

Low-Cost Spatial Reconfiguration of School Libraries as a Behavioral Nudge to Foster Reading Engagement in Primary Education: A Qualitative Case Study

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Abstract

Background: Reading engagement in primary education remains limited in many public schools where libraries are underutilized due to disorganized spatial arrangements and minimal environmental stimulation. In resource-constrained contexts, low-cost environmental interventions represent a promising yet underexplored strategy for strengthening literacy culture.

Aims: This study investigates how low-cost spatial reconfiguration of a primary school library operates as a behavioral nudge to enhance students' reading engagement.

Methods: A descriptive qualitative case study was conducted in a public primary school using structured non-participant observations over a two-week period. Data focused on changes in students' visitation patterns, spatial interaction, and reading behaviors before and after shelf reorganization and improved book categorization. Findings were analyzed narratively through a behavioral nudge framework.

Results: Spatial reconfiguration generated visible environmental order and accessibility, followed by increased frequency of library visits, more directed exploration of book collections, and longer on-site reading duration. Students' engagement shifted from incidental presence to intentional reading behavior.

Conclusion: The findings demonstrate that spatial design can function as a subtle yet powerful pedagogical catalyst. Low-cost reorganization reshaped students' spontaneous behavioral choices without formal literacy programs or technological investment. This study advances primary education research by positioning learning environments as active behavioral agents and offers a scalable, context-sensitive model for strengthening early reading culture in under-resourced schools.

INTRODUCTION

Reading engagement in primary education is widely recognized as a foundational determinant of students' long-term academic development and learning autonomy, as early reading habits shape cognitive growth and learning motivation (Lin, 2025). International literacy

assessments consistently report that students' interest in reading is strongly influenced by the learning environment in which literacy activities are embedded, not merely by instructional methods. Scholars such as Guthrie and Wigfield have emphasized that reading engagement emerges from the interaction between motivation, access to reading materials, and environmental affordances. In many primary schools, however, school libraries remain underutilized despite their potential to function as central literacy spaces. Previous studies indicate that poorly organized library spaces reduce students' spontaneous inclination to read, even when book availability is adequate (Ubat & Academia, 2025). In resource-limited educational contexts, this problem is often intensified by the assumption that improving literacy requires costly interventions or digital infrastructure. This assumption overlooks the pedagogical role of physical learning environments as behavioral cues that shape student engagement. Consequently, examining low-cost spatial strategies in school libraries becomes an urgent and relevant research agenda in primary education research (Hartikainen, 2023).

The urgency of this study is further reinforced by the growing body of educational research highlighting the role of environmental design in influencing students' learning behaviors. Learning space theorists such as Barrett et al. argue that spatial order, visual clarity, and accessibility directly affect students' attention and engagement levels (Peng et al., 2022). In primary schools, children's reading behavior is particularly sensitive to visual stimuli and spatial comfort, as young learners rely heavily on environmental cues to guide their actions (Godwin et al., 2022). Despite this evidence, many school-based literacy initiatives continue to prioritize curricular programs while neglecting the spatial dimension of learning. Research on school libraries has largely focused on collection development or digital services, leaving physical reconfiguration underexplored (Peng et al., 2022). This gap is especially visible in qualitative studies conducted in public primary schools with limited resources. Investigating how simple spatial reorganization can function as a behavioral nudge offers a novel perspective on fostering reading engagement. Therefore, this study positions spatial reconfiguration not as a peripheral issue but as a core pedagogical concern in primary education.

A growing number of international studies emphasize that reading engagement is not solely an individual trait but a context-dependent behavior shaped by environmental factors. Research by Guthrie et al. demonstrates that supportive literacy environments significantly enhance students' willingness to read independently (Bus et al., 2024). In parallel, studies on school library effectiveness suggest that students' frequency of library visits is influenced by spatial accessibility and visual organization rather than collection size alone. Lance and Kachel have shown that inviting and well-managed library spaces are associated with higher student engagement across grade levels. Environmental psychology research further supports the idea that orderly and visually appealing spaces reduce cognitive load and encourage exploratory behavior, as discussed by Kaplan and Kaplan. However, much of this literature examines learning environments in technologically advanced or well-funded schools (Frilot, 2023). As a result, the applicability of these findings to low-resource primary schools remains insufficiently examined. This study responds to that limitation by focusing on low-cost spatial interventions. By doing so, it contributes to a more inclusive understanding of how environmental design supports literacy development in diverse educational contexts (Schiano-Phan et al., 2022).

Recent Scopus-indexed studies have also begun to conceptualize learning environments through the lens of behavioral science (Husamah et al., 2025). Thaler and Sunstein's nudge theory,

although originally developed in economics and public policy, has increasingly been applied to educational settings to explain subtle behavior change mechanisms. Educational researchers such as Damgaard and Nielsen argue that small environmental modifications can influence students' choices without coercion (Nielsen & Ulriksen, 2025). In the context of school libraries, this perspective suggests that spatial cues may encourage reading behavior organically. Nevertheless, existing studies often rely on quantitative designs or experimental settings detached from everyday school realities (Pilcher & Cortazzi, 2024). Qualitative evidence capturing naturalistic behavioral shifts in primary school contexts is still scarce. Moreover, few studies explicitly link spatial reconfiguration with reading engagement using a behavioral nudge framework. This theoretical integration remains underdeveloped in primary education research (Ortiz-Revilla et al., 2022). Therefore, this study adopts a qualitative case study approach to illuminate how spatial design operates as a behavioral nudge within a real school environment.

Despite extensive research on reading engagement and school libraries, several critical gaps remain evident in the literature. First, most studies prioritize instructional strategies, digital literacy programs, or teacher-led interventions, while the role of physical space is often treated as a secondary variable. Second, existing research frequently assumes that effective literacy enhancement requires substantial financial investment, leaving low-cost interventions underrepresented (Akanfe et al., 2025). Third, the application of behavioral nudge theory to primary school library environments remains conceptually underdeveloped and empirically limited. Fourth, many studies rely on survey-based or experimental methods that may not capture spontaneous behavioral changes in natural school settings. Fifth, qualitative insights into students' everyday interactions with reconfigured library spaces are still scarce. Sixth, research focusing on public primary schools in resource-constrained contexts is disproportionately limited in international journals. Seventh, the absence of observational evidence weakens understanding of how environmental changes translate into behavioral engagement. Finally, these gaps collectively indicate the need for context-sensitive, low-cost, and behavior-focused studies to strengthen the theoretical and practical discourse on reading engagement in primary education (Cheyma & Rayane, 2023).

The purpose of this study is to explore how low-cost spatial reconfiguration of a school library functions as a behavioral nudge to foster reading engagement among primary school students. Specifically, the study seeks to examine changes in students' library visitation patterns and reading-related behaviors following spatial reorganization. It aims to understand how visual order, accessibility, and spatial comfort influence students' spontaneous engagement with reading materials. The study also intends to highlight the pedagogical significance of physical learning environments in primary education (Baars et al., 2023). By adopting a qualitative case study approach, the research captures natural behavioral responses rather than artificially induced outcomes. This focus allows for a nuanced understanding of reading engagement as a situated practice. Furthermore, the study aims to contribute conceptual insights by integrating spatial design with behavioral perspectives. Ultimately, the findings are expected to inform educators and policymakers about scalable and low-cost strategies for strengthening reading culture in primary schools (Norman, 2023).

METHOD

Research Design

This study employed a descriptive qualitative case study design to explore how low-cost spatial reconfiguration of a school library functions as a behavioral nudge in a primary education context (Tan, 2024). A qualitative approach was selected because reading engagement is a context-dependent behavior that emerges through everyday interactions rather than measurable outcomes alone. Case study design allows for an in-depth examination of naturally occurring behavioral changes within a bounded system, as emphasized in educational research methodology by Yin. The study focused on observing behavioral responses before and after a spatial intervention rather than testing predefined variables. This design aligns with the exploratory nature of the research and avoids imposing artificial experimental controls. According to Creswell, qualitative case studies are particularly appropriate for investigating educational practices in real-world school settings. The intervention was embedded in routine school activities to preserve ecological validity (Maher, 2022). Therefore, the research design supports an authentic understanding of how spatial cues influence reading engagement among primary school students.

Participant

The participants in this study consisted of primary school students from grades one to six who were enrolled at a public elementary school (Kim, 2022). Rather than selecting participants through sampling procedures, all students who naturally accessed the library during break times were considered part of the observational field. This inclusive approach reflects the qualitative principle of studying behavior as it occurs in situ, as discussed by Merriam in qualitative education research. The focus was not on individual demographic characteristics but on collective behavioral patterns within the school environment. Teachers and school staff were not treated as direct participants but played a supportive role during the spatial reconfiguration process (Kilicoglu & Kilicoglu, 2024). Students were observed without direct interaction to minimize reactivity and observer influence. This approach aligns with non-participant observation techniques commonly used in school-based qualitative studies. Ethical considerations were addressed by ensuring that no identifiable personal data were recorded during observations.

Instrument

The primary instrument used in this study was a structured non-participant observation guide designed to capture students' reading-related behaviors (Jayanti, 2024). Observation indicators were informed by prior studies on reading engagement and learning environments, particularly those discussed (Solé-Beteta et al., 2022). The guide included indicators such as frequency of library visits, duration of stay, interaction with book collections, and reading activities conducted on-site. Field notes were used to document spatial conditions before and after reconfiguration, including book arrangement and accessibility. The observation instrument emphasized visible behavioral cues rather than self-reported attitudes to maintain methodological consistency. To ensure observational focus, indicators were refined during an initial familiarization phase, following guidance from Miles and Huberman on qualitative instrumentation (Ulfah et al., 2025). No questionnaires or interviews were employed, as the study prioritized naturalistic behavioral data. This instrument design supports alignment between the behavioral nudge framework and observable reading engagement.

Analysis plan

Data analysis followed a qualitative narrative analysis approach aimed at identifying patterns of behavioral change across observation phases. Observational field notes were first organized chronologically to distinguish conditions before and after spatial reconfiguration (Capron & Delacour, 2024). Coding focused on recurring behavioral patterns related to library use and reading engagement, consistent with thematic analysis procedures outlined. Rather than quantifying behaviors, the analysis emphasized comparative interpretation of observed changes. Behavioral nudge theory (DeVille & Sughrue, 2023), was used as an analytical lens to interpret how spatial cues influenced student behavior. Analytical memos were developed to connect spatial changes with observed behavioral responses. This interpretive process allowed for theoretical integration without imposing causal claims. The analysis strategy thus supports a nuanced understanding of spatial reconfiguration as a behavioral mechanism in primary education settings (Yu & Olğun-Baytaş, 2025).

Table 1. Observational Indicators of Reading Engagement.

Dimension	Observational Focus	Description
Library visitation	Frequency	Number of student visits during break time
Spatial interaction	Accessibility	Student movement across book shelves
Reading behavior	Engagement	Time spent reading or browsing books
Social behavior	Collective use	Group reading or shared exploration

Table 1 summarizes the behavioral indicators used to systematically guide observations and ensure consistency across the observation period.

RESULTS AND DISCUSSION

Results

The results indicate a clear transformation in both the physical condition of the school library and students’ observable reading behaviors following spatial reconfiguration. Prior to the intervention, the library space appeared disorganized, with books placed randomly and limited seating arrangements, resulting in minimal student visits. After low-cost spatial reconfiguration, including shelf reorganization and clearer book categorization, the library became visually structured and more accessible. Observational records showed a noticeable increase in the number of students entering the library during break times. Students were observed browsing book shelves more actively rather than merely passing through the space. The duration of students’ stay in the library also increased compared to pre-intervention observations. Reading activities shifted from incidental contact with books to intentional engagement, such as sitting and reading on-site. These findings suggest that spatial order functioned as a behavioral cue that redirected students’ spontaneous behavior toward reading activities.

Table 2. Changes in Observed Student Reading Behaviors Before and After Spatial Reconfiguration.

Observational Aspect	Before Reconfiguration	After Reconfiguration
Library visitation	Rare and incidental	Frequent and intentional
Student movement	Unstructured	Directed toward book shelves
Reading duration	Very short	Extended and sustained
Use of space	Minimal	Active and collective

Table 2 illustrates qualitative shifts in students’ reading-related behaviors observed during the intervention period.

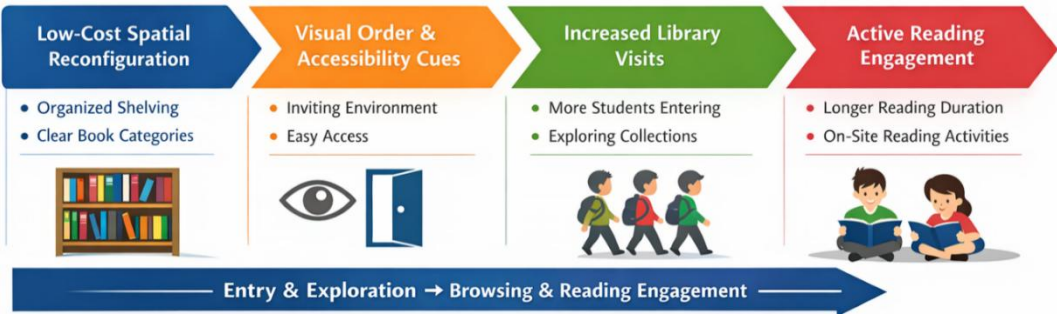


Figure 1. Behavioral Pathway of Reading Engagement Following Spatial Reconfiguration

Figure 1 visualizes how low-cost spatial reconfiguration created visual order and accessibility cues that encouraged students to enter the library, explore book collections, and engage in reading activities.

Discussion

The findings of this study reinforce the growing understanding that reading engagement in primary education is strongly influenced by environmental conditions rather than instructional strategies alone. Previous research has demonstrated that children’s literacy behaviors are shaped by the physical affordances of learning spaces, as highlighted (Young & Cleveland, 2022). Who argue that spatial order enhances attention and engagement. In this study, the reconfigured library environment functioned as an implicit behavioral guide, aligning with Guthrie and Wigfield’s assertion that engagement emerges from interaction between learners and context. The increased frequency of library visits observed supports earlier findings (Bloom et al., 2025). Regarding the importance of inviting library environments. Unlike studies that emphasize technological upgrades, this research shows that behavioral change can occur through simple spatial cues. This supports environmental psychology theory, which posits that organized spaces reduce cognitive overload. The findings therefore situate spatial design as a pedagogical factor rather than a peripheral facility issue. This reframing is particularly relevant for primary education contexts (Kopec, 2024).

From a behavioral perspective, the results align with nudge theory proposed which suggests that subtle environmental changes can influence decision-making without explicit instruction (De Paolis et al., 2025). The spatial reconfiguration acted as a non-coercive intervention that guided students toward reading behaviors organically. Similar educational applications of nudging have been discussed by Damgaard and Nielsen, who emphasize the effectiveness of small contextual modifications. In the present study, visual clarity and accessibility served as nudges that altered students’ default behavior during break times. Rather than choosing outdoor play exclusively, students were drawn into the library environment. This behavioral shift occurred without formal literacy programs or teacher directives. Such findings extend nudge theory into the domain of primary school literacy environments (Forsling & Tjernberg, 2023). Consequently, the study contributes empirical support to interdisciplinary applications of behavioral science in education.

The qualitative nature of the findings provides insight into how students interact with space in real school settings (Yoon & Uliassi, 2022). Unlike survey-based studies that rely on self-reported

interest, this research captured observable behavioral changes, consistent with arguments by Miles and Huberman regarding the strength of naturalistic observation. The increase in reading duration suggests not only curiosity but sustained engagement, which is critical in early literacy development. This observation aligns with research (Kazandjian et al., 2025) on early reading habits, which highlights the importance of repeated and voluntary reading exposure. The collective use of the library space also reflects Vygotskian perspectives on social learning, where shared environments facilitate learning behaviors. These findings suggest that spatial reconfiguration can foster both individual and social dimensions of reading engagement. Importantly, the intervention did not disrupt existing school routines. This reinforces the practicality of spatial strategies in primary education settings (Renaldo et al., 2025).

The study also addresses limitations in existing school library research, which often focuses on collection size or digital services. Has noted that access alone does not guarantee usage, a claim supported by the pre-intervention observations in this study (Kellett et al., 2025). Spatial accessibility and visual order emerged as decisive factors influencing student behavior (Charousaei et al., 2025). This finding challenges assumptions that low-resource schools cannot effectively promote reading engagement. Instead, it supports arguments by OECD education reports emphasizing efficient use of existing resources. The present findings therefore offer an alternative pathway for literacy development in under-resourced schools. They also align with global discussions on sustainable education practices. The study contributes context-sensitive evidence to international debates on educational equity (Mahapoonyanont & Songsang, 2024) .

From a primary education perspective, the findings highlight the importance of aligning learning environments with developmental characteristics of young learners. Research by Fisher on classroom design suggests that children respond strongly to visual structure and spatial clarity. The observed behavioral changes support this claim, as students navigated the reorganized space with greater confidence. The library became a recognizable and purposeful environment rather than an ambiguous storage area. This transformation underscores the pedagogical role of space in shaping behavior. It also supports that learning spaces should be designed intentionally to support educational goals (Ross et al., 2022a). The study thus bridges educational design and literacy research. Such integration remains relatively rare in Scopus-indexed primary education journals.

Overall, this study contributes to international literature by demonstrating that low-cost spatial interventions can meaningfully influence reading engagement (Ross et al., 2022b). While many studies emphasize policy-level or curriculum-based solutions, this research foregrounds everyday school practices. The integration of behavioral nudge theory with qualitative observation provides a novel analytical lens. The findings expand existing knowledge on how environmental design supports early literacy. They also invite reconsideration of how schools conceptualize libraries within the learning ecosystem (Ross et al., 2022b). Importantly, the study maintains ecological validity by situating the intervention within routine school life. This strengthens its relevance for practitioners and researchers alike.

Implications

The findings imply that primary schools can strengthen reading engagement through strategic spatial management without relying on costly programs or digital infrastructure. For educators, this highlights the importance of viewing library spaces as active pedagogical tools rather than passive facilities. Policymakers may consider incorporating spatial design principles into school

literacy initiatives. Teacher education programs in primary education may also integrate environmental literacy as part of pedagogical training. For schools with limited resources, the study offers a scalable and sustainable model. The findings further suggest that behavioral approaches can complement traditional literacy instruction. This has implications for holistic literacy development in primary education contexts. Ultimately, spatial awareness should be recognized as a core component of learning design.

Limitations

This study is limited by its reliance on observational data without triangulation through interviews or surveys. The short duration of the observation period restricts conclusions about long-term sustainability of reading engagement. Behavioral changes were interpreted qualitatively rather than measured quantitatively. The single-case design limits generalizability across different school contexts. Observer interpretation may also introduce subjective bias despite structured observation guides. The study did not examine comprehension outcomes or academic performance. External factors influencing student behavior were not systematically controlled. These limitations suggest caution in extending findings beyond similar contexts.

Suggestions

Future studies should incorporate longitudinal designs to examine the durability of spatially induced reading engagement. Mixed-method approaches combining observation and student interviews could provide deeper insight into motivational factors. Comparative studies across multiple schools would strengthen generalizability. Quantitative measures of reading outcomes could complement behavioral observations. Further research could explore the interaction between spatial design and teacher-led literacy activities. Investigating digital-physical hybrid library spaces may extend this work. Cross-cultural studies could assess contextual variability. Such research would further strengthen the theoretical and practical foundations of spatial interventions in primary education.

CONCLUSION

This study demonstrates that low-cost spatial reconfiguration of school libraries can function as an effective behavioral nudge to foster reading engagement in primary education. By reorganizing library space to enhance visual order and accessibility, students' spontaneous behaviors shifted toward more frequent visits and sustained reading activities. These findings confirm that reading engagement among primary school students is not solely determined by instructional strategies or resource availability, but is also shaped by environmental cues embedded in learning spaces. The study contributes to primary education literature by positioning spatial design as a pedagogically meaningful intervention rather than a peripheral facility concern. Importantly, the qualitative evidence highlights that meaningful behavioral change can emerge without expensive infrastructure or formal literacy programs. This reinforces the relevance of context-sensitive and sustainable approaches to literacy development, particularly in resource-constrained school settings. The integration of behavioral nudge theory with school library environments offers a novel conceptual lens for understanding how subtle spatial cues influence children's learning behaviors. Overall, the study underscores the need for educators and policymakers to recognize learning spaces as active agents in shaping reading culture within primary education.

AUTHOR CONTRIBUTION STATEMENT

Nurul contributed to the conceptualization of the study, research design, and theoretical framing of spatial reconfiguration as a behavioral nudge in primary education. Nurul conducted the field observations, collected and organized qualitative data, and documented changes in students' reading behaviors. Nurul performed data analysis, interpreted the findings, and integrated behavioral and educational perspectives into the discussion. Nurul drafted the original manuscript, including the introduction, methods, results, and discussion sections. Nurul also reviewed and revised the manuscript critically to ensure academic rigor and coherence. All aspects of the study and manuscript preparation were completed and approved by Nurul.

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