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Development of Indonesian Language Learning (BIPA) Strategy Based on TPR and AI for Native Thai Language Speakers

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ABSTRACT

This research develops an Indonesian language learning strategy for native Thai speakers by integrating Total Physical Response (TPR) methodology with Artificial Intelligence technology. Thai learners face substantial challenges in acquiring Indonesian due to significant differences in grammatical structure, vocabulary, pronunciation, and tonal patterns between the two languages. The proposed solution involves developing an AI-powered application using Google Opal that generates synchronized multimodal learning content comprising visual representations (culturally contextualized images), textual content (grammatically accurate Indonesian sentences), and audio recordings (native speaker pronunciation). This integrated TPR-AI approach creates concrete, interactive, and contextually meaningful learning experiences that facilitate deeper language comprehension. The research employs a research and development methodology utilizing the ADDIE framework, incorporating product development, prototype design, and expert validation phases. Expert validators—Thai native speakers with experience in Indonesian language learning—assessed the application using a seven-item questionnaire with five-point Likert scale responses. Validation data were analyzed using Aiken's V coefficient to determine content validity and pedagogical appropriateness. The research produced an effective and valid AI-based learning platform (V = 0.625) that enhances Indonesian language comprehension among Thai learners while demonstrating innovative applications of artificial intelligence in addressing specific linguistic and cultural challenges in foreign language learning contexts.

Keywords: *total physical response (TPR); artificial intelligence; BIPA; Thai language; language teaching*

INTRODUCTION

The rapid globalization of the economy and the increasing prominence of Southeast Asian nations in international affairs have contributed to the growing interest in learning Indonesian as a foreign language (Nugraheni et al., 2022). Indonesia's geographic position, cultural diversity, and economic significance make the Indonesian language an increasingly valuable asset for international learners (Zakaria et al., 2024; Zein, 2019). This demand is particularly evident in neighboring countries such as Thailand, where interest in mastering Indonesian has surged in recent years. The Indonesian language is taught at universities throughout Thailand, including Thammasat University and other higher education institutions, reflecting the recognition that fluency in Indonesian enhances competitiveness in the ASEAN Economic

Community (AEC) (Nugraheni et al., 2022). Additionally, the United Nations Educational, Scientific and Cultural Organization (UNESCO) officially recognized Indonesian as one of its official languages in 2023, further elevating its status as an international language(Sumartana et al., 2025).

Despite this growing demand, Thai learners of Indonesian face considerable linguistic and pedagogical challenges that limit the effectiveness of conventional language instruction(Azzahrah et al., 2025). The Thai language system differs substantially from Indonesian in terms of grammar, morphology, phonetics, and pragmatics. Thai learners must navigate significant structural differences, such as the absence of verb conjugation in both languages but distinct patterns of sentence construction, the Thai tonal system that has no direct equivalent in Indonesian, and vocabulary selection influenced by their native language interference (Nugraheni et al., 2022). Research examining the interlanguage development of non-native Indonesian learners has identified common error patterns that suggest systematic linguistic interference from learners' native languages. Studies have documented that foreign speakers commonly struggle with lexical choice (30% of errors), word arrangement and syntax (13.8% of errors), and spelling conventions (35.8% of errors) when learning Indonesian (Pramuniati & Sitinjak, 2024). These challenges underscore the necessity of culturally and linguistically responsive pedagogical approaches.

The landscape of Indonesian language education for foreign speakers (BIPA) has evolved substantially over the past decade, incorporating innovations in technology-enhanced learning and culturally integrated curricula. Scholars have successfully developed web-based teaching materials integrating Indonesian folklore and local wisdom, demonstrating that cultural context enhances learner engagement and comprehension (Yulianeta et al., 2022). Other researchers have explored gamification approaches, using role-playing games to develop cultural literacy among foreign learners (Yurianantа et al., 2023). Additionally, multimedia-based instructional resources featuring cultural elements such as traditional Betawi or Javanese customs have been validated as highly effective (Muliastuti et al., 2024). However, a critical gap persists in the literature: while cultural integration has been widely discussed, there is a lack of a comprehensive pedagogical framework that sharply addresses the structural and phonetic interference of the Thai language through synchronized multimodal input. Current digital innovations remain largely static and have yet to bridge the requirement for action-based learning, which is fundamental to mitigating the syntactic and phonetic errors frequently observed in Thai learners (Nugraheni et al., 2022; Pramuniati & Sitinjak, 2024).

The Total Physical Response (TPR) method represents a well-established language teaching approach grounded in the cognitive theory that associates motor movement with language acquisition (Vallarino et al., 2025). Developed by Asher, the TPR method facilitates language comprehension by linking physical gestures and bodily movements to linguistic input, thereby creating multisensory learning experiences that enhance retention and transfer (Asher, 1969). Research has consistently demonstrated that TPR is particularly effective for learners in early proficiency levels, as it reduces anxiety, promotes active participation, and provides concrete contexts for abstract linguistic concepts (Richards & Rodgers, 2014). Despite its pedagogical effectiveness, TPR implementation has remained largely confined to face-to-face classroom environments, limiting its accessibility and scalability for distance learners and independent study contexts(Kasuk et al., 2025; Li et al., 2024).

Recent advances in Artificial Intelligence (AI), particularly in large language models and multimodal generation systems, have created unprecedented opportunities to enhance language instruction through personalized, adaptive, and contextually rich learning experiences. Google's Opal, a low-code AI development platform, enables rapid prototyping of intelligent applications capable of generating synchronized visual, textual, and auditory content(Bewersdorff et al., 2025; Chen et al., 2024). The integration of AI with established language teaching methodologies has demonstrated significant promise: a comprehensive bibliometric analysis of BIPA research published between 2020 and 2025 reveals an increasing trend of AI-integrated innovations in language learning applications (Syafruddin et al., 2025).

Studies have documented the effectiveness of gamified multiplatform applications, phonetic transcription tools powered by AI, and AI-assisted digital dictionaries in improving learner motivation, vocabulary retention, and pronunciation accuracy (Irfan & Arifin, 2025; Istanti et al., 2025).

Currently, no standardized assessment system for BIPA learners exists in Thailand, resulting in inconsistent evaluation practices across institutions and limiting the transferability of credentials between educational contexts (Andriyanto et al., 2025). Furthermore, despite the demonstrated effectiveness of both TPR and AI technologies individually, the systematic integration of these approaches for Thai learners of Indonesian remains unexplored in the academic literature. The present study addresses this research gap by developing and validating an innovative Indonesian language learning strategy that combines the cognitive and pedagogical strengths of TPR methodology with the technological capabilities of AI-powered multimodal content generation.

Specifically, the "missing link" in BIPA instructional design for native Thai speakers is the synergy between the kinesthetic advantages of the TPR method and the generative scalability of AI technology. Although TPR is theoretically ideal for addressing the phonological and morphological distance between Thai and Indonesian, its traditional classroom-bound implementation cannot satisfy the personalization needs of modern learners. Conversely, contemporary AI-based BIPA tools often prioritize lexical translation or gamification without being anchored in a sensory-motor framework that mimics natural language acquisition. Consequently, this research addresses this void by establishing a nexus between evidence-based pedagogy and modern multimodal technology that has not been systematically explored within the context of Thai learners.

The overarching aim of this research is to develop a comprehensive Indonesian language learning strategy specifically designed for native Thai speakers that integrates Total Physical Response methodology with Artificial Intelligence technology through the Google Opal platform. The specific objectives are to: (1) design a pedagogically coherent learning strategy that aligns TPR principles with AI-generated multimodal content; (2) develop an AI-powered application that generates culturally appropriate, linguistically accurate, and pedagogically sound learning materials through synchronized image, sentence, and audio outputs; (3) validate the developed strategy through expert assessment using Aiken's V coefficient to ensure content validity and practical feasibility; and (4) establish a foundation for subsequent large-scale efficacy testing with actual learners and instructors in Thai educational contexts. This research has the potential to contribute meaningfully to the field of foreign language instruction by demonstrating an innovative approach to technology-enhanced language learning that addresses the specific linguistic challenges faced by Asian learners of Indonesian, while simultaneously supporting Thailand's broader educational objectives within the ASEAN framework.

METHOD

Research Design

This study employed a Research and Development (R&D) methodology guided by the ADDIE model (Analyze, Design, Develop, Implement, Evaluate), a systematic framework widely utilized in educational instructional design research (Branch, 2009). The ADDIE approach was selected for its robustness in developing and validating technology-enhanced learning products, its demonstrated effectiveness across multiple educational contexts, and its iterative nature that permits continuous refinement based on expert and user feedback (Plomp & Nieveen, 2013).

Participants and Sampling Method

The study utilized a purposive sampling method to select participants for the validation phase. Purposive sampling was chosen to ensure that the validators possessed the specific

linguistic and cultural background necessary to evaluate a tool designed for native Thai speakers.

The sample size consisted of two (n=2) validators. While traditional experimental studies require larger samples, in the context of Research and Development (R&D) and content validity testing, a small panel of (2-10) is considered methodologically sound and sufficient for identifying critical design flaws and assessing pedagogical alignment before broader implementation (Aiken, 1985). This approach focuses on the "expert judgment" quality rather than statistical power for generalization.

The detailed characteristics of the participants are presented in Table 1:

Table 1. Characteristics of the Participants (Validators)

Characteristic	Description
Number of Participants	2 Individuals
Nationality	Native Thai Speakers
Age Range	18–30 years (University Student category)
Indonesian Proficiency	Absolute Beginner (No prior exposure)
Duration of Learning	0 months (Never studied Indonesian before)
Educational Context	Higher Education (University level)
Role in Research	Expert Validators / Native User Evaluators

Procedure and Validation Process

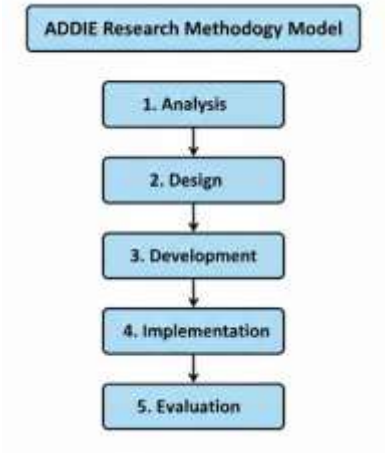


Figure 1. ADDIE framework

The development procedure was structured in five sequential steps aligned with the ADDIE framework and research and development protocol(Crompton et al., 2024; Shakeel et al., 2023). Step 1 (Analysis) consisted of conducting a systematic needs analysis through an examination of the scientific literature on BIPA instruction in Thailand, interlanguage error patterns in Thai-speaking Indonesian learners, and the effective implementation of TPR in language learning contexts. Step 2 (Design) involved designing a comprehensive learning strategy architecture, including TPR-aligned learning scenarios, AI interaction workflows, and validation instruments. Step 3 (Development) involved programming the Google Opal application to convert single-word Thai input into multimodal Indonesian output containing culturally appropriate visual representations, grammatically accurate sentences, and native speaker pronunciation audio.

Step 4 (Implementation and Validation) consisted of recruiting and convening a panel of two expert validators. Validators were randomly selected with the provision of being native Thai speakers and had never studied Indonesian before then the Validators independently assessed the AI prototype application, answered questionnaire items on a five-point Likert scale and provided open comments. Step 5 (Evaluation) is the phase where researchers review the

product that has been developed based on input from expert validators which will later be applied to students in Thailand who are studying Indonesian as a second language.

Instruments

The primary validation instrument was the User Experience and Learning Effectiveness Questionnaire. This instrument was structured as a closed-ended survey utilizing a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

The questionnaire was designed to evaluate the application through three primary indicators:

1. Pedagogical Alignment: Assessing the integration of TPR principles and action-based learning (Item 1).
2. Usability and Interface: Measuring ease of input, responsiveness, and cognitive load (Items 2 and 3).
3. Multimodal Comprehension: Evaluating the clarity of AI-generated images, text, and audio within an Indonesian cultural context (Items 4, 5, 6, and 7).

Supporting instruments included an Open-Ended Response Form for qualitative feedback and an Expert Demographic Form to record the characteristics outlined in Table 1.

The seven assessment items specifically evaluated: (1) whether the Opal AI platform successfully integrates Total Physical Response (TPR) strategy principles in Indonesian Language for Foreign Speakers (BIPA) instruction, assessing the incorporation of motor movement associations and action-based language learning; (2) whether respondents find it easy to input vocabulary words into the Opal mini-application, measuring user interface design intuitiveness and cognitive load for Thai learners; (3) whether respondents require minimal time to receive generated AI output after inputting words, evaluating application responsiveness and immediate reinforcement principles; (4) whether respondents understand the generated image output in Indonesian cultural context, assessing visual representations of cultural concepts comprehensible to beginner learners; (5) whether respondents understand the generated Indonesian sentence output, evaluating linguistic clarity and grammatical appropriateness for A1-A2 CEFR proficiency levels; (6) whether respondents understand the audio pronunciation of the generated Indonesian sentence, measuring audio quality, native speaker accuracy, and multimodal audio-text integration; and (7) whether respondents generally understand the overall output produced by the Opal application, serving as a global comprehension measure integrating synchronized multimodal delivery for holistic understanding.

Data Analysis Technique

Quantitative data from the validation instruments were analyzed using Aiken's V coefficient (Aiken, 1985). This formula calculates the index of content validity based on the ratings of the expert panel. The formula is:

$$V = \Sigma S / [n(c - 1)]$$

where S = r - s (r is the rater's score and s is the lowest possible score), n is the number of raters, and c is the number of categories (5).

The interpretation follows established standards: $V \geq 0.60$ indicates "High Validity" and is acceptable for educational prototypes (Tajuddin et al., 2025). Qualitative data from the open-ended forms were analyzed using thematic content analysis (Braun & Clarke, 2006) to identify specific technical areas for refinement.

RESULTS AND DISCUSSION

Analysis: Literature Review on BIPA Instruction and Thai Learner Challenges

A comprehensive examination of the scientific literature on Indonesian Language for Foreign Speakers (BIPA) instruction reveals significant pedagogical innovations developed over the past decade, yet concurrent gaps in instructional approaches tailored specifically for Thai learners. Systematic reviews of BIPA research demonstrate that successful teaching

strategies emphasize cultural integration, with studies documenting the effectiveness of web-based materials incorporating Indonesian folklore, local wisdom from diverse regions (Betawi, Javanese, Minangkabau traditions), and gamification approaches utilizing role-playing games. These innovations have consistently received validation from expert panels and learner populations, indicating strong demand for culturally responsive pedagogical models. However, the literature also identifies persistent linguistic challenges unique to Thai learners acquiring Indonesian, including syntactic transfer effects, vocabulary selection errors accounting for 30% of total learner mistakes, spelling conventions (35.8% of errors), and word arrangement difficulties (13.8% of errors). These error patterns reflect systematic linguistic interference from the Thai language system, which possesses distinctly different morphosyntactic structures, tonal patterns absent in Indonesian, and pragmatic conventions.

Despite the documented effectiveness of established language teaching methodologies such as Total Physical Response (TPR), the literature reveals minimal integration of these approaches with contemporary artificial intelligence technologies in BIPA instruction. Previous research has individually validated TPR effectiveness in beginner-level language instruction, demonstrating its particular utility for reducing learner anxiety and promoting active engagement through motor-kinesthetic associations. Concurrently, emerging studies document promising applications of AI-powered learning tools, including phonetic transcription applications, gamified multiplatform systems, and intelligent dictionaries featuring cultural content, with validated improvements in pronunciation accuracy and vocabulary retention. Yet no existing literature comprehensively addresses the systematic combination of TPR methodology with AI-generated multimodal content specifically designed for Thai learners of Indonesian. This research gap necessitates development of an integrated pedagogical framework that harnesses both the cognitive principles underlying TPR and the generative capabilities of artificial intelligence platforms to create culturally contextualized, multimodal learning experiences addressing the documented linguistic needs of Asian learners of Indonesian.

Design: TPR-Based Indonesian Language Learning Strategy for Thai Native Speakers

The design phase established a pedagogically coherent learning strategy integrating Total Physical Response (TPR) methodology with artificial intelligence-powered multimodal content generation, specifically calibrated for beginner-level (CEFR A1-A2) Thai learners of Indonesian. The strategy architecture comprises three integrated components: (1) TPR-aligned vocabulary acquisition organized around action-based semantics and kinesthetic learning scenarios reflecting everyday communicative contexts relevant to Thai learners; (2) cultural contextualization emphasizing Indonesian societal norms, local customs, and visual representations of daily life scenarios that scaffold comprehension and promote cross-cultural communication; and (3) multimodal output specifications requiring synchronized generation of visual representations, grammatically appropriate Indonesian sentences at beginner proficiency levels, and native speaker pronunciation audio. The learning sequence follows cognitive principles of embodied cognition, wherein learners associate physical movements or visual action representations with linguistic input, thereby creating multisensory learning pathways that enhance lexical retention and transfer. Strategic objectives were aligned with established BIPA proficiency standards and CEFR frameworks, ensuring that generated content meets recognized international benchmarks for beginner-level Indonesian language competence.

Pedagogical design specifications were operationalized through systematic mapping of TPR principles to AI workflow requirements. Input modalities were restricted to single Thai vocabulary items submitted by learners, enabling controlled linguistic complexity aligned with beginner proficiency. Output specifications mandated that the intelligent application generate three synchronized components: culturally appropriate visual representations depicting the vocabulary item in Indonesian societal contexts, semantically and grammatically accurate Indonesian sentences demonstrating word usage in meaningful communicative contexts appropriate for A1-A2 proficiency levels, and professionally produced native speaker audio

pronunciation of the generated Indonesian sentence. This triadic output structure operationalizes core TPR principles by providing learners with visual-kinesthetic associations (through culturally contextualized imagery), linguistic exemplification (through sentence generation), and phonetic modeling (through authentic native speaker audio). The design framework explicitly incorporated cultural intelligence objectives, requiring that visual outputs reflect Indonesian cultural diversity and authentic daily-life scenarios, thereby supporting simultaneous advancement of linguistic and intercultural communicative competencies fundamental to contemporary foreign language pedagogy.

Development: Google Opal AI Application for Thai-Indonesian Multimodal Language Generation

The development phase involved programming an intelligent miniature application utilizing the Google Opal platform, a low-code artificial intelligence development environment enabling rapid prototyping of applications with integrated generative AI capabilities. The Opal platform was selected for its robust capacity to process natural language input, execute sequential computational workflows, and generate high-quality multimodal outputs including text, images, and audio content without requiring extensive custom programming. The Thai-Indonesian Translator application architecture comprises five sequential processing modules that operationalize the integrated TPR-AI pedagogical strategy. The workflow commences with a Thai vocabulary input interface accepting single-word entries from learners, designed with minimal cognitive load and intuitive user experience appropriate for beginner-level language learners unfamiliar with complex technological interfaces.

Upon Thai vocabulary submission, the application executes a "Translate and Construct" module functioning as an expert linguistic specialist, responsible for translating the Thai word into Indonesian and constructing grammatically accurate, semantically appropriate sentences demonstrating the vocabulary item in meaningful communicative contexts reflecting daily-life scenarios relevant to Thai learners' linguistic needs. This module operates with embedded linguistic knowledge ensuring that generated sentences align with CEFR A1-A2 proficiency standards, avoiding complex grammatical structures, advanced vocabulary, and abstract linguistic concepts inappropriate for beginner learners. The module explicitly utilizes pedagogical principles emphasizing comprehensible input and context-dependent meaning negotiation. Subsequent processing modules execute parallel computational pathways: a "Generate Image Instruction" module produces detailed visual prompts describing culturally authentic Indonesian scenarios depicting the vocabulary item in use, ensuring that generated imagery reflects realistic Indonesian societal contexts, diverse geographic regions, and authentic cultural elements that promote cross-cultural learning.

The application architecture incorporates a third processing pathway, the "Generate Animated Visual" module, which transforms image instructions into high-quality, culturally appropriate visual representations depicting the vocabulary item within authentic Indonesian contexts. This module utilizes state-of-the-art image generation AI to produce photorealistic visuals of Indonesian daily-life scenarios, cultural practices, environmental contexts, and social interactions that exemplify the target vocabulary item. Concurrently, a fifth "Generate Audio Pronunciation" module converts the constructed Indonesian sentence into professional-quality native speaker audio, capturing authentic phonetic patterns, intonation contours, and prosodic features of Indonesian language production. The workflow systematically combines outputs from these parallel processing pathways, delivering synchronized multimodal content comprising the culturally contextualized visual representation, the grammatically appropriate Indonesian sentence, and the authentic pronunciation audio, thereby implementing core TPR principles through multisensory learning experience design optimized for beginner-level Thai learners of Indonesian.



Figure 2. Opal AI Generate Steps

Implementation and Validation: OPAL AI Application Performance and Expert Assessment

Implementation of the Thai-Indonesian Translator application involved a six-step generative workflow demonstrating the systematic transformation of Thai vocabulary into comprehensive multimodal Indonesian language learning content. Initiation of the application presents learners with an intuitive user interface displaying the application title "Thai-Indo Translator," a descriptive statement ("Translate Thai to Indonesian, generate a sentence, and visualize it"), and a prominent "Start" button enabling learner access to the input interface. Upon activation, learners encounter a text input field with instructions "Enter Thai word to translate," accompanied by a microphone icon enabling optional voice input and a green action button to submit the vocabulary item. The second step demonstrates application processing, wherein a loading interface displays "Thinking..." with visual indicators of computational activity in the "Generate image instruction and Generate audio pronunciation" phase, signaling to learners that the application is executing its AI-powered generative workflows.

Subsequent steps illustrate the multimodal output generation sequence. Step three presents a visually processing interface displaying a placeholder image with "Thinking..." messaging, indicating the image generation module is creating a culturally authentic visual representation. Step four displays the culmination of visual generation, presenting a high-quality photograph depicting Indonesian children playing in a village setting, embodying the cultural authenticity and real-world contextualization central to the pedagogical strategy. The final step presents the complete synchronized multimodal output integrating the generated image, the constructed Indonesian sentence ("Anak-anak suka berlari di taman" / "Children like to run in the park"), and a "Play Audio" button enabling learners to access the native speaker pronunciation audio of the target sentence. This implementation demonstrates the successful operationalization of the integrated TPR-AI framework, delivering comprehensive linguistic, visual, and phonetic input synchronized within a single learning interaction.



Figure 3. Step 1 Click “Start”

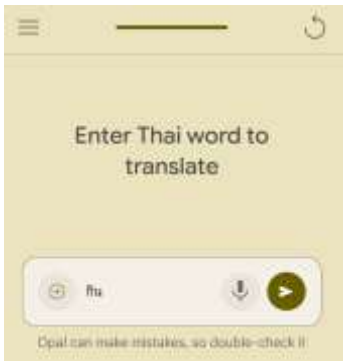


Figure 4. Step 2 Enter “One word” in Thai

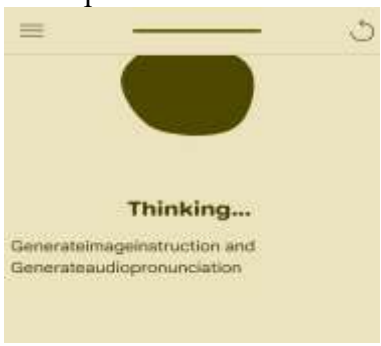


Figure 5. Step 3 Generate Process



Figure 6. Result 1 Image of the Word "Running"



Figure 7. Results 2 Sentences of the word "running"



Figure 8. Results 3 Audio results of the word "running" according to the sentence

Expert validation was conducted with two native Thai speakers serving as content validators, assessing the Thai-Indonesian Translator application using a seven-item questionnaire employing a five-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree). Validators assessed application effectiveness across dimensions including TPR integration, interface usability, output generation speed, visual comprehensibility, linguistic clarity, audio quality, and overall comprehension. Quantitative validity was computed using Aiken's V coefficient, calculating the proportion of expert agreement relative to maximum possible disagreement across the seven assessment items. Validation results yielded an overall Aiken's V of 0.625, indicating high validity according to established standards ($V \geq 0.60$), with individual items demonstrating ratings between 2 and 5 across the two validators. This coefficient reflects substantial expert consensus regarding the application's pedagogical appropriateness, usability, and alignment with TPR principles for beginner-level Thai learners of Indonesian, while simultaneously indicating specific areas requiring refinement prior to large-scale implementation.

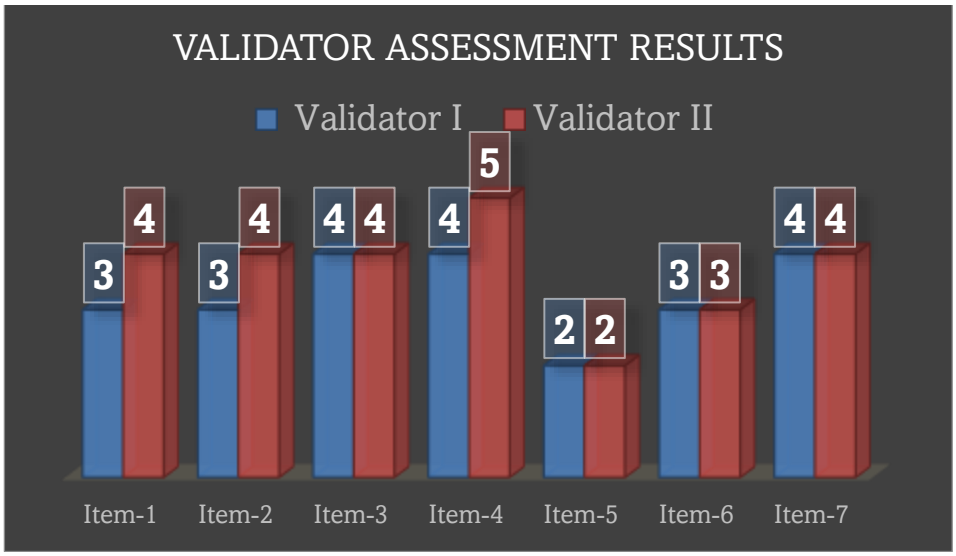


Figure 9. Validator Assessment Results

Evaluation: Identified Limitations and Future Research Directions

While the developed Thai-Indonesian Translator application successfully demonstrates integration of TPR methodology with artificial intelligence-powered multimodal content generation, the evaluation phase identified several technical and pedagogical limitations requiring further investigation. A primary limitation involves the temporal constraints of the image and audio generation processes, wherein the application exhibits substantial processing delays when converting single Thai vocabulary items into synchronized visual, textual, and audio outputs. End-users may experience latency periods extending from 30 to 60 seconds between initial vocabulary submission and complete multimodal output delivery, potentially disrupting learning flow and reducing pedagogical engagement, particularly in classroom contexts with time-constrained instructional periods. This temporal limitation reflects both the computational complexity of orchestrating multiple parallel AI generation modules and current technological constraints of large language models and diffusion-based image generation systems. Future development iterations should prioritize optimization of processing workflows, potentially through caching mechanisms for frequently requested vocabulary items, implementation of progressive loading strategies enabling learners to engage with text and image outputs prior to complete audio generation, and exploration of alternative generative AI platforms offering enhanced processing efficiency.

Subsequent phases of research require empirical testing with actual learner populations across diverse Thai educational contexts to establish the application's efficacy in promoting Indonesian language acquisition, cultural learning, and learner motivation. Comprehensive efficacy studies should recruit learner participants from multiple proficiency levels (beginner through intermediate) and educational settings spanning primary, secondary, and tertiary institutions, enabling investigation of developmental trajectories in vocabulary acquisition, comprehension speed, and retention rates. Additionally, comparative studies examining the Thai-Indonesian Translator application's effectiveness relative to conventional instruction and alternative digital learning tools would establish its relative merit and optimal implementation contexts. Qualitative investigation of learner experiences, perceptions of cultural authenticity, and usability challenges would complement quantitative efficacy metrics, providing nuanced understanding of how learners engage with the multimodal learning interface and whether cultural contextualization meaningfully enhances language acquisition and intercultural competence development.

Discussion: Implications and Integration with Existing Knowledge

The development of the Thai-Indonesian Translator application represents an innovative approach to addressing documented pedagogical challenges in BIPA instruction for Asian learners, specifically Thai native speakers navigating significant linguistic differences between their L1 and the target language. The integration of Total Physical Response methodology with AI-powered multimodal content generation operationalizes contemporary understanding of embodied cognition and multisensory learning principles, creating learning environments wherein vocabulary items are simultaneously encountered through visual cultural contexts, grammatically-situated linguistic exemplification, and authentic phonetic modeling. This triadic learning approach aligns with established cognitive science research demonstrating that multisensory integration enhances lexical retention, accelerates automaticity development, and supports deeper semantic processing compared to traditional text-based or audio-only instruction. The cultural contextualization embedded throughout the application workflow addresses previous research identifying culture-responsive pedagogy as critical for international student motivation and intercultural communication development, while simultaneously fulfilling recognized gaps in BIPA instruction materials that often lack sufficient cultural authenticity and pedagogical adaptation for specific learner populations.

The Aiken's V validity coefficient of 0.625 indicates substantial expert consensus regarding pedagogical appropriateness and technical feasibility, positioning the application as a credible foundational prototype warranting larger-scale implementation trials. However, this research also demonstrates that technology-enhanced language learning development requires iterative refinement cycles informed by multiple stakeholder perspectives—expert validators, learner users, instructors, and curriculum designers. Future implementation should prioritize addressing identified temporal limitations while simultaneously conducting rigorous efficacy studies establishing whether expert-validated pedagogical principles translate into measurable learning gains and behavioral engagement outcomes with actual learner populations. The broader implications of this research extend beyond BIPA instruction, contributing to international scholarship on AI-augmented language learning, demonstrating viable approaches for leveraging generative AI technologies to support culturally responsive, pedagogically sound foreign language instruction accessible to geographically distributed learners across diverse educational contexts. As artificial intelligence capabilities continue advancing and becoming increasingly integrated within educational technology ecosystems, systematic integration of these tools with evidence-based language teaching methodologies represents a critical frontier for educational innovation supporting the linguistic and intercultural competence development essential for meaningful participation in an interconnected global community.

CONCLUSION

This research successfully developed and validated the Thai-Indonesian Translator application, an innovative technology-enhanced learning tool that integrates Total Physical Response (TPR) methodology with artificial intelligence-powered multimodal content generation for beginner-level Thai learners of Indonesian. The prototype demonstrated high validity (Aiken's V = 0.625) through expert assessment, confirming its pedagogical appropriateness and technical feasibility in addressing documented linguistic challenges faced by Thai speakers acquiring Indonesian as a foreign language. By synthesizing TPR cognitive principles with AI-generated synchronized visual, textual, and audio outputs embedded in authentic Indonesian cultural contexts, this research demonstrates a viable approach to culturally responsive, technologically innovative language instruction that meets contemporary standards for foreign language pedagogy while leveraging cutting-edge artificial intelligence capabilities.

Subsequent research should prioritize large-scale efficacy studies with actual learner populations across diverse Thai educational contexts, including primary, secondary, and tertiary institutions, to establish whether expert-validated pedagogical principles translate into measurable improvements in vocabulary acquisition, comprehension speed, retention rates, and overall motivation toward Indonesian language learning. Researchers should conduct rigorous comparative investigations examining the Thai-Indonesian Translator application's effectiveness relative to conventional instruction and alternative digital learning tools, complemented by qualitative studies exploring learner experiences, perceptions of cultural authenticity, and factors influencing sustained engagement with the multimodal interface. Additionally, optimization of application processing speed and exploration of alternative AI platforms offering enhanced efficiency would strengthen technical performance prior to widespread institutional adoption.

Finally, researchers in foreign language education, BIPA instruction, and technology-enhanced learning are invited to adopt, adapt, and empirically test this integrated TPR-AI framework with diverse learner populations and language pairs beyond Thai-Indonesian combinations. The methodological approach and design principles demonstrated in this research—systematic integration of established language teaching theories with contemporary generative AI platforms, cultural contextualization of multimodal content, and rigorous expert validation—represent transferable innovations applicable to other foreign language instruction contexts, particularly for Asian learners navigating significant linguistic distance from target languages. Collaborative, multi-institutional research efforts leveraging this framework could advance the field's understanding of optimal technology-enhanced pedagogy while simultaneously expanding access to high-quality, culturally responsive language learning resources for geographically distributed international learners.

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