

BIJAKBM: A MOBILE-BASED DIGITAL PEDAGOGICAL SCAFFOLD FOR SUPPORTING NOVICE TEACHERS IN PRIMARY SCHOOLS

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Abstract: Teaching Malay grammar in primary schools continues to be demanding, particularly for novice and Contract of Service (COS) teachers who often lack formal preparation in the subject. This study presents BijakBM, a mobile-based digital application designed to provide pedagogical scaffolding and strengthen student learning. Drawing upon Cognitive Load Theory and Multimedia Learning Theory, BijakBM incorporates structured grammar e-books and interactive formative assessments aligned with the national curriculum. A qualitative conceptual design approach was adopted, involving document analysis, instructional design mapping, and theoretical audits to ensure both cognitive and policy coherence. Findings suggest that BijakBM assists novice teachers by reducing lesson preparation, offering standardized content, and supporting systematic planning. Its progressive module sequencing helps manage cognitive demands, while multimedia features improve comprehension and engagement. Interactive quizzes encourage learner autonomy and allow teachers to adapt instruction based on performance data. The discussion emphasizes BijakBM's role as a digital scaffold bridging curriculum expectations with teacher capacity. By aligning with Malaysia's Digital Education Policy, the application demonstrates how technology can translate policy aspirations into classroom practice. In conclusion, BijakBM represents a practical innovation in digital pedagogy, equipping novice teachers with confidence in Malay grammar instruction while fostering student-centered learning. Its replicable framework offers a model for embedding theory-driven digital tools into national education systems.

Keywords: Digital education, digital pedagogy, Malay language, mobile learning, novice teachers

INTRODUCTION

Education worldwide is rapidly evolving through digital integration. In Malaysia, this transformation is formalized in the Digital Education Policy (DEP), which highlights digital fluency, equitable access, and learner-centered approaches (Ministry of Education Malaysia, 2021). Yet, classroom realities often reveal gaps between policy aspirations and actual practice, particularly in Malay grammar instruction at the primary level.

Grammar teaching requires precision, scaffolding, and systematic delivery. However, novice and COS teachers frequently lack specialized training, creating a mismatch between teacher preparation and curriculum demands. This situation compromises student outcomes and heightens teacher anxiety (Darling-Hammond, Hyler, & Gardner, 2017). Addressing these challenges calls for innovative, theory-driven digital tools that simultaneously support teacher development and enhance student learning.

BijakBM was designed as a mobile application to scaffold pedagogical delivery and improve grammar learning. Grounded in Cognitive Load Theory (Sweller, 1988), Multimedia Learning Theory (Mayer, 2014; 2024), and Scaffolding Theory (Vygotsky, 1978), it integrates structured grammar e-books and interactive

assessments aligned with the national curriculum. Its design responds to four challenges: (i) building novice teachers' confidence and reducing preparation time, (ii) minimizing cognitive overload through progressive sequencing, (iii) fostering comprehension and autonomy via multimedia and quizzes, and (iv) operationalizing Malaysia's DEP by bridging curriculum requirements with teacher competency.

RESEARCH BACKGROUND

BijakBM was conceptualized to address difficulties faced by novice teachers in delivering Malay grammar. The application consists of ten progressive modules delivered through interactive e-books and quizzes. Its design emphasizes clarity, progression, and alignment with the Dokumen Standard Kurikulum dan Pentaksiran (DSKP). For COS teachers, BijakBM functions both as a learning tool and a pedagogical support system, reducing anxiety and strengthening teaching self-efficacy (Hussin, 2021). By offering standardized content and ready-to-use lesson structures, it enables teachers to plan confidently and systematically.

Globally, digital pedagogy is increasingly recognized as transformative rather than supplementary (OECD, 2019). BijakBM embodies this shift by operationalizing policy aspirations into classroom practice, bridging the gap between curriculum requirements and teacher competency.

LITERATURE REVIEW

Enhancing Teacher Confidence and Reducing Preparation Time

Research on teacher development underscores the importance of structured, curriculum-aligned resources in reducing anxiety and enhancing self-efficacy. Darling-Hammond et al. (2017) highlight that novice teachers benefit most from sustained support and standardized instructional tools. In Malaysia, COS teachers often lack subject-specific training (Hussin, 2021), making digital scaffolds such as BijakBM particularly relevant. Amemasor et al. (2025) show that professional development programs focusing on digital integration significantly improve teacher confidence and classroom practices. BijakBM builds on these insights by embedding pedagogical support directly into lesson delivery, thereby reducing preparation time and strengthening confidence.

Minimizing Cognitive Overload through Progressive Module Design

Cognitive Load Theory (Sweller, 1988) remains central to instructional design, with recent innovations emphasizing adaptive sequencing and multimodal support (Ouweland et al., 2025). Desmond et al. (2026) stress the importance of progressive structuring in extended reality environments, underscoring the need to respect working memory limits. BijakBM applies these principles by breaking grammar instruction into manageable units, thereby minimizing extraneous load and supporting systematic lesson planning.

Fostering Student Comprehension, Engagement, and Autonomy

Multimedia Learning Theory emphasizes dual-channel processing and active engagement (Mayer, 2024). In multilingual contexts such as Malaysia, multimedia integration is particularly valuable for bridging comprehension gaps. Interactive scaffolding has been shown to foster autonomy and engagement; Zuo et al. (2023) found that scaffolding in online learning environments significantly improves student achievement, while Safahi et al. (2025) highlight its adaptability across subjects. BijakBM operationalizes these findings by integrating visuals, examples, and interactive quizzes that provide immediate feedback, enabling students to monitor progress and develop autonomy.

Operationalizing Malaysia's Digital Education Policy

Malaysia's DEP emphasizes digital fluency, equitable access, and student-centered pedagogy (Ministry of Education Malaysia, 2021). Yet, research highlights persistent gaps between policy aspirations and classroom realities. Rahida Aini Mohd Ismail (2025) notes that the digital divide between urban and rural schools remains a barrier, with infrastructure and teacher training unevenly distributed. Liashin and Kiflee (2026) demonstrate that curriculum-integrated digital tools under Malaysia's TS25 reform improve teacher performance and student outcomes. BijakBM aligns with these reforms by offering a mobile-responsive, curriculum-aligned platform that operationalizes DEP goals.

PROBLEM STATEMENT

Malay language instruction is a cornerstone of Malaysia's national curriculum. However, reliance on untrained teachers poses significant challenges. Many COS teachers lack Pedagogical Content Knowledge (PCK), which is essential for effective grammar instruction (Shulman, 1986; Hussin, 2021). Existing digital resources are fragmented, often designed exclusively for student use, and misaligned with curriculum standards. This leaves teachers navigating inconsistent materials, resulting in instructional drift and increased preparation time (OECD, 2019). There is thus an urgent need for a curriculum-aligned, teacher-centered digital scaffold that supports instructional delivery while fostering student autonomy. BijakBM addresses this gap by offering structured, theory-driven digital support.

RESEARCH QUESTIONS

This study is guided by the following research questions:

- i. How does BijakBM enhance novice and COS teachers' confidence and reduce preparation time in delivering Malay grammar instruction?
- ii. In what ways does BijakBM's progressive module design minimize cognitive overload and support systematic lesson planning?
- iii. How does BijakBM's multimedia integration and interactive quizzes foster student comprehension, engagement, and autonomy?

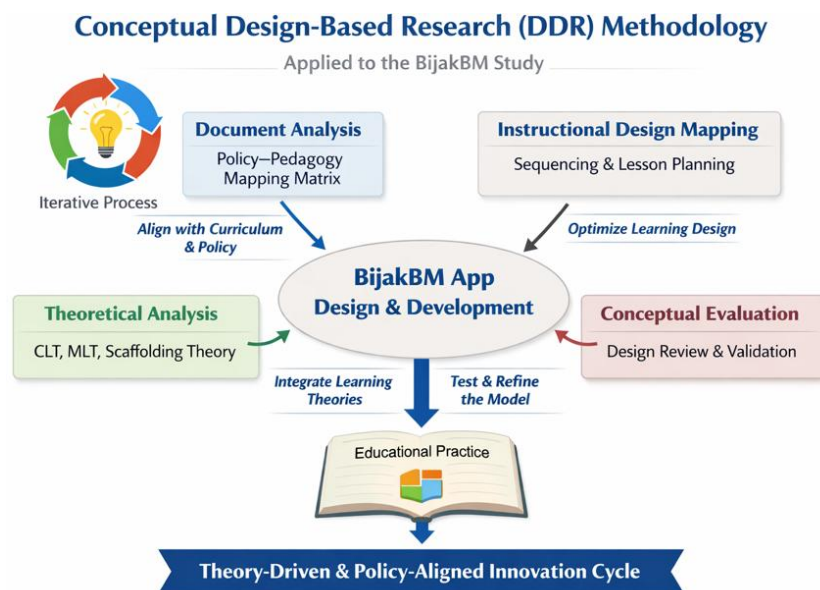
- iv. To what extent does BijakBM operationalize Malaysia's Digital Education Policy by bridging curriculum requirements and teacher competency?

METHODS

The methodological foundation of this study is anchored in a conceptual design-based research (DDR) orientation. This approach was deliberately selected to ensure that the development of BijakBM is both theoretically grounded and practically relevant for classroom application. DDR emphasizes iterative refinement, theoretical validation, and policy alignment, making it suitable for translating abstract pedagogical principles into usable digital tools for teachers. Figure 1 illustrates the iterative DDR cycle, showing how BijakBM's design evolved through continuous alignment with curriculum standards, learning theories, and Malaysia's Digital Education Policy.

Figure 1

Conceptual Design-Based Research (DDR) Methodology



Unlike empirical qualitative studies that rely on sampling and data collection, DDR focuses on conceptual design and validation. The process integrates four interconnected components: document analysis, instructional design mapping, theoretical audits, and conceptual evaluation. Each component contributes to refining the application's design and ensuring coherence between curriculum requirements, pedagogical theory, and national policy aspirations.

Document Analysis

A systematic review of curriculum standards and pedagogical challenges in Malay grammar instruction was conducted. To ensure rigor, a Policy-Pedagogy Mapping Matrix was applied, comparing BijakBM's module features against the objectives of Malaysia's Digital Education Policy (DEP), which emphasizes digital fluency, equitable access, and student-centered pedagogy. This ensured that BijakBM's modules were aligned with the

Dokumen Standard Kurikulum dan Pentaksiran (DSKP), directly addressing the need to enhance novice teachers' confidence and reduce preparation time.

Instructional Design

Mapping Instructional design mapping was employed to sequence grammar modules progressively, reflecting principles of Cognitive Load Theory (CLT). This methodological choice was critical for minimizing cognitive overload and supporting systematic lesson planning. The mapping emphasized clarity, progression, and scaffolding, conceptually enabling novice teachers to deliver lessons with reduced anxiety and greater confidence.

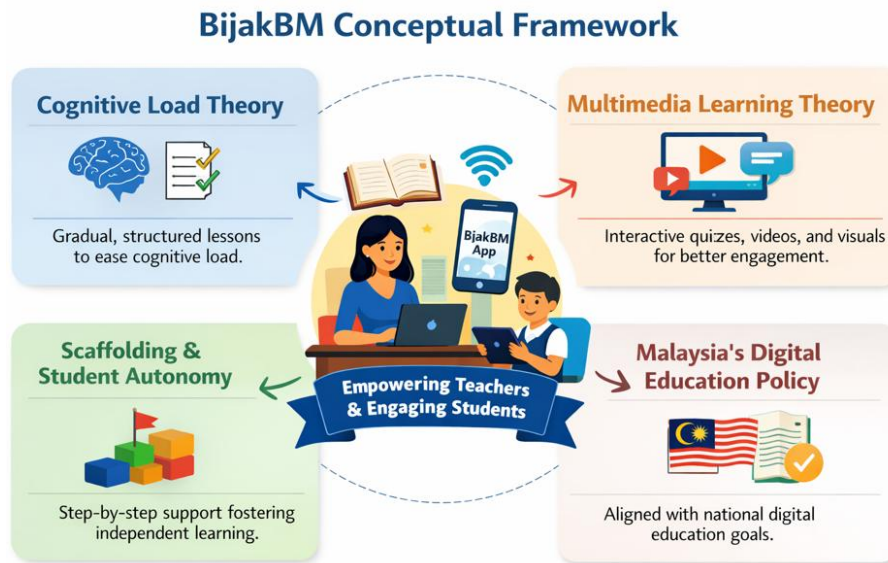
Theoretical Audits

Theoretical audits were conducted to evaluate BijakBM's features against established learning theories, including Cognitive Load Theory, Multimedia Learning Theory, and Scaffolding Theory. This process validated that multimedia integration and interactive quizzes were theoretically grounded, fostering student comprehension, engagement, and autonomy. By embedding immediate feedback mechanisms and multimodal resources, the design was conceptually confirmed as a scaffold that supports both learners and teachers.

Conceptual Evaluation and Policy Alignment

A final policy alignment analysis was undertaken to evaluate BijakBM's consistency with Malaysia's DEP. This step confirmed that the application operationalizes national goals of digital fluency, equitable access, and student-centered pedagogy. By explicitly addressing infrastructure disparities and teacher training gaps, the methodology ensured that BijakBM functions as a practical tool for bridging the divide between policy aspirations and classroom realities.

Taken together, these methodological choices demonstrate a coherent and theory-driven approach to the conceptual development of BijakBM. Each step was intentionally mapped to the research questions, ensuring that the application is pedagogically robust, technically accessible, and policy aligned. To make the design clearer, Figure 2 presents the BijakBM conceptual framework which illustrates the integration of Cognitive Load Theory, Multimedia Learning Theory, Scaffolding for Student Autonomy, and alignment with Malaysia's Digital Education Policy. At the center is the application itself, surrounded by four guiding pillars: Cognitive Load Theory, Multimedia Learning Theory, Scaffolding for Student Autonomy, and Malaysia's Digital Education Policy. This framework illustrates how theory and policy are translated into practical classroom support for novice teachers.

Figure 2*BijakBM Conceptual Framework****Enhancing Teacher Confidence and Reducing Preparation Time***

BijakBM is conceptually designed to strengthen novice and COS teachers' confidence in delivering Malay grammar instruction. By embedding standardized, curriculum-aligned modules into the teaching process, the application shortens lesson preparation and promotes structured delivery. Although this study is conceptual, the design suggests that BijakBM can serve as both a teaching aid and a form of embedded professional development. This aligns with Darling-Hammond et al. (2017), who emphasize the value of structured resources in supporting novice teachers' success.

Minimizing Cognitive Overload through Progressive Module Design

The application's progressive sequencing divides grammar instruction into manageable units, thereby reducing cognitive overload and supporting systematic lesson planning. This finding reflects the principles of Cognitive Load Theory (Sweller, 1988), which highlight the importance of respecting working memory limits. Conceptually, the structured sequencing indicates that students may grasp grammar concepts more effectively when lessons are delivered progressively, confirming BijakBM's potential to optimize cognitive demands.

Fostering Student Comprehension, Engagement, and Autonomy

BijakBM integrates multimedia elements such as visuals, contextual examples, and interactive exercises to enhance comprehension and engagement. Interactive quizzes provide immediate feedback, enabling learners to monitor progress and develop autonomy. This design is consistent with Mayer's (2024) principles of multimedia learning and Zuo et al.'s (2023) findings on scaffolding in digital environments. Conceptually, formative assessments allow teachers to adjust instruction responsively, reinforcing student-centered learning.

Operationalizing Malaysia's Digital Education Policy

The findings confirm that BijakBM operationalizes Malaysia's Digital Education Policy (DEP) by embedding digital fluency, equitable access, and student-centered pedagogy into classroom practice. Its mobile-responsive design ensures accessibility across diverse contexts, including resource-constrained rural schools. Conceptually, BijakBM provides reliable, curriculum-aligned support, bridging gaps in training and infrastructure. This demonstrates how BijakBM translates policy aspirations into practical classroom realities.

DISCUSSION

The conceptual development of BijakBM highlights its potential as a digital pedagogical scaffold that directly addresses challenges faced by novice and COS teachers in Malaysia. This discussion situates BijakBM within broader educational discourses, drawing on recent scholarship to demonstrate its relevance and replicability.

Novice and COS teachers often experience professional anxiety when teaching outside their specialization. BijakBM addresses this challenge by embedding standardized, curriculum-aligned modules into the teaching process. This reduces preparation time and fosters systematic lesson delivery, functioning as embedded professional development. Amemasor et al. (2025) confirm that digital instructional integration improves teacher confidence and classroom practices, and BijakBM exemplifies this by equipping teachers with immediate, reliable pedagogical support. In this way, the application bridges the gap between limited training and curriculum demands, strengthening teacher self-efficacy.

Cognitive Load Theory emphasizes the importance of respecting working memory limits, and BijakBM's progressive module design reflects this principle. By sequencing grammar instruction into smaller, manageable units, the application reduces extraneous cognitive load and supports mastery. Ouwehand et al. (2025) highlight adaptive instructional design as a key innovation in CLT, and BijakBM's structured progression aligns with this trend. Conceptually, students are better able to grasp grammar concepts when lessons are delivered in smaller segments, confirming the application's role in optimizing cognitive demands in digital pedagogy.

Multimedia Learning Theory underscores the importance of dual-channel processing and active engagement (Mayer, 2024). BijakBM integrates visuals, examples, and interactive exercises to enhance comprehension, particularly in Malaysia's multilingual classrooms. Interactive quizzes provide immediate feedback, enabling students to monitor progress and develop autonomy. This scaffolding approach aligns with Zuo et al. (2023), who found that digital scaffolding improves student engagement and achievement. Conceptually, formative assessments allow teachers to adjust instruction based on student performance data, reinforcing both student-centered learning and responsive teaching.

Malaysia's Digital Education Policy emphasizes digital fluency, equitable access, and student-centered pedagogy. Yet, persistent gaps remain between policy aspirations and classroom realities, particularly in rural schools (Rahida Aini Mohd Ismail, 2025). BijakBM operationalizes DEP goals by offering a mobile-responsive, curriculum-aligned platform accessible across diverse contexts. Teachers in resource-constrained settings

conceptually benefit from reliable support that bridges disparities in training and infrastructure. This demonstrates how the application translates national policy into classroom practice, offering a replicable model for integrating theory-driven digital tools into education systems.

BijakBM represents more than a digital teaching aid; it is a teacher-centered conceptual innovation that connects theory, policy, and practice. Its design bridges Cognitive Load Theory, Multimedia Learning Theory, and Scaffolding Theory within Malaysia's Digital Education Policy, forming a replicable framework that transforms abstract educational principles into practical classroom support. Conceptually, BijakBM shows how digital scaffolds can reduce preparation time, promote systematic lesson planning, and foster student autonomy while maintaining curriculum fidelity. Beyond Malay grammar instruction, the framework offers a scalable pathway for embedding theory-driven digital tools across subjects and national contexts, contributing meaningfully to the advancement of inclusive and sustainable digital education.

CONCLUSION

The conceptual development and evaluation of BijakBM highlight its role as a strategic innovation in Malaysia's digital education landscape. By embedding standardized, curriculum-aligned modules into the teaching process, the application is designed to enhance novice and COS teachers' confidence and reduce preparation time, thereby functioning as embedded professional development. Its progressive sequencing of grammar instruction minimizes cognitive overload and supports systematic lesson planning, reflecting contemporary applications of Cognitive Load Theory. At the same time, BijakBM's integration of multimedia elements and interactive quizzes conceptually fosters student comprehension, engagement, and autonomy, ensuring that learners are active participants in their educational journey while enabling teachers to adjust instruction responsively.

Importantly, BijakBM operationalizes the strategic goals of Malaysia's Digital Education Policy by embedding digital fluency, equitable access, and student-centered pedagogy into classroom practice. Its mobile-responsive design ensures accessibility across diverse contexts, bridging the digital divide between urban and rural schools and translating national policy aspirations into practical classroom realities. Taken together, these contributions demonstrate how BijakBM functions as a digital pedagogical scaffold that conceptually strengthens teacher confidence, optimizes cognitive learning, promotes student autonomy, and advances national education priorities.

Looking forward, the framework underpinning BijakBM is replicable beyond Malay grammar instruction. By integrating global learning theories with Malaysia's educational framework, the application offers a model for adapting theory-driven digital tools to diverse subjects and contexts. Future research should explore its long-term impact on teacher performance, student achievement, and scalability across the curriculum, while also investigating opportunities for enhancement through emerging innovations such as AI-driven adaptive learning and extended reality environments. In this way, BijakBM not only addresses immediate pedagogical challenges but also contributes to the broader discourse on digital transformation in education, offering novelty as a teacher-centered scaffold within national systems.

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