Association Between Mobile Library Service Quality and Early Reading Literacy in Early Childhood: A Cross-Sectional Study

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Abstract
Early reading literacy develops through repeated access to print, responsive adult interaction, and meaningful opportunities to engage with books. In resource-constrained communities, mobile libraries may extend these opportunities beyond the classroom and home. This cross-sectional study examined the association between the quality of mobile library services and early reading literacy among children aged 5–6 years in an anonymized local study area. The sample comprised 150 children from five early childhood education institutions and 150 parents or caregivers; all participating children had prior exposure to the mobile library program. Consequently, the study estimates associations within an exposed sample and does not compare children with and without access to mobile library services. Data were collected from September to December 2025 using a structured parent/caregiver questionnaire and an early reading literacy assessment. Mobile library services were represented by visit frequency, access to age-appropriate books, participation in shared reading, and parental involvement, whereas early reading literacy covered letter recognition, phonological awareness, basic vocabulary, and simple comprehension. Simple linear regression showed a positive association between the overall mobile library service score and early reading literacy ($B = 0.55$, $\beta = 0.41$, $t = 5.90$, $p < 0.001$, $R^2 = 0.17$). The four service dimensions also showed positive unadjusted standardized associations ($\beta = 0.22$–0.31; all $p < 0.05$), but these indicator-level estimates were not adjusted for parental education or the number of children's books at home and should not be interpreted as independent causal effects. The findings therefore support an association between service quality and literacy within the five participating institutions, while causal effects and comparisons with unexposed children require longitudinal or quasi-experimental evaluation.

1. Introduction

Early reading literacy develops from cumulative oral-language, print, phonological, vocabulary, and meaning-making experiences during the preschool years. Longitudinal and intervention evidence indicates that the quality of these experiences is related to later reading development, although effects vary across children and contexts (Bleses et al., 2021; Caffarra et al., 2025; Salminen, Khanolainen, Koponen, Torppa, & Lerkkanen, 2021). For children aged 5–6 years, opportunities to recognize letters, attend to speech sounds, acquire vocabulary, and discuss story meaning are therefore central components of school readiness.

Access to such opportunities is uneven across families. Home literacy environments differ in book availability, shared-reading frequency and quality, parents' educational resources, and adults' intentional literacy interactions. These differences are associated with emergent literacy and later reading outcomes, while socioeconomic resources shape the opportunities through which literacy practices occur (Bigozzi, Vettori, & Incognito, 2023; Cheung, Dulay, Yang, Mohseni, & McBride, 2021; Shen & Del Tufo, 2022). Joint book reading and library visits during the preschool years are also linked with later reading behavior and comprehension (Pfost & Heyne, 2023).

Public, community, and mobile libraries can reduce material and geographic barriers to books, but their educational value depends on more than physical access. Storytime and community-literacy research emphasizes the importance of talk, questioning, modeling, caregiver engagement, implementation quality, and sustained access to developmentally appropriate materials (Cahill & Ingram, 2022; Fleisch & Schöer, 2023; Perkins & Sawyer, 2025; Sung, Abdullah, & Huyen, 2023). This evidence supports viewing mobile libraries as relational literacy services that combine resource provision with guided interaction.

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Within the Indonesian literature, early literacy studies have emphasized age-appropriate materials, teacher strategies, family involvement, and library management (Djafri & Bouty, 2022; Febiyanti, Kurniati, & Nzunda, 2021; Hidayatullah, Syihabuddin, & Damayanti, 2021; Setyaningsih, Muthmainnah, & Indrawati, 2022). Recent qualitative evidence on a mobile library further suggests that repeated visits may stimulate children's reading interest, participation, and communication (Sumardiana & Ningrum, 2025). However, prior mobile-library work in this context has largely emphasized reading interest, engagement, or descriptive service experiences rather than directly assessed early reading literacy. A quantitative gap therefore remains regarding whether variation in mobile-library service quality is associated with children's foundational reading-related competence.

The study setting was selected because the mobile library program served five early childhood education institutions whose families differed in educational background and access to children's books at home. This variation provided a relevant context for examining service quality within an already-exposed population, rather than comparing exposed and unexposed children. Accordingly, the present study examined (1) the association between the overall quality of mobile library services and early reading literacy among children aged 5–6 years and (2) the unadjusted indicator-level associations of visit frequency, access to age-appropriate books, shared reading participation, and parental involvement with early reading literacy. The study was designed to distinguish service availability from interaction quality while explicitly treating the observed relationships as cross-sectional associations rather than causal effects.

2. Method

2.1. Design and Setting

This study used a cross-sectional explanatory quantitative design to examine statistical associations between mobile library service quality and early reading literacy. Data were collected from September to December 2025 in five ECE institutions within the operational coverage of the mobile library program in an anonymized local study area. To protect site confidentiality, the participating institutions are identified as Site A, Site B, Site C, Site D, and Site E. All five institutions were already served by the mobile library program; therefore, the design did not include a comparison group of children without mobile-library access. The design estimates the magnitude and direction of associations within the exposed sample and does not establish temporal or causal effects.

2.2. Participants and Sampling

The analytic sample comprised 150 children aged 5–6 years and 150 parents or caregivers, with one supporting adult respondent for each child. Thirty children were recruited from each of the five participating institutions. Purposive sampling ensured that all participating children had actual exposure to mobile library activities and that a parent or caregiver was sufficiently familiar with the child's reading experiences to complete the service questionnaire. Eligibility required participation in mobile library activities, parent/caregiver awareness of the child's reading activities at home, and enrollment in an institution located within the program's operational area. Because every child in the analytic sample was exposed to the service, the study cannot estimate differences between children with and without access to a mobile library.

2.3. Measures

Mobile Library Services (X) were measured using a structured parent/caregiver questionnaire consisting of 16 items covering four dimensions: frequency of mobile library visits, access to age-appropriate reading materials, children's participation in shared reading or literacy activities facilitated by the service, and parental involvement encouraged by the program. Each dimension was represented by four items. Items used a five-point response scale. The raw item scores were aggregated and transformed into a 0–100 composite score, with higher values indicating more frequent and more educationally meaningful exposure to the service. The construct reflects a community-literacy model in which access, interaction, and family engagement operate together (Campbell-Hicks, 2024; Sung et al., 2023). Content validity was established through expert judgment during instrument preparation, and the instrument was pilot-tested prior to the main data collection. The questionnaire demonstrated good internal consistency, with Cronbach's $\alpha = 0.86$.

Early Reading Literacy (Y) was represented on a 0–100 scale based on a structured assessment consisting of 20 items/tasks covering letter recognition, phonological awareness, basic vocabulary, and simple story comprehension. Each domain was represented by five items/tasks. These domains are consistent with contemporary early literacy interventions and observational work emphasizing code-related and oral-language processes as complementary foundations for reading development (Bleses et al., 2021; Parpucu & Ezmeci, 2024; Piasta et al., 2021). Assessment scores were aggregated and transformed into a 0–100 ability score, with higher values indicating stronger foundational reading-related competence. Content validity was examined through expert judgment during instrument preparation, and pilot testing was conducted before the main data

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collection. The assessment demonstrated good internal consistency, with Cronbach's α = 0.84. Table 1 summarizes the operationalization of the two study variables.

Table 1. Operationalization of the Study Variables

Variable	Respondent / source	Indicators	Score	Interpretation of higher scores
Mobile Library Services (X)	Parent/caregiver questionnaire	Visit frequency; age-appropriate book access; shared reading participation; parental involvement	0–100 composite	More frequent and educationally meaningful exposure to mobile library services
Early Reading Literacy (Y)	Child assessment and structured rating	Letter recognition; phonological awareness; basic vocabulary; simple comprehension	0–100 ability score	Stronger foundational reading-related competence

2.4. Procedure and Data Analysis

Research procedures comprised instrument preparation and expert review, pilot testing, participant recruitment and consent, questionnaire administration to parents/caregivers, direct assessment of children, data cleaning, and statistical analysis. Descriptive statistics were used to characterize the sample. A simple linear regression estimated the association between the overall mobile library service score and early reading literacy. The four service dimensions were subsequently examined in separate single-predictor indicator-level regressions; they were not entered simultaneously into one multiple-regression model. Accordingly, the indicator coefficients are unadjusted associations and do not represent independent contributions after controlling for shared variance among service dimensions. Parental education and the number of children's books at home were described as characteristics of the home literacy context but were not included as covariates in the reported source analysis. Normality, linearity, and heteroscedasticity were evaluated before model interpretation. Children were clustered within five institutions (30 children per institution). A multilevel model was considered conceptually, but with only five level-2 units and no multilevel output in the source analysis, no multilevel estimates are reported; clustering is therefore treated as a limitation requiring confirmation in future reanalysis or studies with a larger number of institutions. Statistical analyses were conducted in IBM SPSS Statistics version 30, with statistical significance evaluated at $p < 0.05$.

3. Results and Discussion

3.1. Results

3.1.1. Participant Characteristics

The sample was balanced across the five ECE institutions and by child sex. The mean age was 67.4 months (SD = 3.8; range = 60–72 months). Family educational backgrounds and access to children's books varied substantially. As shown in Table 2, 30% of children lived in homes with only 0–5 children's books and a further 42.0% had 6–15 books, indicating that most participants had relatively modest home print resources.

Table 2. Characteristics of Participating Children and Their Home Literacy Context (n = 150)

Characteristic	Category	n	%
ECE institution	Site A	30	20
	Site B	30	20
	Site C	30	20
	Site D	30	20
	Site E	30	20
Age (months)	Mean ± SD	67.4 ± 3.8	—
	Range	60–72	—
Gender	Male	74	49.3
	Female	76	50.7
Highest parental education	Primary school/equivalent	22	14.7
	Junior high school/equivalent	44	29.3
	Senior high school/vocational	62	41.3
	Diploma/Bachelor's degree or higher	22	14.7
Children's books at home	0–5	45	30.0
	6–15	63	42.0
	16–30	32	21.3
	>30	10	6.7

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3.1.2. Unadjusted Associations Between Mobile Library Services and Early Reading Literacy

The overall mobile library service score was positively associated with early reading literacy. The model yielded an unstandardized coefficient of B = 0.55 (SE = 0.09), a standardized coefficient of β = 0.41, t = 5.90, $p < 0.001$, and $R^2 = 0.17$. Thus, higher service scores were associated with higher literacy scores, while 83% of the observed variance remained outside the single-predictor model. In four separate unadjusted indicator-level regressions, standardized coefficients were positive for shared reading participation (β = 0.31, t = 3.76, $p < 0.001$), access to age-appropriate books (β = 0.28, t = 3.02, p = 0.003), parental involvement (β = 0.25, t = 2.80, p = 0.006), and visit frequency (β = 0.22, t = 2.54, p = 0.012). Because unstandardized coefficients and standard errors for the indicator-level models were not available in the source statistical output, only the reported standardized coefficients, test statistics, and p values are presented. These indicator-level models were estimated separately and should therefore not be interpreted as mutually adjusted or as evidence that one service dimension has an independently stronger effect than another.

Table 3. Regression Estimates for Mobile Library Services and Early Reading Literacy (n = 150)

Predictor	B	SE	β	t	p
Overall mobile library service score	0.55	0.09	0.41	5.90	< 0.001
Visit frequency	—	—	0.22	2.54	0.012
Access to age-appropriate books	—	—	0.28	3.02	0.003
Shared reading participation	—	—	0.31	3.76	< 0.001
Parental involvement	—	—	0.25	2.80	0.006

Note. For the overall model, $R^2 = 0.17$. Each service dimension was examined in a separate unadjusted single-predictor regression. Unstandardized coefficients and standard errors were not available for the four indicator-level models in the source statistical output; therefore, only standardized coefficients, t statistics, and p values are reported for those models. The indicator-level estimates were not mutually adjusted for parental education or the number of children's books at home.

3.2. Discussion

3.2.1. Mobile Libraries as Relational Literacy Infrastructure

The central finding is an association, not a causal effect: within the five institutions already exposed to the mobile library program, children with higher service-quality scores also had higher early reading literacy scores. The standardized association (β = 0.41) and $R^2 = 0.17$ indicate that service quality covaried with literacy, while most observed variance remained outside the single-predictor model. Early literacy develops through cumulative interactions among child characteristics, family resources, adult mediation, preschool instruction, and opportunities to encounter print (Bigozzi et al., 2023; Salminen et al., 2021; Vanbecelaere, Matsuyama, Reynvoet, & Depaepe, 2021). The result should therefore be interpreted as evidence that mobile libraries may form one component of a wider literacy ecology, not as evidence that increasing service intensity will necessarily cause literacy gains.

This interpretation is consistent with evidence showing that library contact can shape reading behavior when it creates sustained opportunities to engage with books. In a large longitudinal study, joint library visits and joint book reading in the preschool years predicted later leisure reading, which in turn was associated with reading comprehension (Pfost & Heyne, 2023). Public-library research in Asian contexts similarly emphasizes that families value libraries when services actively build relationships with caregivers and support literacy engagement across print and digital contexts (Sung et al., 2023). In resource-constrained settings, increasing the physical availability of storybooks is also a necessary precondition for reading participation, as demonstrated by a randomized classroom-library model that substantially expanded children's book access (Fleisch & Schöer, 2023). Together, these studies suggest that the positive association observed in the study setting is best understood as the contribution of a distributed literacy infrastructure that connects access, interaction, and continuity across settings.

The present findings also need to be interpreted in relation to the home literacy environment. Nearly three quarters of the sample had 15 or fewer children's books at home, including 30% with no more than five, and parental education varied across families. Research with heritage-language learners shows that shared book reading partly mediates socioeconomic differences in emergent literacy, while studies across Asian contexts document systematic links among family resources, literacy practices, and early learning opportunities (Cheung et al., 2021; Shen & Del Tufo, 2022). Because parental education and home-book availability were not included as covariates in the reported regression models, the present study cannot determine whether the observed service associations are independent of these family characteristics. Any equity interpretation must therefore remain provisional.

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3.2.2. Why Shared Reading Emerged as the Strongest Service Dimension

Shared reading had the largest unadjusted standardized indicator coefficient (β = 0.31), but this numerical ordering should be interpreted cautiously. Shared book reading can expose children to vocabulary, narrative structure, print concepts, inferencing, and phonological patterns, and evidence has reported benefits for phonological awareness and early language when adults are supported to create responsive conversations around books (Dicataldo, Rowe, & Roch, 2022; Parpucu & Ezmeci, 2024). At the same time, intervention findings do not imply that shared reading produces uniform literacy gains across children or settings. The present cross-sectional estimate cannot establish that shared reading caused higher literacy, nor that it has a stronger independent effect than the other service dimensions.

A more plausible interpretation is that the educational value of shared reading is conditional on how the interaction is implemented. Public-library storytime research shows that extratextual talk can support inferencing and symbolic understanding, but the quality and cognitive demand of questions vary across sessions (Cahill & Ingram, 2022). Teachers likewise differ in their use of oral-language and emergent-literacy strategies during shared book reading (Weadman, Serry, & Snow, 2023). Thus, the presence of a book or a nominal shared-reading activity is not equivalent to a high-quality literacy interaction; adult prompts, turn-taking, vocabulary explanation, print referencing, and opportunities for child retelling are likely important conditions.

Implementation quality, dosage, participant responsiveness, and family characteristics provide additional reasons for caution. Early literacy intervention research shows that implementation quality and dosage shape program value (Piasta et al., 2021), while longitudinal and follow-up evidence indicates that gains can vary across children and may attenuate over time (Bleses et al., 2021; Rippe & Merkelbach, 2021). Home literacy conditions also differ substantially across families (Shen & Del Tufo, 2022). Accordingly, the β = 0.31 estimate is best read as an unadjusted association within this sample, not as proof that shared reading is a universally superior or causally dominant service component.

3.2.3. Age-Appropriate Books, Family Involvement, and Service Continuity

Access to age-appropriate books was the second-strongest indicator (β = 0.28). Developmentally matched texts can reduce unnecessary comprehension barriers while giving children repeated opportunities to connect print, images, oral language, and prior knowledge. Longitudinal research has linked access to literacy resources with early reading development, and book exposure in infancy and preschool has been associated with later vocabulary and emergent literacy even after adjustment for family characteristics (Leech, McNally, Daly, & Corriveau, 2022; Tanji & Inoue, 2023). Short-term literacy training also demonstrates that targeted exposure to letter-sound and decoding content can change preschoolers' behavioral performance, although the mechanisms and persistence of gains depend on the nature and duration of intervention (Caffarra et al., 2025). For mobile libraries, collection development should therefore prioritize not simply volume but developmental suitability, linguistic accessibility, cultural relevance, and repeated availability of high-interest texts.

Parental involvement also showed a significant positive coefficient (β = 0.25). This is consistent with evidence that active home literacy environments operate through more than book ownership: adults' reading behavior, shared conversation, and support for children's participation all matter (Romero-González et al., 2023; Shen & Del Tufo, 2022). Parent-child reading can strengthen language learning and maintain continuity between organized literacy activities and everyday family routines (Leech et al., 2022). In Indonesia, early childhood literacy studies similarly emphasize the importance of aligning teacher and parent practices and of providing families with usable strategies rather than relying on decontextualized print resources alone (Febiyanti et al., 2021; Hidayatullah et al., 2021). A mobile library can therefore function as a bridge: librarians model reading interactions, parents reproduce them at home, and teachers connect them to classroom literacy.

Visit frequency had the smallest, although still significant, standardized coefficient (β = 0.22). This pattern suggests that continuity matters, but frequency alone is insufficient. Repeated visits create opportunities for borrowing, rereading, and routine formation, yet the educational return on each visit is likely constrained by what happens during the encounter. Public-library scholarship has increasingly argued for deliberate literacy content, staff preparation, caregiver communication, and extended outreach rather than relying on attendance counts as the main indicator of quality (Campbell-Hicks, 2024; Perkins & Sawyer, 2025). Local Indonesian studies point in the same direction: literacy initiatives in ECE settings benefit when library management, age-appropriate collections, and structured teacher-family practices are integrated rather than implemented separately (Djafri & Bouty, 2022; Setyaningsih et al., 2022).

3.2.4. Contribution to the Indonesian Early Literacy Evidence Base

The study adds a quantitative service-level perspective to an Indonesian literature that has more often examined classroom strategies, digital literacy media, descriptive library initiatives, reading interest, or child

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engagement. Indonesian research has documented the role of teacher strategies, coordination of school and home literacy resources, and community-based library management (Febiyanti et al., 2021; Hidayat, Hidayat, & Umayah, 2021; Hidayatullah et al., 2021). Recent qualitative work on a Jakarta mobile library suggests that repeated visits may increase young children's interest, participation, and communication around books (Sumardiana & Ningrum, 2025). The present study differs by relating variation in a multidimensional mobile-library service measure to directly assessed early reading literacy in a 150-child, five-site sample, while retaining the limitations of a cross-sectional, exposed-only design.

Internationally, the result also resonates with evidence that community-based literacy supports can be delivered by educators and non-teaching adults when programs provide structure, high-quality materials, and interactional guidance (Piasta et al., 2021). Sustained intervention effects are not guaranteed, however. Follow-up evidence from early childhood literacy trials shows that some gains attenuate or vary across subgroups, underscoring the need to examine durability and differential benefit rather than assuming that initial participation translates automatically into long-term reading achievement (Bleses et al., 2021; Rippe & Merkelbach, 2021). Future evaluations of mobile libraries should therefore move beyond single-wave prediction toward longitudinal and quasi-experimental designs that test how service quality affects trajectories of literacy growth.

3.3. Implications

The findings support cautious program priorities rather than causal prescriptions. Regular scheduling may facilitate borrowing and rereading; collections may be curated for developmental level, language demands, cultural relevance, and child interest; and shared-reading sessions may emphasize open questions, vocabulary explanation, child retelling, print referencing, and responsive interaction (Cahill & Ingram, 2022; Dicataldo et al., 2022; Parpucu & Ezmeci, 2024). Librarians and ECE teachers may also model practical reading interactions for caregivers so that literacy engagement can continue at home. These implications are consistent with evidence on family engagement and professional learning in public-library contexts (Perkins & Sawyer, 2025; Sung et al., 2023), but the present data do not establish that strengthening any single service component will necessarily increase literacy.

3.4. Limitations

Several limitations qualify the conclusions. First, the purposive sample comprised children from five ECE institutions already reached by mobile-library services; there was no unexposed comparison group, so the study cannot estimate the effect of access versus non-access. Second, the cross-sectional design establishes association rather than temporal or causal direction. Third, service exposure was partly parent-reported, creating potential recall and social-desirability bias. Fourth, the reported models did not adjust for parental education or number of children's books at home, although both are relevant features of the home literacy environment; indicator-level coefficients therefore cannot be interpreted as independent effects. Fifth, 150 children were clustered within only five institutions, and no multilevel estimates were available, leaving possible site-level dependence unmodeled. Sixth, the available source analysis does not contain the complete item-level psychometric output or the unstandardized B and SE values for the four indicator-level regressions, which limits appraisal of measurement precision and comparative magnitude until the original outputs are restored. Future research should use longitudinal or quasi-experimental designs, include a comparison group where feasible, apply controlled analyses of home literacy environment variables, and use multilevel models in samples with sufficient numbers of institutions.

4. Conclusion

Within five ECE institutions already exposed to a mobile library program, higher mobile-library service-quality scores were positively associated with early reading literacy among 5–6-year-old children. Shared reading, age-appropriate book access, parental involvement, and visit frequency each showed positive unadjusted indicator-level associations, but their numerical ordering should not be interpreted as independent or causal effects because the analyses were cross-sectional and did not control for parental education or home-book availability. The findings therefore support viewing mobile libraries as one component of a broader literacy ecology rather than as a demonstrated cause of literacy improvement. Longitudinal and quasi-experimental studies, together with controlled analyses of the home literacy environment and appropriate modeling of institutional clustering, are needed to determine whether changes in service quality precede and contribute to sustained literacy gains.

Author Contributions

All authors contributed equally to this paper. All authors have read and approved the final manuscript.

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Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics and Consent Declarations

Parents or caregivers provided informed consent for participation, and data collection procedures were designed to protect children's comfort, privacy, and confidentiality. Participation was used solely for academic research purposes, and personally identifying information was not reported in the analysis.

Data Availability

De-identified data supporting the findings of this study may be made available by the corresponding author upon reasonable request, subject to participant privacy and applicable ethical restrictions.

Declaration on AI Use

AI-assisted technology was used for language refinement and structural editing under human oversight. The authors retain full responsibility for the research design, data, statistical results, source verification, interpretations, conclusions, and final submitted text.

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