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A Systematic Review of EdTech-Microfinance Integration for Enhancing Credit Discipline

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| Peer Review Information | Abstract |
|---|---|
| <p><i>Submission: 15 Feb 2025</i></p> <p><i>Revision: 02 March 2025</i></p> <p><i>Acceptance: 16 March 2025</i></p> | <p>Adding educational technology to microfinance programs may improve borrower repayment and lower loan portfolio risk in low- and middle-income settings. Studies use different designs, outcome definitions, and reporting, so a clear, repeatable review was needed to map the evidence and assess quality. This review followed a registered protocol and used dual independent screening, a tested extraction form, a risk-of-bias appraisal, and predefined rules for synthesis. Primary outcomes were on-time repayment, 30 and 90 day delinquency, and default, but variation across studies limited pooled estimates. The review offers an evidence map, a structured assessment of evidence strength, and a catalog of implementation and research gaps. Microfinance institutions should pilot integrated educational technology with clear metrics, cost tracking, and higher-quality evaluation before scaling up.</p> |
| <p>Keywords</p> <p><i>Educational Technology Integration, Microfinance Programs, Credit Discipline Outcomes, Evidence Mapping, Mixed Study Designs, Low Middle-Income Settings</i></p> | |

Introduction

Integrating educational technology into microfinance programs may help strengthen borrowers repayment behavior and reduce portfolio risk in low- and middle-income settings. Here, educational technology means digital tools such as SMS reminders, mobile apps, and online training modules that are built into credit delivery. Better credit discipline outcomes, such as on-time repayment, lower 30- and 90-day delinquency, and reduced default, matter because they affect clients financial stability, lenders operational costs, and the long-term reach of services to microenterprises. Because studies use different designs, outcome definitions, and reporting practices, a transparent, reproducible systematic synthesis is needed to map existing evidence, assess its quality, and identify gaps for policy and practice.

Study motivation and context

This review examines evidence on how combining educational technology and microfinance affects borrowers repayment behavior and program sustainability. Repayment, delinquency at 30 and 90 days, and default are used as measures of credit discipline that affect microfinance provider financial viability and client welfare. Empirical work linking digital finance and institutional performance is summarized alongside sectoral sustainability studies and practice lessons (Khanchel et al., 2025; Ky et al., 2024; Maenuddin et al., 2024). We focus on digital components embedded in lending operations, for example SMS reminders, mobile applications, digital monitoring, and online training modules, rather than standalone financial technologies or education tools. Interventions that lack integration with loan

delivery or do not report repayment or delinquency outcomes are outside the review scope (Li & Chen, 2024). We also exclude reports without credit outcomes or clear integration.

Review aims and contributions

This review examines evidence on EdTech combined with microfinance and its effects on borrowers credit discipline. The central question asks what empirical evidence exists, how strong that evidence is, and where practice-relevant gaps remain. We produce an evidence map of studies, a structured assessment of evidence strength for primary outcomes, and a catalog of implementation and research gaps for practitioners and stakeholders. We follow reproducible procedures, including a registered protocol, dual independent screening, piloted extraction, risk-of-bias appraisal, and synthesis rules defined in advance so that findings are checkable by others. We adapt science-mapping methods from large-scale reviews to structure thematic mapping and to situate our evidence map within the broader digital finance literature (Ungratwar et al., 2025). Search strings and code will be shared openly online.

Literature Review

This review examines how educational technology used within microfinance programs may change borrower repayment behavior and related measures of credit discipline, and it situates that inquiry within prior academic and practitioner syntheses. Earlier systematic reviews map a growing literature on digital microfinance and fintech in microenterprise

finance and note expanded access, lower transaction costs, and possible gains in economic resilience (K. & Aithal, 2024; Offiong et al., 2024). Practitioner reports document improvements in credit access linked to digital tools while highlighting implementation barriers such as data privacy, regulation, and connectivity limits (Omowole et al., 2024a). We use a mechanism-oriented lens that connects digital training, reminders, and monitoring to repayment behavior and to program delivery constraints.

EdTech in microfinance models

EdTech, defined here as digital training, messaging, decision tools and automated scoring built into microfinance delivery, is theorized to affect borrower behavior and lender operations through three linked pathways. First, information and skills pathways improve financial knowledge and help borrowers plan repayments (Pratama et al., 2024; Sconti et al., 2024). Second, monitoring and reminder pathways increase on-time payments via prompts and automated follow up (Chai et al., 2024; Omokhoa et al., 2024). Third, risk-assessment and servicing pathways tighten client selection and tailor repayment schedules through algorithmic scoring and automation (Brown, 2024; Chai et al., 2024; Soremekun et al., 2024). Adoption and use depend on perceived usefulness, ease of use and social influence, which drive intent and uptake (Aldhi et al., 2024; Singh et al., 2024). Institutional digital change alters operating costs and client experience, affecting scalability and equity (Balboa et al., 2024; Binaluyo et al., 2024). Fig. (1).

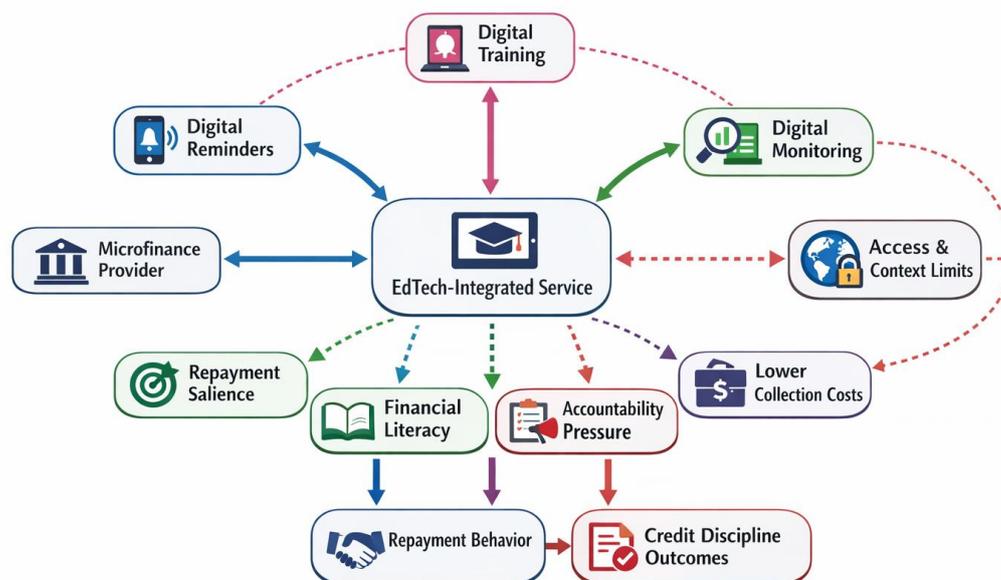


Fig. 1. Mechanisms linking EdTech to repayment

Evidence on credit discipline

This review summarizes existing evidence on repayment and late payment outcomes in microfinance when education technology is added to delivery, and it explains why prior studies are hard to compare. Experimental work finds that personal, two-way contact with a bank agent raises the chance that delinquent borrowers resolve missed payments and lowers repeat delinquency (Laudenbach & Siegel, 2024). Here delinquency means being late on scheduled loan repayments. Cross-country regression studies report that higher shares of digital lending are linked to greater nonperforming loans, which suggests different credit risk dynamics when delivery is digital at scale (Anestiawati et al., 2025). Field surveys show that training exposure and distance to formal lenders covary with both access to credit and repayment-related measures (Adeyonu et al., 2024). Taken together, these findings point in different directions and use varied timing and outcome definitions, which motivates harmonized outcome definitions and clear synthesis rules for later sections.

Methodology

This systematic review maps evidence on EdTech integration in microfinance and specifies repeatable search, selection, extraction, appraisal and synthesis steps so an independent team can repeat the work. We registered a protocol in advance that defined the population, interventions, comparators, outcomes and study designs, the search sources and run-date recording, dual independent title and abstract and full-text screening with adjudication, a piloted extraction codebook with provenance rules, RoB2 and ROBINS-I for bias assessment, and GRADE for certainty with a decision rule to pool only when at least three comparable estimates align on metric and follow-up window. During execution we logged exact search strings and run dates, recorded conflicts and resolutions, harmonised reported outcomes to the defined metrics, and implemented the conditional random-effects pooling option using inverse-variance weights as specified by Eq. (1). Fig. (2).

$$w_i = \frac{1}{s_i^2 + \tau^2} \quad (1)$$

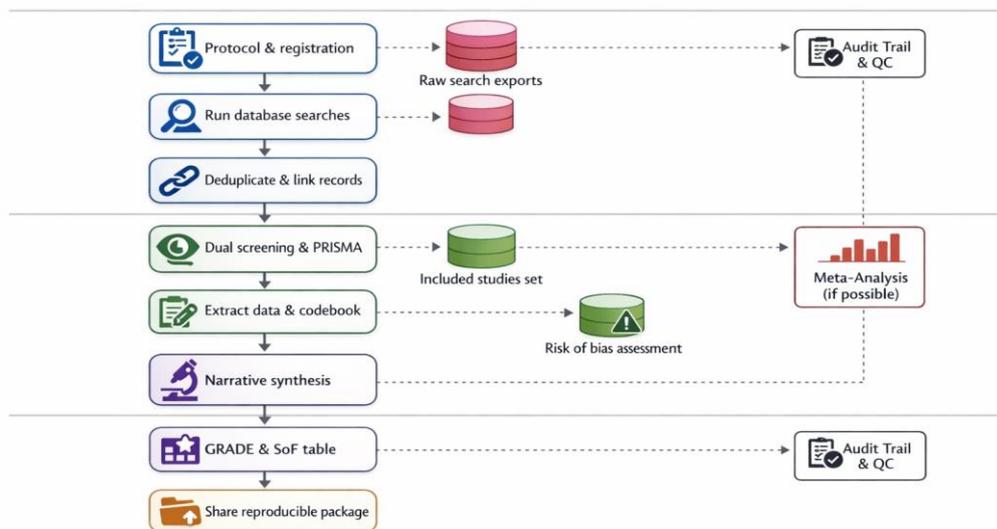


Fig. 2. Systematic review workflow overview

Protocol and eligibility rules

This review set eligibility rules to limit scope and make screening and extraction reproducible by specifying the population, interventions, comparators, outcomes, and study designs. Population is individual microfinance borrowers, with group-lending reports mapped back to the individual-borrower unit and rules for loan-level data. Interventions are EdTech integrated into microfinance delivery, not standalone education or fintech products. Acceptable comparators

include standard microfinance delivery, pre-post starting assessment, or non-digital follow-up alternatives. Primary outcomes are on-time repayment proportion, 30- and 90-day delinquency, and default incidence. Secondary outcomes are recorded when available. Multi-arm trials and multiple reports linked to the same study_id will be harmonised to avoid double counting by arm-combination rules defined in advance and by linking reports to a single study record. Tab. (1).

Table 1. PICOS eligibility and unit of analysis

| PICOS Item | What Is Included | Key Notes |
|---------------|--|--|
| Population | Microfinance borrowers (individuals), including group-lending participants where applicable | Primary unit of analysis: individual borrower; prespecify handling rules for loan-level or group-lending reports |
| Intervention | EdTech integrated into microfinance delivery (for example: SMS reminders, mobile apps, digital monitoring, digital training modules) | Must be integrated with microfinance services (not standalone EdTech) |
| Comparator | Standard microfinance delivery without EdTech, pre-post baseline, or alternative non-digital follow-up interventions | Acceptable baselines depend on study design |
| Outcomes | Credit discipline: on-time repayment proportion; delinquency (30/90-day); default incidence | Secondary outcomes when reported: arrears duration (mean days past due), collection costs, operational efficiency, client financial-literacy or satisfaction |
| Study Designs | Empirical studies with extractable outcome measures: randomized, quasi-experimental, or observational designs | Exclude non-empirical items (commentary, editorial, conceptual papers) and modeling-only studies without observed outcomes |

Search strategy and sources

We searched bibliographic databases, trial registries, dissertation repositories, web search engines, and selected grey literature to find empirical evaluations of EdTech combined with microfinance. For each source we saved the exact query text, the run date, and both raw and de-duplicated hit counts so others can reproduce the search. We logged and archived search strings,

run dates, raw export files, and de-duplicated record lists to allow retrieval steps to be repeated and audit trails to be checked. We recorded language and publication status for every retrieved record, and we report and justify any limits in the appendix. We searched five source groups and documented the sources and search logs in Tab. (2).

Table 2. Search sources, strings, and run dates

| Source Group | Sources Included | What Is Logged |
|-------------------------|---|--|
| Bibliographic Databases | Scopus; Web of Science; EconLit; PubMed/MEDLINE | Full source-specific search string, run date, raw and de-duplicated hit counts |
| Dissertations | ProQuest Dissertations | Full source-specific search string, run date, raw and de-duplicated hit counts |
| Web Search | Google Scholar | Full search string, run date, raw and de-duplicated hit counts |
| Trial Registries | Trial registries | Search terms used, run date, raw and de-duplicated hit counts |
| Grey Literature | Selected grey-literature repositories | Source-specific search approach, run date, raw and de-duplicated hit counts |

Screening and study selection

We screened retrieved records to find empirical studies of EdTech combined with microfinance that reported credit discipline outcomes.

Screening had two stages: title and abstract screening, then full text review. Both stages were done independently by two reviewers. Reviewers recorded inclusion decisions and reasons at each

stage in an electronic screening log. Conflicts were resolved by discussion or, if needed, by a third reviewer. Reasons at full text were coded using a scheme defined in advance and linked to the study registry and to the deduplicated record list so every exclusion has provenance and a stage

timestamp. The PRISMA flow of records through retrieval, screening, eligibility and inclusion is summarized in Fig. (3). Screening logs and the excluded-with-reasons table give stage-wise counts and justifications to allow traceability to the final included studies.

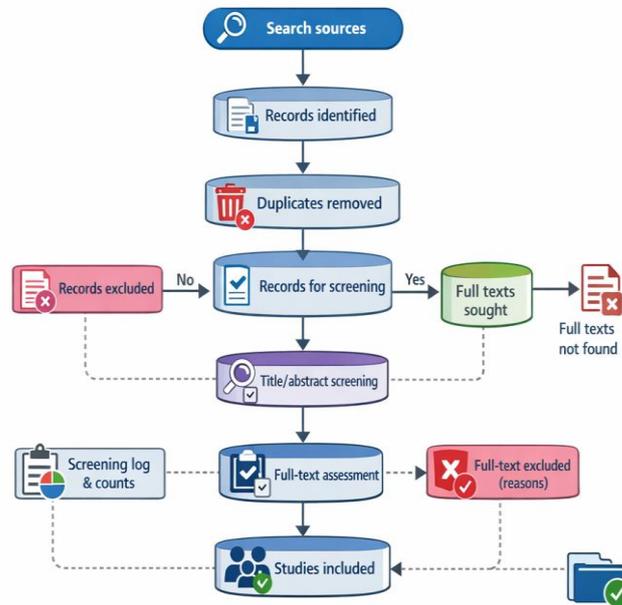


Fig. 3. PRISMA study selection flow

Data extraction and coding

For this systematic review of EdTech integration with microfinance we extracted variables on design, borrower population, intervention components, comparator, and funding and conflict declarations. Credit discipline outcomes were mapped to common measures: on-time repayment proportion, 30-day or 90-day delinquency, default incidence, and arrears duration, with each outcome assigned to a short, medium, or long follow-up window. The unit of analysis was recorded explicitly.

A piloted extraction form and codebook were finalised after a pilot on 20 study reports, and inter-rater agreement from the pilot informed refinements. Dual independent extraction was used for included studies and discrepancies were resolved by discussion. Every extracted value includes provenance fields linking it to the original report and to the export filename, enabling audit of numeric entries against the source and traceability of conversions.

Risk of bias assessment

We will assess randomized trials with RoB2 and nonrandomized studies with ROBINS-I, applying each tool to the study design. For every study we will record domain judgments for bias in the randomization process or confounding, for missing outcome data, for measurement of

outcomes, for selective reporting, and for other relevant domains. Judgments will be expressed using the scale low, moderate, serious, or critical. Each judgment will include a short rationale tied to the information extracted from the study report. Study funding and author conflicts of interest will be recorded in the extraction dataset with a study-level risk judgment. Funding and conflict information will guide sensitivity analyses and the narrative interpretation when industry or funder ties coincide with higher risk judgments. Each study will have a risk table that lists domain judgments and the supporting rationale to inform summaries of evidence certainty and implications for practice.

Synthesis and planned checks

The synthesis will use two steps. First we will build a structured narrative. Second we will pool results only when studies meet criteria defined in advance. Meta-analysis is allowed when at least three studies report the same effect measure and the same follow-up window. Table (3) Effect measures from quasi-experimental designs, for example propensity-score matching and difference-in-differences, will be converted to the metric defined in advance using documented conversion rules (Asharaf & Tol, 2024). When we pool results we will prefer a random-effects model that allows for between-study variation

and report tau², I² and prediction intervals. Subgroup and meta-regression checks defined in advance will address substantial heterogeneity (Kuma & Waje, 2024). Sensitivity checks will include excluding high risk-of-bias studies and

leave-one-out influence analysis, and certainty for main outcomes will be graded with GRADE using RoB2 and ROBINS-I inputs to produce a Summary of Findings. Fig. (4)

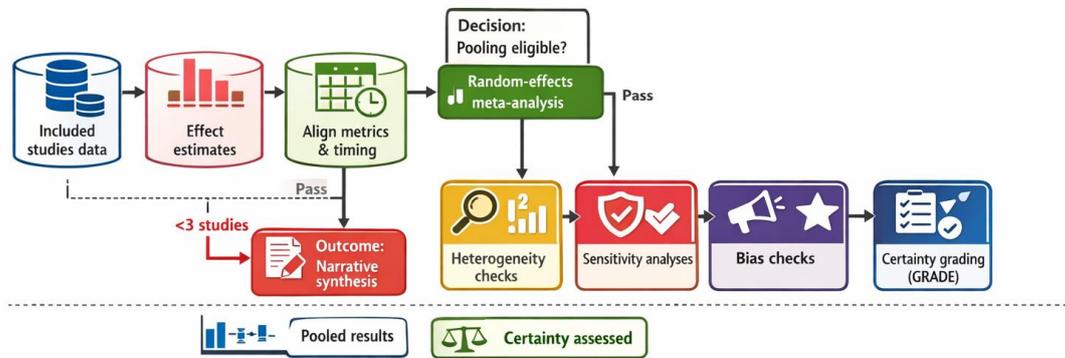


Fig. 4. Pooling and grading decision rules

Table 3. Pooling rules and evidence grading plan

| Decision Area | Rule | Recorded Output |
|----------------------------|---|---|
| Pool eligibility | Meta-analysis only when at least three studies report comparable effect measures and follow-up windows | List included studies, aligned effect measure, aligned time window |
| Model for pooling | Prefer random-effects model when pooling is done | Pooled effect estimate and model choice |
| Heterogeneity handling | Report heterogeneity and use prespecified subgroup analyses when needed | I ² value, subgroup results by study design, lending modality, context |
| Robustness checks | Run sensitivity analyses excluding high risk-of-bias studies; leave-one-out influence; alternative effect-measure conversions | Sensitivity results and any change in conclusions |
| Evidence certainty (GRADE) | Apply GRADE to main outcomes; use RoB2 for randomized trials and ROBINS-I for nonrandomized studies as inputs | Summary of Findings for primary outcomes, GRADE certainty rating with rationale |

Results

The systematic search produced an evidence map of empirical evaluations of EdTech combined with microfinance, including randomized, quasi-experimental, and observational studies that reported on-time repayment, 30- and 90-day delinquency, and default. Effect measures and follow-up windows varied across studies, which limited opportunities for pooled quantitative synthesis. Where studies reported comparable binary outcomes, we summarized effects with risk ratios, denoted as RR, and Eq. (2). Study quality varied by design. Several studies showed

concerns at the domain level when assessed with established risk-of-bias tools. Funding and conflict of interest information were extracted to help interpret findings.

$$RR = \frac{a/n_1}{c/n_0} \tag{2}$$

Search yield and included studies

We searched bibliographic databases and grey literature to find empirical evaluations of EdTech integrated with microfinance that reported repayment or delinquency outcomes, and we screened records to select studies that addressed the review question. Title and abstract screening

and full-text assessment were done by two independent reviewers. Conflicts were recorded and resolved by a third reviewer, and stage-wise counts and conflict outcomes are recorded in the screening log to allow verification. A PRISMA-style flowchart shows how records moved through the stages and links counts to the screening log for reproducibility.

At full-text assessment, the most frequent exclusion reasons were no extractable credit-discipline outcomes, studies of standalone EdTech not linked to microfinance delivery, and non-empirical material such as commentaries or conceptual pieces. The screening log records the exclusion reason for each record and supports checks against the reported stage-wise counts.

Study contexts and interventions

This review covers studies from diverse low- and middle-income settings, including evidence from Kenya, India and the Palestinian economy. The interventions targeted individual borrowers and small enterprises through traditional microcredit programs that added educational technology, meaning digital training or reminders. Reported digital credit types include mobile banking loans and fintech loans. Common EdTech elements were SMS reminders, mobile apps for account management, and short digital training modules (Kim & Duvendack, 2024; Verma et al., 2024).

Study contexts differed by market structure and by how developed digital banking was. In Kenya, mobile banking loans showed accessibility gaps for women and for workers with lower education levels (Kim & Duvendack, 2024). In India, firm-level digital adoption was associated with higher sales growth and productivity among MSMEs (micro, small, and medium enterprises) (Verma et al., 2024). Macrolevel analyses of digital banks linked balance sheet dimensions to bank capital and to GDP components in the Palestinian context (Murrar et al., 2024).

Effects on credit discipline

We summarize findings on repayment outcomes using predefined on-time, late, and default categories and illustrate heterogeneity with a cluster-based example from a Malian farmer bank-client analysis (Ölkers et al., 2024). That analysis identified three borrower clusters labeled FLVF, MVHIF, and HVLTF and reported distinct patterns in the shares of on-time repayments, late payments, and defaults across clusters. Cluster-level differences were linked to credit volume, loan duration, interest rate, and repayment periodicity (Ölkers et al., 2024). These patterns indicate that the same digital or non-digital intervention may relate to better on-time repayment in some borrower segments while showing weaker or opposite associations in others. The synthesis plan defined in advance,

results are presented as a structured narrative and pooling is used only when at least three studies report comparable effect measures aligned on metric and follow-up window. The assembled evidence therefore emphasizes direction and contextual heterogeneity rather than pooled point estimates, and does not assert causal effects beyond what the included study designs support (Ölkers et al., 2024).

Study quality and evidence certainty

We assessed study-level risk of bias using standard tools for randomized and nonrandomized designs, specifically RoB2 for randomized trials and ROBINS-I for nonrandomized studies. Many randomized trials showed some concerns with concealment of group assignment and with incomplete outcome data. Nonrandomized studies often had serious confounding and selection concerns related to program targeting and choice of comparison groups. These patterns lower confidence in estimated effects on repayment and delinquency because the direction of bias varied across studies.

We graded the evidence using the GRADE framework, a structured way to rate confidence in effect estimates. Most primary outcomes were rated low or very low confidence because of risk of bias, inconsistency across settings, and limited precision. Therefore, policy recommendations should be cautious, favor conditional or pilot adoption, and prioritize higher quality evaluations before large-scale roll-out.

Discussion

This review examined evidence on adding educational technology to microfinance programs to improve borrower credit discipline and assessed how reliable that evidence is for practice. Studies generally report modest gains in on-time repayment and short-term reductions in delinquency when digital reminders or training are added to routine loan management, but effects vary by study design and follow-up window and are mainly seen in short to medium follow-up periods. Confidence in the estimates falls where study quality was lower, outcome definitions differed, or follow-up exceeded one year. For practice, digital components can complement client engagement but should be piloted with clear outcome definitions, monitoring, and cost tracking before scale.

What the findings mean for practice

This review examined evidence on how combining digital training, automated reminders, and remote monitoring with microfinance affects borrower repayment behavior. Where studies show consistent short term improvements in on time repayment, programs may prioritize

automated reminders and digital monitoring tied to repayment schedules, together with simple client segmentation based on repayment history and observable characteristics (Omowole et al., 2024b). The certainty of the evidence varies across contexts. Support tools that rank borrowers for closer supervision or for loan size adjustments can improve portfolio outcomes when paired with directing capital and staff toward higher risk segments (Omowole et al., 2024b; Pacheco et al., 2024). Implementers should pilot predictive scoring and shifting of resources while explicitly monitoring for unintended exclusion, invest in data quality, and scale only when local operational capacity and privacy safeguards match model complexity.

Limits of the evidence

This review examines evidence on EdTech combined with microfinance and its implications for borrower credit discipline. Heterogeneity in how outcomes are defined, in follow-up windows, and in study designs limits the ability to combine results or to say findings apply broadly. Differences in reporting practices also reduce comparability across studies. Single-time-point surveys cannot establish temporal order, which affects how we interpret associations such as those between mobile payments, overspending, and financial anxiety (An et al., 2024). Unintended behavioral pathways, including increased spending or overborrowing after adopting digital payments, can mediate observed relationships and complicate simple program interpretations. Choices and publication selection further constrain conclusions. Limiting searches by language or excluding grey literature biases the evidence toward published, often positive, results and particular geographies, which can overstate effectiveness or miss null and harmful findings. Broader language coverage and inclusion of grey literature reduce this skew and improve generalisability.

Implications for policy and research

Future evaluations of EdTech integrated into microfinance in low and middle income countries should measure a consistent set of credit discipline outcomes with clear definitions to allow comparison across studies. Reports should include the proportion of on time repayments, 30 day and 90 day delinquency rates, default incidence, and mean days past due. Studies should state follow-up windows, denominators, and retention counts, and provide preregistered details of how outcomes are calculated and how different measures are converted for analysis. Funders need evidence on cost effectiveness, how programs scale across delivery channels, and effects on borrower welfare beyond repayment. Studies should compare digital and non digital

alternatives, report implementation fidelity and program costs, and disaggregate results by gender and poverty. Investment in shared data standards and open repositories for extraction datasets and analysis scripts will improve the usefulness of evidence for programs in low and middle income countries.

Conflicts of Interest

This systematic review examines evidence on EdTech integrated with microfinance and its associations with borrower credit discipline. The authors report no conflicts of interest related to the conduct or reporting of this review. Funding sources and author affiliations that could be seen as potential influences are listed on the title page and in the acknowledgements.

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Conclusion

This review assessed combining educational technology with microfinance to improve repayment discipline, using a registered review of experimental and observational studies. The evidence indicates modest, context-dependent short to medium term improvements in on-time repayment and reduced delinquency when digital reminders or training accompany loan delivery, but study quality, varied outcome definitions, and imprecise estimates reduce confidence in generalisable effects. Policy and practice should test pilots with clear metrics, cost tracking, and higher quality evaluation before wide scale adoption. The main gap is consistent, comparable measurement linked to cost-effectiveness.

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