

From Expert Refinement to Real-World Use: User-Informed Refinement of a Malay Early Reading Module for Children with Dyslexia

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DOI: <https://doi.org/10.47772/IJRISS.2026.100800436>

Received: 23 August 2026; Accepted: 28 August 2026; Published: 08 September 2026

ABSTRACT

Educational module development does not necessarily end when content and design have been reviewed and refined by experts. Expert evaluation and user evaluation address complementary questions, and real-world use may reveal implementation difficulties that are not fully visible before use. This study examined user-informed refinement needs for BACAdys, a structured Malay early reading module designed to support parents in guiding children with dyslexia at home. The study reports a focused qualitative analysis from Phase 3 of a broader Design and Development Research (DDR) project. Six purposively selected parents used the expert-refined BACAdys prototype with their children at home for two weeks and subsequently participated in semi-structured interviews. The original Phase 3 thematic analysis produced six usability themes; the present paper focuses specifically on evidence related to refinement and product development. Four refinement areas were identified. First, additional practice was required selectively for reading patterns that remained unstable, particularly more complex sound combinations. Second, instructional videos were valued but required shorter, topic-specific and slower demonstrations at points of difficulty. Third, visual and manipulative activities needed controlled adaptation because the same activities produced different responses across children. Fourth, requests for higher-level reading materials were better interpreted as future product expansion rather than deficiencies in the current early reading module. The findings indicate that post-use refinement should be targeted rather than additive. User feedback was most useful when it identified a specific implementation difficulty and supported a corresponding design decision rather than simply increasing the amount of content, visual material or digital support. By distinguishing targeted refinement, conditional refinement and future product expansion, the study offers a decision-oriented approach to post-use refinement and highlights real-world user evaluation as a complementary stage after expert refinement in educational product development.

Keywords: dyslexia, Malay language, parent-mediated literacy, module refinement, user feedback

INTRODUCTION

Dyslexia is characterised by persistent difficulties in accurate and fluent word recognition, decoding and spelling, although the nature and severity of these difficulties vary across learners (Snowling et al., 2020). For children who require continued reading support, learning cannot always be confined to formal instructional settings. Families frequently become involved in reading practice, homework support and other literacy activities at home. Recent evidence indicates that family-implemented literacy interventions can contribute positively to school-aged children's literacy outcomes, while also showing substantial variation in how interventions are structured, taught and implemented across families (Dahl-Leonard et al., 2025; Guo & Keles, 2025). Parent coaching has also produced positive literacy outcomes for children with and without dyslexia in a Hong Kong Chinese context, illustrating the potential contribution of structured parental support when families receive clear guidance (Ruan et al., 2024).

However, asking parents to support literacy at home does not mean that instructional materials are automatically usable in family settings. Parents may need to understand the target skill, follow an instructional sequence, recognise when repetition is required and respond to children's attention, motivation and emotional readiness. Caregiver-implemented interventions therefore need to address implementation barriers explicitly and provide procedures that can be carried out outside professional instructional settings (Justice et al., 2015). A recent systematic review of interventions for parents of children with learning disorders similarly emphasised the importance of practical support and parent education in helping families respond to learning-related demands (Guerra et al., 2025). This issue is particularly important in dyslexia, where parent-centred and home-based perspectives remain comparatively peripheral to the broader research literature, which has historically been dominated by child-centred, clinical and school-based traditions (Othman et al., 2026).

In educational product development, these implementation realities raise a distinction between expert refinement and user refinement. Expert review can strengthen content accuracy, pedagogical coherence and theoretical alignment before implementation, whereas evaluation with intended users can reveal how a resource functions under actual conditions of use. Contemporary design-based research treats development as an iterative cycle of design, implementation, evaluation and refinement, while usability research emphasises that user experience cannot be inferred solely from product characteristics or expert judgement (Tinoca et al., 2022; Lu et al., 2022). Expert and user evaluation therefore provide complementary rather than interchangeable forms of evidence.

This distinction is relevant to early reading resources for children with dyslexia. Structured reading instruction generally requires explicit, systematic and cumulative progression, with previously introduced skills consolidated before more complex patterns are introduced (Moats, 2020). Evidence from Malay reading research is particularly relevant because Malay combines relatively consistent grapheme-phoneme relations with increasingly complex syllable structures. Lee and Wheldall (2011) identified syllable awareness, phoneme blending and systematic grapheme-phoneme instruction as important for low-progress Malay readers, while Lee (2019) demonstrated how these linguistic characteristics can be translated into a structured Malay word-recognition intervention for children with dyslexia. When such instruction is mediated by parents, the resource must make enough of this instructional logic visible for a non-specialist user to act on it. At the same time, refinement should not be equated with adding more material. Additional pages, visual elements, activities, or videos may increase complexity if they are not linked to a specific implementation difficulty. Research on dyslexia-friendly visual design, for example, suggests that spacing, simple layouts, clear hierarchy and controlled visual presentation are more consistently helpful than simply increasing the amount of colour or illustration (Elma et al., 2026). Similarly, multimedia support is most useful when it reduces unnecessary processing and provides information at the point where it is needed (Mayer, 2014).

The present study is situated in the development of BACAdys, a structured Malay early reading module for children with dyslexia. An earlier needs analysis with parents identified uncertainty about how to teach reading at home, limited access to suitable reading materials, a lack of practical guidance and the need for progressive content, visual support, multisensory activities and QR-linked instructional videos (Othman et al., 2025). These needs were subsequently translated into an initial prototype. The prototype was then refined through interviews with five experts and evaluated through a Fuzzy Delphi process involving 19 expert panellists before proceeding to home-based usability evaluation.

In the BACAdys development process, expert agreement established the perceived appropriateness of the proposed design elements before home implementation. It did not, however, substitute for evidence about how parents would interpret, use and adapt the refined resource with a particular child. This distinction is consistent with contemporary educational design literature, which positions authentic-context evaluation as a separate source of evidence for iterative refinement (Tinoca et al., 2022; Lu et al., 2022). The transition from expert refinement to home use therefore generated evidence grounded in actual implementation. After parents used the refined BACAdys prototype, their feedback became more specific: rather than asking generally for more practice, visual support or video guidance, they identified where reinforcement was still

needed, how digital support could be reorganised, which activities worked differently across children and which requests represented a need for a future product rather than further modification of the existing early reading module.

This paper therefore focuses on one question: What refinement needs can be identified from parents' experiences after using an expert-refined Malay early reading module with their children at home? Rather than reporting the full usability findings from Phase 3, the article examines post-use feedback as evidence for design decisions. The central premise is that user-informed refinement is most useful when it distinguishes among components that require targeted strengthening, features that require conditional adaptation and suggestions that are better treated as future product expansion.

METHODOLOGY

Research design

This study reports a focused qualitative analysis from Phase 3 of a broader Design and Development Research (DDR) Type 1 project concerned with the development of BACAdys. DDR was selected because the wider study involved the systematic development, evaluation and refinement of an educational product across interconnected phases rather than the evaluation of a single pre-existing intervention. This iterative orientation is consistent with contemporary design-based research, in which educational interventions are developed through recurring cycles of design, implementation, evaluation and refinement in relation to the contexts in which they are intended to operate (Richey & Klein, 2007; Tinoca et al., 2022).

In the wider project, Phase 1 identified parents' needs and gaps in existing Malay reading resources. Findings from this phase, together with relevant literature and instructional foundations, informed the development of the initial BACAdys prototype. Phase 2 involved formative refinement through interviews with five experts followed by a Fuzzy Delphi evaluation involving 19 expert panellists. The resulting expert-refined prototype then proceeded to Phase 3, in which intended users implemented BACAdys with their children in the home context. Figure 1 summarises the progression from needs analysis and prototype development to expert refinement, home use and subsequent user-informed refinement.

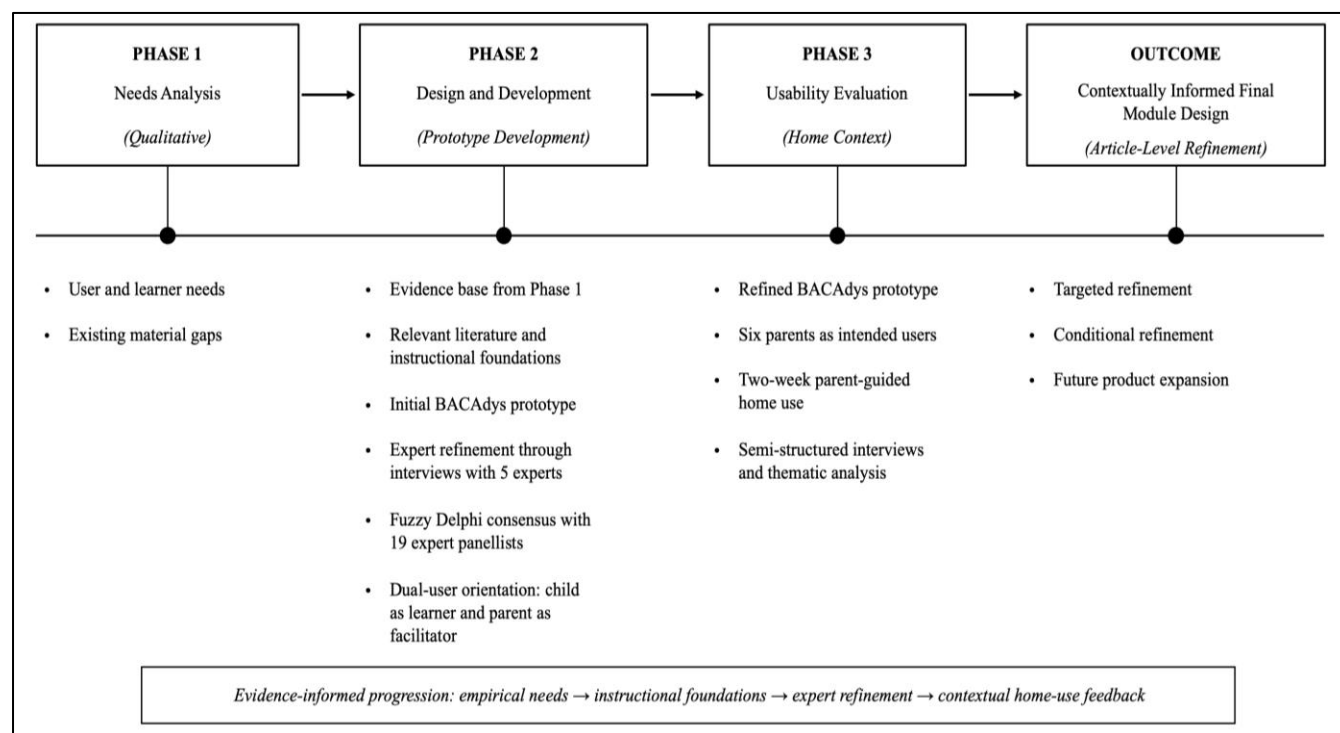


Figure 1. Overview of the BACAdys development and refinement process within Type 1 Design and Development Research.

The present article focuses specifically on the post-use evidence generated during Phase 3. It does not reanalyse the Phase 1 needs study or the Phase 2 expert-consensus findings. Instead, the earlier phases provide the developmental context for understanding how the prototype reached the version evaluated by parents and why subsequent home use represented a distinct stage of evidence generation.

Phase 3 employed a qualitative user-evaluation approach because the purpose was to examine how the expert-refined prototype functioned when implemented by parents with their children rather than to reassess content validity or determine reading effectiveness. Educational usability research emphasises the importance of examining how intended users experience and interact with designed resources within their context of use rather than inferring usability solely from design characteristics or expert assessment (Lu et al., 2022). Because the evaluation sought detailed accounts from users with direct experience of implementing a specific educational product, participants were selected purposively according to their relevance to the research question and their experience of supporting Malay reading at home (Campbell et al., 2020). The sampling strategy and justification for the six-parent sample are described in the following subsection.

BACAdys is organised progressively across four volumes. The sequence begins with letter and sound recognition and develops through open syllables, closed syllables and more complex Malay reading patterns including digraphs, diphthongs and vowel combinations. The prototype also incorporates reading and writing reinforcement, visual and manipulative activities, parent-oriented instructions, monitoring tips, progress records and QR-linked instructional videos. The version evaluated in Phase 3 had already undergone expert refinement and Fuzzy Delphi consensus before being introduced to parents for home use.

Participants

Six parents were selected purposively because the study required information-rich accounts from individuals who had direct experience with the phenomenon under investigation. Purposive sampling is appropriate when participant selection is aligned with the research aim and with participants' capacity to provide relevant experiential information rather than statistical representativeness (Campbell et al., 2020). The sample consisted of five mothers and one father, all of whom were primary caregivers of children with dyslexia and had direct experience supporting reading at home. They also represented the intended adult users of BACAdys. All six had participated in the earlier needs-analysis phase, allowing continuity between needs identified before development and experiences reported after use of the refined prototype. Their role differed across phases: Phase 1 elicited challenges and design needs, whereas Phase 3 elicited feedback based on actual module use.

The adequacy of the six-parent sample is justified in relation to the focused purpose of Phase 3 and the specificity of the participant group. Information power provides a framework for considering qualitative sample adequacy according to the study aim, sample specificity, use of theory, quality of dialogue and analysis strategy rather than a fixed numerical threshold (Malterud et al., 2016). Contemporary guidance likewise recommends that qualitative sample size be explicitly justified in relation to the design and research purpose rather than treated as a universal number (Mthuli et al., 2022). The present study was not intended to provide statistical generalisation; instead, it sought in-depth post-use accounts from a narrowly defined group of intended users. The limitations associated with the small and returning participant group are acknowledged and evaluation with new users is recommended.

Table 1. Participant and Home-Use Context

Participant	Caregiver	Child educational context	Home language
P1	Father	Special education programme with additional support	Malay / English
P2	Mother	Special education programme with additional support	Malay

Participant	Caregiver	Child educational context	Home language
P3	Mother	Mainstream classroom with additional support	Malay
P4	Mother	Special education programme with additional support	Malay
P5	Mother	Mainstream classroom with additional support	Malay
P6	Mother	Homeschool with additional support	Malay / English

Home-use procedure and data collection

Each parent used the refined BACAdys prototype with their child at home for two weeks. The home-use period allowed parents to encounter the module's instructions, progressive content, reinforcement activities, visual features, videos and monitoring tools within ordinary family routines. The purpose was not to impose a standardised intervention dosage or test reading effectiveness. Instead, the home-use period was intended to generate post-use feedback on how the refined product functioned in practice.

After the two-week period, semi-structured interviews were conducted with all six parents. The interview protocol was reviewed before data collection for content relevance, language clarity, appropriateness of terminology, question sequence and alignment with the objectives of Phase 3. Interview prompts addressed clarity of instructions, ease of use, activity suitability, visual design, digital support, progress monitoring, feasibility within home routines and suggestions for improvement. With participants' consent, the interviews were audio-recorded and transcribed verbatim. Interviews were conducted mainly in Malay with natural code-switching where it occurred. Selected excerpts were translated into English for reporting while preserving the intended meaning. The original Phase 3 analysis generated six usability themes. For the present article, attention was restricted to refinement-related evidence and to selected experiences from other themes when those experiences explained why a particular refinement was proposed.

Data analysis

Interview data were analysed thematically using the broad six-phase approach developed by Braun and Clarke (2006). More recent reporting guidance was used to strengthen transparency around analytic coherence, theme development and reporting of the thematic process (Braun & Clarke, 2024). Transcripts were coded systematically and an audit trail was maintained to support analytic traceability. The original Phase 3 analysis generated six themes: implementation support, ease of home use, suitability of activities for the child's level and needs, visual design and learning support, feasibility within home reading routines and needs for refinement and further development.

The present paper uses a focused analytic synthesis rather than presenting the full six-theme usability analysis. Refinement-related feedback was examined in relation to the problem experienced during use and the design implication that followed. Three decision categories were used to organise this synthesis: targeted refinement, where an existing component required strengthening or clarification; conditional refinement, where adaptation depended on differences in user response; and future product expansion, where a request extended beyond the scope of the current early reading module. These categories are an article-specific synthesis developed for the present research question and do not replace the original Phase 3 thematic structure.

Ethical Considerations

The study was conducted in accordance with established research ethics principles. Written consent was obtained from all participants, who were informed of the purpose of the study, confidentiality of the information provided and their right to withdraw at any time. Participant identities were protected through

the use of codes P1–P6 in place of real names. Identifying information relating to the participants, their children, schools and families was not reported. All data collected were securely stored and used solely for academic and research purposes.

RESULTS

The focused analysis identified four areas in which parents' post-use feedback informed decisions about further development of BACAdys: targeted reinforcement for reading skills that remained unstable, refinement of instructional video support, controlled adaptation of visual and manipulative activities and requests for higher-level materials that represented future product expansion. The findings did not indicate a need to restructure the module as a whole. Instead, parents identified specific points at which the refined prototype could be strengthened or where additional development should occur beyond the scope of the existing module.

Illustrative excerpts are presented in English translation while retaining the original participant, phase, theme and subtheme codes.

Targeted Reinforcement for Unstable Reading Skills

Parents did not request additional practice throughout all four volumes. Their suggestions were concentrated on particular reading patterns that remained difficult after use, especially the more complex sound combinations introduced in the later volume.

P1 explained:

“So far, I think it is okay. Maybe there could be more practice for the parts she is still not strong in. If she can already do the basics, there is no need for too much. But she still gets confused with sounds like nga and ngu in the last volume.” (P1:F3:T6:ST1)

P2 similarly reported that additional examples would be useful for patterns such as nga and nya because the child continued to confuse these forms and required repeated practice before they became stable. P4 also suggested additional exercises only for the sounds that continued to cause difficulty and considered the remaining parts of the module satisfactory.

These accounts indicate that parents were not requesting a general increase in the amount of practice. Rather, they were identifying specific points where mastery remained uncertain and where further reinforcement would be useful.

This interpretation was supported by parents' broader experiences of repetition during home use. P6 described how performance could vary across sessions:

“Today she can do it, tomorrow it might be gone again. So repeat.” (P6:F3:T3:ST3)

The refinement need was therefore localised rather than general. Additional practice was required at points where particular sound patterns remained unstable, without increasing the density of exercises throughout sections that children had already mastered.

Refinement of Instructional Video Support

QR-linked instructional videos had already been incorporated into BACAdys as supplementary support for parents. After using the refined prototype, parents continued to value the videos but identified ways in which they could be made more responsive to actual use.

P1 explained:

“If possible, shorter videos would be easier. You do not need to watch a long video just to find one method.” (P1:F3:T6:ST2)

P2 expressed a similar preference for shorter videos organised around specific topics so that the required demonstration could be accessed directly. For P3, however, the issue was not only video length but also the pace of particular demonstrations:

“I think the video is good and necessary. If possible, some parts could be shown more slowly or for slightly longer because sometimes I want to follow the pronunciation.” (P3:F3:T6:ST2)

P5 likewise suggested that additional video support would be particularly useful for sounds that were difficult to pronounce.

The post-use issue was therefore not the absence of digital support. Instead, parents required more precise access to support at the point of difficulty. Their feedback indicated a need for shorter topic-specific videos, together with slower demonstrations for selected pronunciation patterns, rather than simply increasing the overall quantity of video content.

Controlled Adaptation of Visual and Manipulative Activities

Parents generally valued the variety of activities provided in BACAdys, including pictures, colouring, cutting, pasting, reading and writing tasks. However, experiences during home use showed that the same activity did not function in the same way for every child.

P5 reported that activities involving cutting, drawing and video support were particularly engaging for the child and suggested retaining or expanding similar options. At the same time, the parent cautioned against excessive use of any one activity:

“Both are fine, but do not put too much of each. Give a little at a time.” (P5:F3:T6:ST3)

Contrasting experiences demonstrated why such activities required controlled rather than uniform expansion. P1 reported that cutting was acceptable but colouring was less preferred because the child favoured activities that could be completed more directly. In contrast, P3 described cutting as presenting an additional challenge:

“The cutting part was a little challenging. She found it difficult to use the scissors, but it was okay. We could do it slowly.” (P3:F3:T3:ST2)

For P5, the same types of activities had a different effect. Colouring and cut-and-paste tasks increased the child’s willingness to participate because extended reading activities were less preferred.

These differences indicate that visual and manipulative activities should not be treated as universally suitable simply because they offer variety or multisensory engagement. The post-use feedback instead supported retaining several activity formats as options while controlling their quantity and ensuring that each activity remained connected to the intended reading skill.

Future Product Expansion Beyond Early Reading

The final group of suggestions concerned continued literacy support beyond the current scope of BACAdys. Parents whose children were able to progress through substantial parts of the module expressed interest in materials that could extend to more advanced levels of schooling.

P4 hoped that similar support could eventually continue into secondary education because children with dyslexia may still require structured assistance at later stages.

P6 expressed this expectation more explicitly:

“Everything is okay. But I do hope there will be a higher-level module for secondary school that aligns with the school syllabus. I believe my child can do so much better.” (P6:F3:T6:ST4)

The parent further explained:

“They still need support. When they enter secondary school, the texts are longer and the questions are more complex.” (P6:F3:T6:ST4)

These suggestions differed from requests to refine an existing component. BACAdys was developed specifically to support foundational Malay reading. Extending the resource to longer texts, more advanced comprehension, writing and secondary-school curriculum demands would require new instructional objectives, content, sequencing and evaluation procedures.

Accordingly, these suggestions were interpreted as future product expansion rather than evidence of deficiencies in the current early reading prototype.

Table 2. Summary of Post-Use Feedback and Development Decisions

Post-use feedback	Issue identified	Development decision	Classification
Additional practice requested for specific patterns such as nga, ngu and nya	Mastery remained unstable for selected reading patterns	Add targeted examples and practice to the identified patterns without expanding all sections	Targeted refinement
Videos were useful but some were too broad or required slower demonstrations	Existing digital support was not sufficiently precise at particular points of difficulty	Segment videos by topic, shorten general demonstrations and slow selected pronunciation examples	Targeted refinement
Children responded differently to colouring, cutting, pasting and other visual or manipulative activities	No single activity format was equally suitable for all children	Retain activity variety while controlling quantity and allowing adaptation according to learner response	Conditional refinement
Parents requested materials extending to higher reading and schooling levels	Requested content extended beyond the intended early reading scope	Develop higher-level materials through a separate future development process	Future product expansion

Overall, the findings show that parents’ post-use feedback became more specific once the refined module was implemented with their children at home. Rather than requesting broad changes to BACAdys, parents identified particular areas where existing components could be strengthened, adapted, or extended. The resulting feedback therefore provided a basis for distinguishing between changes that could be incorporated into the current prototype and suggestions that would require a separate cycle of future development.

DISCUSSION

The findings show that post-use evaluation generated a different form of evidence from that available during needs analysis and expert refinement. Before development, parents could describe what they lacked, including clearer instructional guidance, more appropriate reading materials, progressive activities, visual

support and digital demonstrations (Othman et al., 2025). Experts could then assess whether the proposed objectives, content, activities and supports were pedagogically appropriate. After actual use, however, feedback became more localised and actionable: parents could identify where mastery remained unstable, which digital support needed reorganisation, which activities functioned differently across children and which requests exceeded the purpose of the current product.

This progression reflects the iterative logic of educational design. Foundational DDR positions evaluation and refinement as integral to product development (Richey & Klein, 2007), while more recent design-based research similarly emphasises iterative cycles in which implementation and contextual evidence inform subsequent design decisions (Tinoca et al., 2022). Usability research also shows that evaluation with users contributes information about interaction and experience that cannot be established from design-oriented assessment alone (Lu et al., 2022). Expert refinement and user evaluation should therefore be understood as complementary: the former strengthens the anticipated appropriateness of a design, while the latter examines how that design functions when enacted under actual conditions of use.

The first refinement area supports the value of targeted rather than general reinforcement. Structured reading instruction depends on systematic and cumulative progression, but cumulative instruction does not imply identical amounts of practice for every learner (Moats, 2020). Recent literacy implementation guidance likewise emphasises the need to select and plan intervention in relation to identified learner needs and implementation conditions (Whittingham et al., 2024). Parents' requests in the present study were concentrated at points where a child still confused particular sound patterns. This is consistent with family-implemented literacy research in which parents are provided with structured guidance while practice remains responsive to the target skills requiring support (Dahl-Leonard et al., 2025; Ruan et al., 2024). For BACAdys, the refinement implication is therefore to strengthen weak points rather than enlarge every section.

The video findings show a similar movement from additive design to functional design. Multimedia should address a specific instructional or communication problem rather than exist as a feature for its own sake. Segmentation research demonstrates that shorter, meaningfully organised instructional-video units can support learning by managing the amount and sequence of information presented (Prabawa et al., 2024). Parent-training research using asynchronous digital modules also illustrates the value of accessible, structured guidance for family-mediated implementation (Fischbacher et al., 2024). These findings complement established multimedia-learning principles (Mayer, 2014) and recent dyslexia user-experience evidence showing that actual use can reveal needs for personalised support and presentation adjustments (Liu et al., 2025). For BACAdys, refinement should therefore improve access to the exact demonstration needed rather than simply increase the number or length of videos.

The visual and manipulative findings further demonstrate that a feature should not be treated as universally dyslexia-friendly simply because it is visually engaging or multisensory. The same cutting activity increased engagement for one child and created additional motor difficulty for another. Recent synthesis of dyslexia-friendly reading design suggests that simple layouts, spacing and clear visual hierarchy have more consistent support, while colour and illustrations should be used selectively and without unnecessary distraction (Elma et al., 2026). Recent dyslexia-focused inclusive-design research likewise emphasises the need to match interaction features to diverse learner needs rather than assume that the same multisensory feature will function identically for every user (Husni et al., 2026). Thus, user feedback supports conditional refinement: provide alternatives and preserve the reading target without requiring every child to engage with the same activity format.

The distinction between refinement and future expansion is also important. User feedback can easily lead developers to expand a product until its scope becomes unclear. Requests for secondary-school material were meaningful because they signalled an ongoing support need, but they did not demonstrate that an early reading module was incomplete. Iterative educational design provides a basis for carrying such needs into a subsequent development cycle in which new objectives, content and evaluation criteria can be specified

explicitly (Tinoca et al., 2022). Treating higher-level materials as future development therefore preserves the coherence of the existing product while recognising an important direction for continued support.

Overall, the findings suggest that post-use refinement is most useful when feedback is translated into a design decision. The logic can be expressed as a feedback-to-decision pathway: user feedback, implementation issue and design response. This differs from simply asking whether users liked a resource or whether more content should be added. Participatory development work with parents and other stakeholders in special education similarly shows that user involvement can improve the contextual relevance of intervention components when feedback is connected to concrete design choices (Musendo et al., 2025). In the present study, the most valuable feedback identified the location and nature of difficulty, allowing refinement to remain targeted, conditional or future-oriented rather than uniformly additive.

This approach also has practical implications for parent-mediated educational resources. Home-literacy research shows that structured activities and clear guidance can strengthen parental engagement in children's learning (Tong et al., 2021), while evidence from South Asia indicates that parent-mediated programmes can support parent and child outcomes when interventions are feasible and adapted to local conditions (Koly et al., 2021). These findings complement broader reviews of family-delivered literacy and parent-involved learning interventions (Dahl-Leonard et al., 2025; Guo & Keles, 2025).

Dyslexia-specific evidence also indicates that parent-implemented reading practice can be acceptable and may support aspects of reading performance when procedures are clearly specified, although findings remain context dependent (Kerjean et al., 2023). A parent-oriented resource should therefore not only contain appropriate instructional content; it should support implementation clearly enough that post-use feedback can identify where unnecessary difficulty remains. In this sense, real-world parent evaluation functions as a design mechanism rather than only a satisfaction check.

LIMITATIONS AND FUTURE RESEARCH

This study involved six purposively selected parents and a two-week period of home use. The focused aim and specificity of the participant group supported in-depth qualitative exploration, but the sample was not intended to provide statistical representation of the wider population of families of children with dyslexia (Malterud et al., 2016; Mthuli et al., 2022). All six parents had also participated in the earlier needs-analysis phase. This continuity strengthened the connection between pre-development needs and post-use experience, but it also means that participants were not completely new users. Future evaluation should therefore include a larger and more diverse group of parents who encounter BACAdys for the first time and should examine whether the same refinement needs are reproduced across different home contexts.

The study also relied on parents' post-use accounts rather than direct observation, detailed usage logs, or independent child perspectives. Longer implementation periods, parent diaries and observations of parent-child reading sessions could provide a richer account of how refinement needs develop over time. Finally, the present paper addresses product refinement rather than intervention effectiveness. The findings do not establish that BACAdys improves reading outcomes or that the proposed refinements will produce measurable literacy gains. Future effectiveness studies would require appropriate reading measures and comparative designs.

CONCLUSION

This study examined what parents' real-world use of an expert-refined Malay early reading module revealed for subsequent product refinement. The findings show that post-use feedback did not call for wholesale redesign. Instead, it identified specific reading patterns requiring additional reinforcement, video support requiring more precise organisation, activities requiring conditional adaptation and requests that were better treated as future product expansion.

The central implication is that user-informed refinement should be targeted rather than additive. Adding more exercises, pictures, activities, or videos is not necessarily an improvement unless the addition responds to an identifiable implementation problem. Post-use evaluation becomes more useful when feedback is translated into a clear decision about what should be strengthened, adapted, retained, or developed separately.

For educational product development, expert refinement and user refinement therefore serve different but complementary functions. Expert judgement can strengthen the coherence and appropriateness of a prototype before implementation, while user experience reveals how those decisions operate under actual conditions of use. Incorporating both forms of evidence allows refinement to remain responsive without allowing product scope or complexity to expand unnecessarily.

ACKNOWLEDGEMENTS

The authors thank the parents who participated in the home-use evaluation and shared their experiences of using BACAdys with their children.

Data Availability

The qualitative data supporting the findings contain confidential family and child information and are not publicly available. De-identified excerpts relevant to the reported findings are presented in the manuscript. Further information may be considered by the corresponding author subject to ethical and confidentiality requirements.

Conflict Of Interest

The authors declare no conflict of interest.

FUNDING

The authors received no specific funding for this study.

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