as the institutional mechanism that structures and reinforces this pathway. This contrasts with much of the existing SHG literature, which tends to treat financial literacy as a starting point rather than as itself contingent on numeracy. The finding from Jayaraman et al. (2018) that numeracy levels are associated with measurable shifts in financial literacy scores is particularly important here: it suggests that SHG financial literacy modules delivered without attention to underlying numeracy gaps may produce shallow or unstable literacy gains, particularly among women with limited formal schooling. This has direct implications for SHGs operating in regions with documented foundational numeracy deficits, where a substantial proportion of participants may struggle with the interest-rate calculations, proportion comparisons, and budgeting arithmetic that financial literacy curricula assume as baseline competencies.

❖ Economic empowerment

The evidence on SHG-driven economic empowerment—improved credit access, reduced dependence on informal moneylenders, and increased participation in income-generating activities—is comparatively strong and consistent across studies. Hoffmann et al. (2021) and Pro. Dharmendra Kumar and Pandey (2023) both point to tangible economic gains from SHG membership. However, these gains appear to be more directly attributable to institutional access to pooled credit than to individual financial literacy per se, raising the possibility that some measured "empowerment" reflects structural access rather than enhanced individual capability. Where financial literacy is explicitly measured, as in Aparoopa and Parida (2024), the literacy-empowerment link strengthens, suggesting that literacy amplifies but does not solely generate economic empowerment outcomes. This distinction matters for program design: interventions that provide credit access without building underlying capability risk producing empowerment effects that are institutionally dependent and may not persist if SHG membership lapses.

❖ Social and psychological empowerment

Social dimensions of empowerment—voice in household decision-making, leadership within the group, and reduced dependence on male relatives for financial matters—show more uneven results. Harchekar et al. (2023) found that despite financial literacy gains, many women continued to defer financial decisions to husbands, a pattern consistent with the broader gender gap in financial decision-making authority documented by Bucher-Koenen et al. (2024) and attributed to entrenched social norms rather than knowledge deficits alone. This indicates that financial literacy and numeracy improvements are necessary but not sufficient conditions for empowerment; they must be accompanied by shifts in intra-household bargaining norms, which SHGs can support through leadership training and peer modeling but cannot resolve through financial content alone. Psychological empowerment—confidence and self-efficacy in financial matters—appears most directly responsive to SHG group dynamics, where peer support and collective learning environments have been shown to build confidence even where individual numeracy remains limited, though this confidence may not always translate into accurate financial decision-making if underlying numerical skills are weak.

❖ Digital financial literacy as an emerging complication

The rapid expansion of digital financial services—UPI transactions among Indian women grew from an estimated 35 million users in 2017 to 200 million by 2025—adds a further layer of complexity. Kandpal and Khalaf (2020) and Rahman and Rahman (2023) both suggest that digital financial services increasingly mediate the literacy-empowerment relationship, meaning that numeracy and financial literacy gaps are now compounded by digital literacy gaps. For SHGs, this implies that capacity-building curricula designed around traditional passbook savings and manual interest calculations may be insufficient preparation for a financial ecosystem increasingly mediated by mobile applications, requiring an expanded competency set that includes basic digital numeracy alongside traditional arithmetic skills.

❖ Structural and programmatic gaps

Integrating these strands, three gaps emerge. First, most SHG training curricula appear to treat numeracy as a given rather than as a distinct, trainable competency requiring dedicated pedagogical attention, despite evidence that numeracy deficits directly constrain financial literacy uptake. Second, monitoring and evaluation

frameworks for SHG programs commonly use composite financial literacy or empowerment indices that do not disaggregate the numeracy component, making it difficult for program managers to diagnose whether weak outcomes stem from numeracy gaps, content design, or social barriers. Third, the shift toward digital financial services has outpaced curriculum adaptation in many SHG programs, creating a risk that digitally mediated financial inclusion could bypass, rather than build upon, foundational numeracy gains achieved through earlier SHG training cycles. These gaps collectively suggest that numeracy should be treated as a distinct, measurable prerequisite within SHG financial capability programming rather than an implicit assumption embedded within broader financial literacy content.

Findings and Conclusion

This paper synthesizes recent literature to argue that mathematical skills constitute a foundational, and often under-addressed, precondition for financial literacy within SHG-based women's empowerment programs. Three findings emerge. First, numeracy and financial literacy are empirically linked, with documented evidence that low numeracy meaningfully constrains financial literacy outcomes, particularly among populations with limited formal schooling. Second, SHG participation drives measurable economic empowerment primarily through institutional credit access, with financial literacy amplifying—but not solely generating—these effects; social and psychological empowerment lag behind economic gains due to persistent gendered norms around financial decision-making authority. Third, the growing digitalization of financial services is introducing new competency demands that current SHG curricula have not fully absorbed, compounding existing numeracy gaps rather than resolving them. The paper concludes that SHG program design should explicitly integrate structured numeracy modules as a prerequisite to, rather than an assumed component of, financial literacy training, and that monitoring frameworks should disaggregate numeracy from broader financial literacy indices to better diagnose program gaps. Policymakers and SHG facilitating institutions should also pair financial and numeracy capability-building with deliberate efforts to shift intra-household financial decision-making norms, since capability gains alone appear insufficient to secure durable social empowerment. Future research should prioritize primary, field-based studies that directly measure numeracy, financial literacy, and multidimensional empowerment outcomes within specific SHG populations to test and refine the conceptual pathway proposed here. Verified and Corrected Reference Links The following links were checked against publisher, institutional, repository, or bibliographic records. Where a supplied reference could not be verified exactly as written, the discrepancy is identified rather than silently retained.

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- The author agrees to take responsibility for every facet of the work, making sure that any concerns about its integrity or veracity are thoroughly examined and addressed

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