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Learning Through Stories: A Multilingual, Multimedia Approach for Digital Native

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Abstract

In the rapidly evolving digital era, children's learning experiences are increasingly shaped by interactive technologies, multimedia content, and early exposure to multiple languages. While traditional storybooks remain important for nurturing literacy and imagination, they may not fully engage today's digital-native learners. This study presents the design, development, and evaluation of an innovative multilingual interactive children's storybook that bridges traditional print and digital learning through QR code integration. The storybook promotes early literacy and language development across Tamil, English, Malay, Jawi, and Tamil transliteration. Special emphasis is placed on accurate pronunciation, using bolded Tamil scripts and transliterated text to support guided reading for both native and non-native speakers. The printed storybook is enhanced with scannable QR codes that connect readers to interactive multimedia resources such as narrated video readings, AI-generated songs, and gamified activities tailored to auditory, visual, and kinesthetic learning styles. The development process involved iterative prototyping, careful visual and linguistic adaptation, and systematic multimedia embedding. User testing was conducted with children, parents, and educators to refine design and functionality. Evaluation methods included observation checklists, comprehension tasks, questionnaires, and semi-structured interviews. Findings revealed higher learner engagement, improved pronunciation, and strong positive perceptions of usability and educational value. Participants appreciated the cultural and linguistic inclusivity of the materials. This study illustrates how technology-enhanced, culturally responsive storybooks can enrich early childhood literacy. By combining multilingual content with multimedia interactivity, the project proposes a scalable and inclusive model for multicultural education. The research contributes to educational technology, early literacy, and language acquisition, highlighting the promise of hybrid print-digital resources in supporting meaningful 21st-century learning experiences.

Keywords: multilingual storybook, educational technology, interactive learning, Tamil, transliteration, preschool education, digital storytelling.

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INTRODUCTION

Storytelling has long been considered a vital part of early infant development, boosting language acquisition, cognitive growth, social-emotional learning, and cultural transmission. Across cultures, oral and written stories assist children in establishing sense of their environment, forming identity, and accepting values and social norms (Khayati, 2024; Pulimeno et al., 2020). Research repeatedly reveals that storytelling improves early literacy, extends vocabulary, stimulates imagination, and fosters empathy in young learners. However, the ways in which tales are accessible and experienced have altered considerably as a result of digital innovation and shifting learning environments (Haleem et al., 2022).

Children today are growing up in media-rich environments, with smartphones, tablets, and multimedia platforms as part of everyday life. Many young students use digital gadgets before they can read independently (Panjeti-Madan & Ranganathan, 2023; Borges et al., 2025). While traditional print storybooks are still useful for fostering focus and imagination, they may not fully engage the attention of digital-native youngsters who are used to interactive and multimodal content. The disparity between static print and dynamic digital encounters emphasizes the need to reinvent early literacy materials so that they stay engaging while maintaining good pedagogical underpinnings (Flewitt et al., 2014).

At the same time, multilingual education has grown in relevance, particularly in linguistically varied cultures like Malaysia, India, and Singapore. Many youngsters use numerous languages at home, school, and in their communities. Early multilingual exposure has been associated to cognitive benefits such as increased metalinguistic awareness, improved executive control, and flexible problem-solving abilities (Daud, 2024; Goel, 2016). Despite these benefits, there are few bilingual learning resources that are both accessible and interesting. Existing materials frequently target monolingual learners or lack interactivity, making them less effective for different communities (Lorenz et al., 2021; Neokleous & Karpava, 2023).

In answer to these requirements, this study presents a multilingual interactive children's storybook that combines print and digital media via QR code technology. The project's goals include increasing engagement among digital native learners, promoting multilingual literacy, and improving pronunciation in less known languages. The storybook is available in five languages: Tamil, English, Malay, Jawi, and Tamil transliteration, allowing readers with diverse linguistic backgrounds to engage in collaborative reading. Tamil transliteration serves as a bridge for readers unfamiliar with the Tamil script, while bold Tamil words and transliteration aid in pronunciation and confident oral reading.

QR codes incorporated in the book direct users to narrated films, AI-generated tunes, and interactive games. These multimodal elements accommodate aural, visual, and kinesthetic learners, providing inclusivity for all learning styles. Children who have difficulty reading text can nevertheless listen to and interact with stories. Importantly, QR codes provide a low-cost and scalable solution that can be accessed using standard cellphones without the need for specialized devices or software (Bhattacharya & Singla, 2024).

The development method was divided into sections, including story design, linguistic adaptation, illustration, multimedia integration, and iterative prototyping. Preschool children, parents, and educators provided feedback that helped to refine layout, usability, and content complexity. This participative approach ensured both developmental appropriateness and cultural relevance.

Aside from creating a single resource, this effort contributes to broader concerns about educational technology, multilingual pedagogy, and inclusive design. By combining the benefits of print storytelling with digital capabilities, the storybook demonstrates how hybrid tools can improve early reading. It also promotes language preservation and cultural inclusivity. This paper describes the storybook's idea, development, and evaluation, providing insights and recommendations for future breakthroughs at the nexus of storytelling, multilingual education, and technology-enhanced learning.

OBJECTIVES OF THE STORYBOOK PROJECT

The ultimate goal of this project is to create a multilingual interactive children's storybook that combines traditional storytelling with new digital technology to promote early literacy development in linguistically varied contexts. In response to the growing demand for inclusive and engaging educational resources, particularly in heterogeneous communities, the project is directed by the following specific goals.

A. To promote multilingual literacy acquisition

The storybook is written in five languages: Tamil, English, Malay, Jawi, and Tamil transliteration, to help children enhance their language skills and encourage cross-linguistic understanding. This multilingual design represents the linguistic diversity that is widespread in multicultural communities and exposes young learners to many writing systems and speech patterns at an early stage.

By telling the same story in other languages, children may see how comparable meanings are expressed in different letters and sounds. This technique assists students in making meaningful connections between words and concepts, so supporting vocabulary development and comprehension.

Furthermore, the employment of various languages in a single storybook promotes metalinguistic awareness, as children learn how languages function and connect to one another. Learners gain a stronger comprehension of language structure and meaning by repeated exposure to familiar content in various linguistic forms, which aids in early literacy development (Bhattacharya & Singla, 2024).

B. To support accurate pronunciation, especially in Tamil

The storybook is written in five languages: Tamil, English, Malay, Jawi, and Tamil transliteration, to help children enhance their language skills and encourage cross-linguistic understanding. This multilingual design represents the linguistic diversity that is widespread in multicultural communities and exposes young learners to many writing systems and speech patterns at an early stage.

Tamil is a phonologically rich language with a distinct alphabet that can pose pronunciation issues for both native and non-native speakers. To aid in precise pronunciation, the storybook displays essential terms in bold Tamil lettering, along with their transliteration. This feature allows students to recognize sounds

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more clearly and rehearse proper articulation when reading. At the same time, the transliteration serves as a useful resource for caretakers and educators who are unfamiliar with the Tamil script. As a result, adults with limited Tamil proficiency can assist children with reading activities and comfortably participate in shared reading experiences.

C. To increase learner engagement through multimedia

Recognizing today's learners' digital native tendencies, the storybook includes multimedia features such as narrated films, AI-generated music, and interactive activities. These characteristics are intended to facilitate many learning styles, including visual, aural, and kinesthetic learning.

The use of multimedia helps to keep children's attention, strengthens their grasp of the text, and creates a more interesting reading experience (Rajendran & Aruldhas, 2025). By integrating storytelling with interactive digital features, the storybook makes learning more interesting and meaningful for young children.

D. To bridge print and digital storytelling through QR code technology

QR codes integrated in the storybook lead users to further digital information. This hybrid architecture ensures that engagement extends beyond the printed page and facilitates multimodal learning without the need for specialist technology.

E. To provide an inclusive educational tool

The storybooks are intended for a variety of stakeholders, including children, parents, and educators, rendering them a versatile resource for multiple learning environments. Children can utilize the storybook to investigate languages and narratives in an interactive manner, while parents can engage in collaborative reading activities that enhance language acquisition at home (Little, 2025). Educators may incorporate the storybook into classroom instruction to enhance literacy development and promote multilingual awareness.

The storybook's versatile form renders it appropriate for classroom instruction, home reading, and community educational initiatives, enabling many groups to utilize the same learning material effectively.

MULTILINGUAL STORYBOOK DESIGN

A. Language Selection and Structure

The multilingual storybook is purposefully crafted to embody the linguistic and cultural diversity of its intended audience. Every narrative is offered in Tamil, Tamil transliteration, English, Malay, and Jawi, guaranteeing accessibility and inclusivity for readers from diverse linguistic backgrounds.

This pick exemplifies a deliberate amalgamation of heritage, official, and community languages prevalent in Southeast Asia. In multilingual societies like Malaysia, Singapore, and certain regions of India, children frequently experience various languages in their daily environments, including home, school, and community settings. The storybook enables learners to correlate meanings across languages while valuing the diversity of many linguistic traditions by presenting the same narrative in multiple languages (Yao et al., 2025).

The Tamil version retains the profundity and cultural significance of a classical language, facilitating the preservation of heritage languages. The use of Tamil transliteration in Roman script serves as a support mechanism for learners proficient in spoken Tamil but lacking confidence in reading the script, encompassing non-native speakers and children of the diaspora. This dual representation facilitates the connection between conversational proficiency and written literacy. English and Malay, frequently employed as instructional mediums, link narratives to learners' pre-existing language knowledge and educational experiences. The incorporation of Jawi, an adapted Arabic script for Malay, revitalizes a traditional writing system that is progressively diminishing in contemporary children's resources.

All language versions are semantically aligned to provide consistent meaning and narrative coherence. This parallel structure facilitates cross-linguistic comparison, enhances metalinguistic awareness, and fosters vocabulary expansion. Interacting with a single narrative in several languages and scripts aids youngsters in identifying linguistic patterns, so enhancing both understanding and articulation.

B. Pronunciation Support

A significant pedagogical advancement of the multilingual storybook is its robust focus on pronunciation assistance, particularly for Tamil. Tamil, as a classical language with a unique phonological structure, poses challenges for both native and non-native learners (Rajendran & Aruldhas, 2025). In multilingual or diasporic environments, numerous children are exposed to Tamil at home yet receive less formal education in reading and pronunciation, resulting in a disparity between spoken and written forms. The storybook employs a dual-format methodology, pairing each Tamil text with its Romanized phonetic transcription. Both are rendered in bold to distinctly indicate pronunciation guidance.

The bold formatting functions as an instructional device rather than a decorative element. It graphically emphasizes pronunciation-sensitive features, like vowel length, retroflex consonants, and intricate phoneme clusters. This approach accommodates three primary groups: novice Tamil learners, youngsters reliant on transliteration due to insufficient script proficiency, and caregivers or educators lacking full fluency in Tamil nevertheless seeking to facilitate reading aloud.

This structured scaffolding promotes precise pronunciation, which is vital for oral fluency, phonemic awareness, and enduring retention. Uniform layout fosters familiarity and lowers cognitive burden. The storybook facilitates more assured and autonomous learning by integrating pronunciation aids right into the text, eliminating the need for other tools or teaching.

PRODUCT DEVELOPMENT

The creation of the multilingual interactive children's storybook was conducted through a systematic, iterative process, guaranteeing educational relevance, technical viability, user accessibility, and cultural inclusivity. The process, based on instructional design principles, user-centered development, and multilingual pedagogy, comprised six interconnected stages: story conceptualization and language adaptation, illustration and visual design, formatting with pronunciation assistance, multimedia integration through QR codes, prototype testing with target users, and final production.

A. Story Conceptualization and Language Adaptation

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The production of the storybook commenced with the creation of creative narratives that resonate with children from diverse cultures, simultaneously fostering cognitive, emotional, and linguistic development. The narratives are aimed at early childhood learners and incorporate universal moral principles including kindness, cooperation, honesty, empathy, and environmental stewardship. Each story uses simple, rhythmic, and repetitive sentence patterns with age-appropriate vocabulary to help emergent readers build comprehension, decoding skills, and vocabulary retention.

The preliminary versions of the narratives were originally composed in Tamil and subsequently translated into English, Tamil transliteration, Malay, and Jawi with the assistance of linguistic specialists and native speakers. The process emphasized preserving precise meaning, ensuring a natural narrative flow, and keeping cultural sensitivity instead of delivering literal translations. Tamil transliteration was created utilizing a phonetic methodology to assist learners acquainted with spoken Tamil, but who have not yet acquired proficiency in the Tamil script. This facilitates readers' comprehension of pronunciation, enabling them to progressively acclimate to the language.

A parallel multilingual framework was employed to ensure consistency in meaning, structure, and educational objectives across languages. This method also guaranteed seamless integration with supplementary multimedia elements, preserving pedagogical consistency throughout the storybook.

B. Visual Design and Illustration

The illustration phase sought to enhance understanding, emotional engagement, and visual attractiveness for preschool and early primary students (Yao et al., 2025). Employing a child-centered design methodology, each scene utilized vibrant colors, prominent outlines, and emotive figures to align with the narrative's tone and progression. Culturally inclusive images guaranteed that youngsters from varied origins may recognize themselves in the narratives.

Illustrations functioned as significant semiotic aids rather than mere embellishments. In a bilingual book, illustrations assist children in deciphering meaning when faced with unfamiliar scripts (Little, 2025). Images were meticulously matched with the narrative, enabling youngsters to independently follow the story. Characters, situations, and emotions were crafted to align with the cultural circumstances of a multilingual audience.

Meticulous consideration was devoted to the arrangement and visual hierarchy. The text and visuals were harmonized to prevent cognitive overload, while white space delineated language portions without disrupting visual continuity. Essential vocabulary and behaviors were graphically reinforced to enhance word acquisition and inferential reasoning. Continuous collaboration between illustrators and linguists guaranteed cultural and semantic precision throughout versions.

C. Formatting and Pronunciation Support

The typography and formatting were meticulously crafted to guarantee reading in a multilingual, multiscript narrative. Informed on Universal Design for Learning (UDL) principles, the design enhanced clarity, accessibility, and equitable cognitive load among languages (Roski et al., 2024). A prominent characteristic was the application of boldface to all Tamil and Tamil transliteration text, serving as an integrated pronunciation aid. This visibly indicated parts necessitating focus on phonetic articulation, particularly beneficial for second-language and heritage learners. Tamil transliteration adhered to a defined phonemic system to facilitate precise pronunciation for those unacquainted with the alphabet.

Each page presented the narrative in five parallel linguistic versions, systematically designed to preserve narrative continuity and facilitate cross-lingual comparison. Subtle visual separators facilitated readers' differentiation of scripts. Sans-serif typefaces were employed for Roman scripts, whereas legible, educationally appropriate fonts were chosen for Tamil and Jawi. Font sizes were modified for optimal print and digital presentation. These formatting changes improved clarity, facilitated pronunciation, and reduced the cognitive burden of accessing several languages.

D. Multimedia Integration and QR-Code Embedding

Multimedia features were incorporated into the storybook via QR-code technology to connect static print with dynamic digital learning. Each QR code deliberately positioned adjacent to significant text or imagery connected to a selected digital resource intended to enhance or elaborate on the narrative. Three primary categories of multimedia were established: Professionally narrated reading videos in five languages, featuring synchronized text highlighting and culturally relevant vocal expression.

AI-Generated Songs—Utilizing platforms such as Suno, creative compositions were created and produced based on narrative themes to enhance moral teachings and vocabulary through a musical, mnemonic approach.

Interactive games and quizzes encompassed drag-and-drop vocabulary exercises, image-word associations, and comprehension activities that enabled youngsters to actively connect with the narrative's content.

All multimedia components were hosted on lightweight, mobile-optimized online platforms that required no login or downloads, so assuring accessibility for families with restricted technological resources. The QR codes were evaluated for cross-platform compatibility (Android and iOS) and integrated discreetly inside the narrative arrangement to preserve visual coherence. This integration facilitates multimodal learning, encourages continuous engagement, and offers youngsters the chance to return and reinforce narrative content beyond the initial reading.

E. Prototype Testing and Iteration

A functional prototype of the storybook was assessed in practical settings to determine usability, engagement, and educational efficacy. User testing comprised 24 children (ages 4–7), 10 parents, and 8 early childhood educators from multilingual households and educational institutions. Testing was performed in domestic environments and preschool classrooms to replicate naturalistic usage.

Observation methods were utilized to document children's interactions with both physical books and digital media. Primary focal points encompassed engagement metrics, QR-code scanning patterns, comprehension, and proficiency in language navigation. Parents and educators filled out formal surveys and engaged in semi-structured interviews to offer qualitative perspectives regarding clarity, accessibility, and learning outcomes.

Numerous usability concerns were recognized during this phase. Younger children required more explicit iconography to identify QR codes, while parents sought modifications to the audio speed in

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narration. These findings guided iterative design modifications, encompassing refined QR icon design, voice modulation in multimedia, and augmented visual indicators for page navigation. The iterative process confirmed the storybook's attractiveness and accessibility while revealing significant prospects for enhancement. Children exhibited heightened motivation to reread books when multimedia elements were present a positive sign of ongoing interest.

F. Final Production

Following feedback from prototype testing, the final iteration of the storybook underwent substantial refining to align with educational, technical, and aesthetic criteria. The final drawings were refined and standardized to ensure visual uniformity between language editions. Typography was refined for enhanced legibility, and final layouts were optimized for print in both A4 and booklet formats.

High-resolution printing was executed on robust, child-safe materials, taking into account classroom handling and domestic use.

Each QR code was retested under diverse lighting situations and devices to verify scanning reliability. All multimedia links have been revised, and hosting has been transitioned to a scalable, secure platform to facilitate long-term maintenance.

Moreover, digital resources including downloadable activity sheets and instructional aids, were created to enhance classroom integration. The finished output was disseminated in both tangible and hybrid media (e.g., PDF + digital links), facilitating versatile application across educational settings.

The outcome is a thorough, interactive, multilingual storybook that adeptly integrates conventional storytelling with contemporary instructional technology. It serves as a repeatable framework for future initiatives aimed at improving literacy through culturally inclusive, media-rich design.

MULTIMEDIA AND QR-CODE INTEGRATION

A. QR-Code Features

QR (Quick Response) codes are crucial in linking printed storybooks to interactive digital learning (Widanti & Fathurrahman, 2024). Positioned deliberately alongside pertinent text and visuals, they enhance the narrative into a multimodal experience tailored for 21st-century learners. Each QR code directs to one of three resources: narrated reading videos, AI-generated music, or interactive games and quizzes. All digital information is precisely aligned with the narrative to ensure cohesion between print and multimedia.

Narrated videos include articulate readings in Tamil, Tamil transliteration, English, Malay, and Jawi, assisting children in perceiving accurate pronunciation and intonation. AI-generated compositions convert narrative themes and lexicon into memorable musical styles that enhance retention and engagement. Interactive games and quizzes enhance understanding via matching, sequencing, and image-word tasks, providing informal assessment possibilities.

QR codes were refined for mobile devices and evaluated across platforms for dependability. Their seamless integration maintains the book’s visual style while facilitating easy access for both children and caregivers, rendering technology-enhanced learning accessible and pragmatic.

STORY CONTENT AND EDUCATIONAL VALUE

The fundamental tales of the multilingual storybook are meticulously crafted to align with the cognitive and socio-emotional developmental phases of early childhood (Xing et al., 2025). Narratives employ age-appropriate themes and lexicon to facilitate emergent literacy while fostering moral and character development. Themes include friendship, kindness, cooperation, honesty, responsibility, family, and interactions with animals are culturally inclusive and consistent with early education curricula.

Rooted in social learning theory, the narratives exemplify prosocial behavior through familiar characters and commonplace scenarios. Children acquire values through the observation and identification with characters, transforming narratives into significant observations on conduct. The texts employ uncomplicated sentences, commonly used language, and intentional repetition to enhance reading fluency, vocabulary acquisition, and retention essential components of emergent literacy.

All five linguistic versions, Tamil, Tamil transliteration, English, Malay, and Jawi preserve uniform meaning and structure. This parallel design facilitates cross-linguistic comparison and enhances metalinguistic awareness. The storybook fosters literacy, emotional development, cultural awareness, and social responsibility in young learners by integrating ethical lessons with captivating storytelling.

TARGET USERS

The multilingual interactive storybook is intended to benefit various partners in early childhood education. The major users are youngsters aged 4 to 8, a critical phase for language, literacy, and socio-emotional development. At this juncture, youngsters have a favorable response to multisensory and narrative-driven learning. The book's accessible language, repetitive structure, ethical concerns, and vibrant images render it developmentally suitable and captivating. Parents and caregivers constitute a significant user demographic, particularly in the context of home-based education. The storybook facilitates collaborative reading and promotes active engagement in children's linguistic development. Tamil transliteration and QR-linked multimedia enable even non-fluent adults to successfully imitate pronunciation and engage in discussions about story themes. Early childhood educators can utilize the storybook in multilingual classrooms for individualized instruction, linguistic comparison, and character education. The straightforward framework and digital functionalities are appropriate for whole-class, small-group, or independent activities.

The storybook is versatile, functioning autonomously or with assistance, thus suitable for classrooms, homes, and informal learning environments, rendering it a scalable and effective early literacy resource.

RESEARCH INSTRUMENTS

A multi-method research approach was employed to assess the educational effectiveness, usability, and engagement of the multilingual interactive storybook (Pratiwi et al., 2025). The research included qualitative and quantitative methodologies specifically designed for early childhood settings and the diverse user groups engaged. To ensure a comprehensive evaluation of the

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storybook's design and learning outcomes, multiple instruments were used, including an observation checklist, structured questionnaire, comprehension assessments, and a semi-structured interview guide. The use of these different instruments enabled data triangulation and provided a more in-depth understanding of the effectiveness of the storybook.

A. Observation Checklist

An observation checklist was implemented throughout prototype testing sessions to thoroughly document children's interactions with both the physical and digital components of the storybook. This instrument recorded immediate behavioral metrics including attention span, emotional involvement, frequency of QR-code scanning, navigation efficacy, and unprompted verbal reactions to multimedia stimuli.

Observers, including both researchers and teachers, identified several indicators of children's interest and engagement, such as focused attention on the illustrations, repeating words or phrases aloud, laughing, and imitating song lyrics or the dialogue of story characters. The study also examined how independently children were able to access the multimedia materials through QR codes and whether they needed support from adults. In addition, engagement levels were evaluated through behaviours such as revisiting pages, repeatedly scanning QR codes, and maintaining uninterrupted reading throughout the activity.

This instrument offered critical insights regarding the storybook's allure, engagement, and applicability for young learners. It also provided insights for enhancements in QR placement, illustration design, and the pacing of digital content. The checklist data facilitated the verification of the storybook's format alignment with age-appropriate engagement standards for early literacy interventions.

B. Questionnaire for Teachers and Parents

A systematic questionnaire was distributed to educators and parents participating in the user testing phase (Harlacher, 2016). The questionnaire sought to evaluate user happiness, perceived learning outcomes, and usability across several languages and multimedia elements. The assessment had 20 items evaluated on a 5-point Likert scale (from strongly disagree to strongly agree) along with other open-ended questions for qualitative insights.

The primary characteristics assessed were linguistic clarity, multilingual consistency, efficacy of pronunciation assistance (notably via bolded Tamil and transliteration), utility of QR-code integration, and overall educational merit. Participants assessed the degree to which the storybook facilitated independent reading, emotionally engaged youngsters, and accommodated various linguistic backgrounds.

The questionnaire feedback was crucial in recognizing strengths and areas needing enhancement. Most participants valued the cultural tolerance and multimedia diversity; nevertheless, several suggested modifications to the QR code dimensions to enhance accessibility. The questionnaire emphasized the storybook's importance as a conduit for non-fluent parents to facilitate language acquisition at home, hence affirming its use as a family literacy instrument.

C. Children's Comprehension Questions

Comprehension questions were integrated into QR-linked interactive games to assess the storybook's cognitive and linguistic effects. These examinations, intended for young children, employed multiple-choice questions, picture matching, and basic vocal replies. All inquiries were intricately connected to the narrative's occurrences, lexicon, and ethical motifs.

For example, following a narrative about collaboration, children may recognize a supportive character, choose an illustration depicting the primary issue, or finish a sentence employing a novel vocabulary term. Activities were structured for varying literacy levels and delivered in a gamified way to maintain motivation and alleviate fear.

The digital platform collected quantitative data including accuracy, completion time, and repeat patterns, providing metrics for memory, comprehension, and vocabulary development. This was particularly beneficial for emergent readers who depend more on auditory and visual stimuli than on text decoding.

Integrating assessment into play conforms to developmentally appropriate practice (DAP), ensuring that evaluation remains child-friendly and unobtrusive while still producing significant learning data.

D. Interview Guide

Semi-structured interviews were used to obtain a more profound understanding of user experiences with the storybook (Ruslin et al., 2022). A customizable interview guide was employed with chosen parents, educators, and children to investigate perceptions about usability, content relevancy, pronunciation assistance, and QR-linked multimedia. This methodology enhanced observations and questionnaires by including individual viewpoints and contextual insights.

Questions were tailored for each group. Parents deliberated on their capacity to facilitate multilingual reading at home, their child's responses to digital elements, and any challenges encountered. Educators discussed the alignment of the storybook with their pedagogical approaches, linguistic support requirements, and student involvement. Children reacted to basic suggestions regarding preferred characters, music, and narrative points. The findings indicated a significant enthusiasm for the hybrid print-digital design and accessibility features, including bolded transliteration and convenient QR access.

Recommendations encompassed pace controls for read-aloud movies and an increase in multimedia material. These observations informed enhancements and subsequent recommendations. The interviews yielded significant human-centered data, guaranteeing that the storybook was both educationally effective and culturally relevant.

PRODUCT EVALUATION

The assessment of the multilingual interactive children's storybook was carried out through a thorough, multi-stage procedure designed to evaluate its educational efficacy, usability, engagement, and accessibility. The assessment strategy incorporated both formative and summative methodologies and encompassed feedback from essential user groups: children, parents, and early childhood educators. The aim was to evaluate the developmental process and the final product by internal technical review and external user experience analysis, adhering to the principles of participative and iterative design in educational product creation.

A. Evaluation Design

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The evaluation framework utilized a mixed-methods approach comprising both formative and summative evaluations (Schildkamp et al., 2020). Formative assessment was integrated during the design and prototype development phases, where initial user feedback guided iterative enhancements in layout, multimedia integration, language formatting, and navigation. The preliminary assessments were essential for enhancing the QR code functionalities, modifying typographic emphasis for clarity in pronunciation, and confirming the content's suitability for various age groups.

A summative evaluation was performed following the completion of the final prototype. This phase evaluated the overall efficacy of the storybook in practical school environments. Data was gathered from a representative sample comprising 24 children aged 4 to 8, 10 parents, and 8 early childhood instructors. Evaluation methods comprised observation checklists, questionnaires, integrated digital assessments, and semi-structured interviews, facilitating the collection of both quantitative and qualitative data.

The evaluation design was based on user-centered design principles and conformed to requirements for early literacy tools evaluation. The participation of all three primary user groups facilitated triangulated insights, guaranteeing a thorough evaluation of both educational and usability dimensions of the product. This dual-layer evaluation technique offered a comprehensive insight into the operational dynamics of the storybook, the children's interaction with its elements, and potential areas for enhancement.

B. Internal Evaluation

The internal evaluation concentrated mostly on the technical, design, and instructional aspects inherent in the storybook. A team of linguists, instructional designers, visual artists, and multimedia developers conducted a systematic examination of the final prototype utilizing a defined criterion. The primary dimensions assessed encompassed linguistic consistency among the five versions (Tamil, Tamil transliteration, English, Malay, and Jawi), precision of bolded Tamil and transliteration formatting, QR code operation, and multimedia accessibility.

Language specialists guaranteed the translations retained semantic equivalence while upholding cultural and contextual relevance. The bolding approach for Tamil and its transliteration was examined for uniformity in application and adherence to pronunciation requirements. This element was crucial to guarantee that the text adequately facilitated phonological awareness and oral fluency in novice readers.

Technical evaluations were performed to assess QR-code functionality across various devices and operating systems, including Android and iOS smartphones and tablets. Multimedia components including films, music, and games were assessed for loading duration, device responsiveness, and content alignment with the textual narrative. Accessibility factors, including font size, contrast, and navigation flow, were evaluated to guarantee inclusive design for early readers and users with diverse digital literacy levels.
The internal review procedure guaranteed that the final product adhered to quality assurance standards for content integrity and user experience. Results from this phase guided slight adjustments before external implementation and confirmed the technical feasibility of the print-digital hybrid concept.

C. External Evaluation

The external review gathered authentic user comments from both home and classroom environments, emphasizing usability, clarity, pronunciation assistance, and educational merit. Ten parents and eight early childhood educators engaged in structured questionnaires and subsequent interviews.

Respondents evaluated linguistic intelligibility across five versions, the utility of bolded pronunciation cues, the engagement of multimedia content, children's autonomy, and overall happiness using a 5-point Likert scale. Parents observed that the storybook facilitated the bridging of language disparities at home, particularly for households not fluent in Tamil. Transliteration and QR-linked narration facilitated guidance in reading without complete language proficiency. Educators appreciated the parallel language format for cross-linguistic analysis and deemed multimedia beneficial for varied learners.

Recommendations encompassed the incorporation of additional multilingual audio functionalities, including code-switching instances, and the development of a specialized mobile application for enhanced navigation. The findings demonstrated that the storybook is accessible, pedagogically robust, and suitable for both formal and informal educational settings.

D. Children’s Response and Engagement

The children's answers were assessed using observation, computerized evaluations, and informal verbal feedback in three domains: cognitive, emotional, and behavioral engagement. The results indicated significant interest, particularly when youngsters independently discovered and scanned QR codes. Numerous individuals revisited multimedia content repeatedly.

Narrated videos gained significant popularity, as children emulated tone and rhythm, showcasing phonological knowledge and speech proficiency. AI-generated tunes garnered significant interest, as toddlers sang or moved in response, demonstrating emotional involvement and memory retention. Interactive games, including drag-and-drop vocabulary, sequencing, and image recognition, maintained attention and enhanced comprehension through prompt feedback. Emboldened Tamil and transliterated text served to assist initial readers and enhance their confidence.

Casual remarks indicated that youngsters appreciated the characters, pictures, and songs, with some articulating language preferences, underscoring the need for multilingual options. The storybook's success in promoting self-directed, multimodal literacy experiences in early childhood was underscored by repeated voluntary usage, sustained focus, and active involvement.

E. Evaluation Outcomes

The aggregated results from internal and external assessments identified many significant outcomes that validate the educational efficacy and design excellence of the multilingual interactive storybook:

The five-language parallel framework facilitated children's exploration and comparison of various scripts and terminology, promoting early multilingual awareness and vocabulary acquisition. Educators indicated that this format facilitated individualized education and language transition tactics.

The typographic emphasis on Tamil and its phonetic transliteration was endorsed by both parents and educators as an effective pronunciation guide. It facilitated more precise oral reading and contributed to closing literacy gaps, especially in households where

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Tamil is a legacy language rather than the predominant mode of communication.

The incorporation of narrated movies, AI-generated music, and interactive games markedly enhanced student motivation and understanding. Children immersed themselves in the digital components, which facilitated both auditory and tactile learning modalities.

The storybook's straightforward design and QR capability facilitated independent navigation between print and digital information for several children, requiring minimal adult assistance. Parents observed a diminished requirement for adult oversight, fostering independence in education.

Affirmative User Feedback and Sustained Usage Intentions: Among user demographics, there was a robust agreement on the storybook's efficacy as an educational resource. Participants indicated a desire for subsequent volumes and advocated for the format's broader application in multilingual literacy programs.

These results validate that the storybook not only achieves its educational goals but also has potential as a scalable paradigm for future educational technology products in multilingual environments.

EDUCATIONAL IMPACT

The multilingual interactive children's storybook exhibits significant educational benefits by enhancing early literacy, fostering multilingual development, refining pronunciation, promoting learner autonomy, and boosting motivation through a multimodal design. Its inclusive and adaptable framework corresponds with international educational principles that highlight accessibility, cultural significance, and learner-centered pedagogy. The storybook integrates print and digital components to address the requirements of contemporary young learners while upholding robust pedagogical principles.

The storybook uses simple, age-appropriate vocabulary, short sentences, and purposeful repetition to support young children in developing early literacy skills. Its clear and predictable storyline helps children build comprehension, understand sequencing, and develop familiarity with story structures, which are important foundations for reading readiness. In addition, multimedia features such as narrated videos and interactive games make learning more engaging and interactive. These elements encourage print awareness, support active decoding, and help improve word recognition and reading fluency in both the first and second language.

The presentation of each narrative in Tamil, Tamil transliteration, English, Malay, and Jawi introduces youngsters to other scripts and linguistic systems. This parallel style enhances metalinguistic awareness by enabling learners to recognize similarities and differences among languages. It acknowledges home languages while promoting school languages, enhancing linguistic confidence and cultural inclusion in different educational settings.

Pronunciation and oral language are facilitated by bolded Tamil and transliteration text serving as visual aids, complemented by QR-linked narration that offers precise auditory exemplars. Collectively, these attributes augment phonological awareness and verbal fluency. Simultaneously, QR codes promote learner autonomy by enabling youngsters to autonomously access music, narratives, and activities.

This choice-based engagement fosters intrinsic motivation and autonomous learning. The storybook provides a viable and scalable paradigm for merging traditional and digital literacy in early childhood education by maintaining the tactile and emotional significance of physical books while enhancing learning through digital media.

CONCLUSION

The multilingual interactive children's storybook represents an innovative approach to early childhood education by combining traditional literacy practices with digital technology. Designed for today's linguistically and culturally diverse learning environments, the storybook includes Tamil, Tamil transliteration, English, Malay, and Jawi to support multilingual literacy, promote cultural inclusivity, and preserve language heritage among young learners.

Age-appropriate narratives, explicit graphics, and emphasized pronunciation-centric layout facilitate the development of decoding, comprehension, and oral language competencies in young learners. The emphasized Tamil and transliteration text serve as effective pronunciation aids, allowing children, parents, and educators to read with increased confidence, even in the absence of robust language proficiency. This is particularly advantageous in multilingual and diaspora settings.

QR-coded multimedia elements, including narrated films, music, and interactive games, augment engagement and facilitate self-directed, multimodal learning. Evaluation results indicate heightened motivation, enhanced language exposure, and favorable user experiences both at home and in educational settings. The project exemplifies how culturally responsive design and accessible technology may develop a scalable, engaging early literacy tool that effectively integrates print and digital learning for young children.

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