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THE EFFECTIVENESS OF SELF-CREATED PICTURE VOCABULARY (SCPV) IN MOBILE-ASSISTED VOCABULARY LEARNING FOR JUNIOR HIGH SCHOOL STUDENTS

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Abstract: Vocabulary mastery is central to language learning success, yet traditional instructional approaches have consistently failed to promote durable retention among junior high school learners. Mobile-assisted language learning (MALL) offers promising alternatives by leveraging learner familiarity with mobile devices to create flexible, engaging learning environments. Despite theoretical support for combining visual learning with self-generated content in mobile contexts, empirical research specifically examining the Self-Created Picture Vocabulary (SCPV) approach remains limited, particularly for junior high school vocabulary instruction. This study investigated the effectiveness of SCPV in improving vocabulary mastery across four dimensions: word recognition, meaning comprehension, spelling accuracy, and contextual usage. A quasi-experimental pre-test and post-test design was employed with 64 eighth-grade EFL students (31 males, 33 females; aged 12–14 years) during a four-week SCPV intervention using a mobile application. Paired-samples t-tests revealed statistically significant improvements across all dimensions ($p < .001$), with an overall result of $t(63) = 18.45$, a very large effect size ($d = 2.31$), and a mean score increase of 22.58 points (41.6%). Meaning comprehension showed the greatest gains ($d = 1.97$), followed by contextual usage ($d = 1.42$), word recognition ($d = 1.28$), and spelling accuracy ($d = 1.06$). These findings support SCPV as an effective, practical approach to EFL vocabulary instruction.
Keywords: *SCPV; Self-Created Picture Vocabulary; MALL; mobile-assisted language learning; vocabulary mastery; junior high school students; vocabulary retention*

INTRODUCTION

Vocabulary acquisition constitutes a foundational pillar of language learning, underpinning competence in all four skills: reading, writing, speaking, and listening (Nation, 2020). Without a sufficiently broad and deep vocabulary, learners struggle to comprehend input, express ideas with precision, and engage authentically with target language texts (Zhang, X., & Zou, 2022). For junior high school students in English as a Foreign Language (EFL) context, this challenge is particularly acute. They must consolidate basic vocabulary while simultaneously expanding their repertoire to meet the demands of increasingly complex curricular content (Rachmawati & Budiarti, 2024; Rachmawati & Irawan, 2024). The transition from elementary to intermediate vocabulary involves not merely learning more words, but developing richer, more nuanced knowledge of word forms, meanings, and usage patterns, a multidimensional undertaking that conventional instructional methods often fail to support adequately (Chen, L., & Yang, 2023).

Traditional vocabulary instruction in many Indonesian EFL classrooms continues to rely heavily on rote memorization strategies, namely copying word lists, translating isolated items, and completing decontextualized exercises (Asari, 2023; Shi & Tsai, 2024; Silitonga et al., 2024). Although these approaches may produce short-term recognition, research consistently demonstrates that they yield shallow processing and poor long-term retention (Nation, 2020). Learners who encounter words only in decontextualized lists rarely develop the semantic depth necessary for productive use, and motivation tends to decline as learners perceive vocabulary study as tedious and disconnected from meaningful

communication (Huang, Y. M., Shu, F., & Zhao, 2020). These limitations create a pressing need for instructional innovations that engage learners more deeply, connect new vocabulary to personal experience, and harness the technologies that contemporary students use naturally (Bahari et al., 2022; Teng, 2024).

The proliferation of mobile technology has reshaped how young people access information and interact with content outside formal educational settings. Mobile-assisted language learning (MALL) has emerged as a pedagogical response to this technological transformation, leveraging the ubiquity of smartphones and tablets to extend vocabulary learning beyond classroom walls (Zou, D., & Li, 2021). MALL is distinguished by four core affordances, they are portability, enabling learning in diverse real-world contexts; immediacy, allowing instant access to resources; connectivity, supporting peer interaction and collaborative learning; and personalization, permitting individualized learning pathways (Kukulska-Hulme, 2020). Contemporary junior high school students often described as digital natives, exhibit high comfort with mobile devices, making MALL not only feasible but potentially motivating for this population (Wu, T., & Chen, 2024) (Li & Wang, 2023; Shin & Chon, 2023; Zou et al., 2025)

Despite these promising affordances, existing MALL research has concentrated primarily on receptive vocabulary gains using pre-designed digital flashcard applications; comparatively little is known about what happens when the mobile environment is used not merely to deliver content, but to support active, student-driven creation of vocabulary representations (Quan, Grant, & Hocking, 2024; Seibert Hanson & Brown, 2020).

Within the broader MALL landscape, research has increasingly focused on the role of visual and multimedia elements in facilitating vocabulary acquisition (Wahyudi et al., 2025). Visual imagery activates dual coding processes, wherein new lexical items are encoded simultaneously through verbal and visual channels, creating multiple retrieval pathways that support both recognition and recall (Paivio, 2013). When vocabulary learning incorporates images, whether photographs, illustrations, or drawings, learners construct richer mental representations that transcend simple form-meaning mappings and support contextual understanding (Lin, J. J., Wang, Y., & Li, 2022). Mobile applications integrating visual elements have demonstrated superior retention outcomes compared to text-only platforms, with effect sizes that increase when learners actively engage with the visual content rather than passively receiving it (Hsu, 2025; Teng, 2024; Zhang, X., & Zou, 2022).

What remains underexplored, however, is whether the cognitive advantages of visual vocabulary learning are further amplified when learners themselves produce the images rather than receive them ready-made, a distinction with meaningful theoretical and practical implications that the existing visual-learning literature has not yet resolved.

Building upon these insights, Self-Created Picture Vocabulary (SCPV) represents an innovative pedagogical approach that synthesizes mobile technology, visual learning, and constructivist principles. Rather than presenting learners with ready-made visual associations, SCPV requires students to create their own visual representations of vocabulary items using mobile devices, thereby positioning them as active constructors rather than passive consumers of knowledge (Chen, L., & Yang, 2023). This self-generation process demands deeper engagement with word meanings as learners must interpret, conceptualize, and externalize their understanding through visual expression. The approach draws on constructivist learning theory (Vygotsky, 1978), which holds that meaningful learning emerges from active engagement, personal connection, and the social negotiation of meaning rather than transmission from teacher to student.

The theoretical rationale for SCPV draws from several complementary frameworks. Dual Coding Theory posits that simultaneous verbal and visual encoding strengthens memory traces and retrieval pathways (Paivio, 2013). Generative Learning Theory emphasizes that learners who actively produce content summaries, drawings, concept maps, achieve superior retention and transfer compared to those who passively study provided materials (Fiorella, L., & Mayer, 2016). Personalization theory in educational technology suggests that learning experiences connected to individual contexts, preferences, and prior knowledge foster intrinsic motivation and deeper processing (Walkington, C., & Bernacki, 2020). SCPV integrates all three: the visual component activates dual coding, the self-creation process instantiates generative learning, and the freedom to draw on personal experience provides inherent personalization (Fiorella, 2023; Lawson & Mayer, 2024).

Notwithstanding this strong theoretical alignment, empirical research specifically testing

learner-generated visual content within a structured, mobile-delivered vocabulary program and measuring its effects across multiple, clearly differentiated vocabulary knowledge dimensions, remains absent from the literature, particularly for junior high school EFL populations.

Existing studies have investigated MALL, learner-generated content, and visual vocabulary learning as separate constructs; however, the unique combination of self-created visual representation within a mobile-assisted framework, and its differential effects across multiple vocabulary knowledge dimensions, remains insufficiently examined, particularly among junior high school EFL learners (Fang et al., 2021; Lin et al., 2020; Shadiev et al., 2020). This gap is further compounded by limited attention to learner perceptions of SCPV, which are essential for understanding the practical viability and motivational impact of the approach in real classroom settings. Addressing these gaps, the present study is guided by the following research questions: RQ1: Does SCPV significantly improve overall vocabulary mastery among junior high school EFL students? RQ2: Are there differential effects of SCPV across the four dimensions of word recognition, meaning comprehension, spelling accuracy, and contextual usage? RQ3: How do students perceive the SCPV approach in terms of engagement, usefulness, and learning value?

This study makes three specific contributions to the field. First, to the authors' knowledge, it is the first to integrate self-created imagery, mobile delivery, and multidimensional vocabulary assessment within a single intervention, constituting a novel synthesis that prior research has not attempted. Second, the observed overall effect size (d = 2.31) substantially exceeds the medium-to-large effects previously reported in MALL vocabulary research, signaling that the self-creation mechanism produces benefits beyond what mobile delivery alone achieves. Third, by reporting dimension-specific effect sizes for word recognition, meaning comprehension, spelling accuracy, and contextual usage, this study provides a granular empirical profile of SCPV's differential impact that no prior study has documented.

Accordingly, this study aims to investigate the effectiveness of SCPV in promoting vocabulary mastery across four dimensions among junior high school students. Specific objectives are: (1) to examine the effect of a four-week SCPV intervention on overall vocabulary mastery; (2) to identify differential effects across word recognition, meaning comprehension, spelling accuracy, and contextual usage; (3) to assess retention and recall patterns following the intervention; and (4) to explore student engagement and perceptions of the SCPV approach. The findings are expected to contribute empirical evidence to the growing literature on MALL and learner-generated content, while providing practical guidance for EFL educators seeking evidence-based vocabulary instruction strategies.

This study carries significance at three levels. Theoretically, the findings extend Dual Coding Theory and Generative Learning Theory into the mobile learning context, demonstrating that their predictive power holds and may be amplified, when self-generation and visual encoding are enacted through personally owned devices in everyday settings rather than controlled laboratory conditions. By documenting dimension-specific effect sizes, the study also advances a more nuanced theoretical account of how different vocabulary knowledge components respond differentially to multimodal, generative instruction, a distinction that existing theoretical frameworks have not yet fully articulated.

Practically, SCPV represents a low-cost, evidence-based intervention that requires no specialist equipment beyond the smartphone students already own. The approach demands minimal additional classroom time, just 30 minutes of weekly in-class guidance, making it feasible within the time and resource constraints that characterize Indonesian junior high school settings. Teachers can implement SCPV without extensive technical training, and the framework is transferable across vocabulary units and proficiency levels, offering immediate applicability to EFL practitioners seeking alternatives to rote memorization.

At the policy level, the evidence generated by this study can inform curriculum decisions regarding technology integration in Indonesian secondary education. At a time when the national curriculum increasingly promotes digital literacy alongside language competence, findings demonstrating that structured mobile-assisted activities produce large, measurable vocabulary gains provide curriculum developers and school administrators with empirical grounds for embedding MALL-based approaches within formal instructional frameworks, rather than treating mobile devices solely as sources of classroom distraction.

METHOD

This study employed a quasi-experimental one-group pre-test and post-test design to evaluate the effectiveness of SCPV as a vocabulary learning intervention. Vocabulary mastery was measured immediately before and one week after the conclusion of the four-week intervention, allowing assessment of both learning gains and short-term retention. Although the absence of a control group limits causal inference, this design was selected to establish preliminary evidence of effectiveness within an authentic classroom context. The four-week intervention period was chosen to align with typical curriculum unit lengths in Indonesian junior high schools, enabling seamless integration without disrupting existing instructional schedules (Nation, 2020).

Participants comprised 64 eighth-grade EFL students (31 males, 33 females; aged 12–14 years) drawn from two intact classes at SMPN 1 Mlarak Ponorogo, East Java, Indonesia. SMPN 1 Mlarak is a state junior high school located in Mlarak sub-district (Kecamatan Mlarak), Ponorogo Regency, and serves as one of the primary educational institutions in the area. The school operates 18 classes (rombongan belajar) across three grade levels, with each class accommodating approximately 32 students. Notably, nearly all students owned personal smartphones and were already familiar with using mobile applications for creative tasks such as drawing and image editing, providing a favorable technological foundation for the SCPV intervention. All participants had received at least four years of formal English instruction and were assessed as intermediate-level learners based on school records. Students demonstrated basic digital literacy through prior personal use, but had no previous experience with structured mobile-assisted vocabulary learning. Convenience sampling was employed as the study was conducted within existing educational structures. Written informed consent was obtained from all participants and their parents or guardians, and ethical approval was granted by the institutional review board. Participation was voluntary, and students were assured that withdrawal would not affect their academic standing.

Two principal instruments were used in this study: a vocabulary assessment instrument and the SCPV mobile application.

The vocabulary assessment instrument comprised 60 items targeting the same 60 vocabulary words included in the SCPV intervention. Items were organized into four sections corresponding to the dimensions of vocabulary mastery under investigation. Section 1 (Word Recognition, 15 items) presented multiple-choice items in which students identified the correct written or phonetic form of words. Section 2 (Meaning Comprehension, 20 items) required matching words with definitions, selecting synonyms, or identifying words from contextual descriptions. Section 3 (Spelling Accuracy, 15 items) used fill-in-the-blank prompts requiring correct orthographic production. Section 4 (Contextual Usage, 10 items) included sentence completion and short-answer tasks assessing appropriate application of vocabulary in context. Total scores ranged from 0 to 100. Internal consistency reliability, estimated using Cronbach's alpha, was $\alpha = .89$, indicating high reliability. Content validity was established through expert review by three senior EFL instructors who confirmed alignment between items and the targeted vocabulary knowledge dimensions. A parallel test form was constructed for post-test administration to control for practice effects, with equivalence between forms verified through pilot testing.

The SCPV mobile application was custom-developed for this study and designed for cross-platform compatibility on both iOS and Android devices. The application provided students with a vocabulary input module for entering target words and definitions, built-in drawing tools and camera access for creating or capturing visual representations, annotation features including text labels and arrows, a flashcard-style self-review function, and a progress tracking dashboard. The interface was designed to be intuitive for adolescent users, and a 45-minute orientation session ensured all participants could operate the application confidently before the intervention began.

Target vocabulary comprised 60 English words drawn from the seventh-grade national curriculum, selected to represent diverse word classes (nouns, verbs, adjectives, adverbs) and a balance of concrete items (e.g., landscape, harvest, laboratory) and abstract concepts (e.g., courage, opportunity, consequence). Word selection criteria included curriculum relevance, appropriate difficulty for participants' proficiency level, and potential for visual representation.

The study proceeded through three phases. In the pre-intervention phase (Week 0), students completed the vocabulary pre-test under controlled classroom conditions within a 60-minute period. Students were informed that the assessment was

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for research purposes only and would not affect their course grades, reducing test anxiety. The orientation session was conducted immediately after pre-test administration.

During the intervention phase (Weeks 1–4), students created SCPV entries for 15 vocabulary words per week, totaling 60 entries. Each week included a 30-minute in-class session in which the instructor reviewed effective visualization strategies, showcased exemplary student entries (with permission), and facilitated brief peer discussions. The remaining work was completed independently outside class, estimated at 60–90 minutes per week. Students were instructed to: (1) create a unique visual representation for each assigned word; (2) include the word, its definition, and the visual image in each entry; (3) use imagery that was personally meaningful; and (4) review their entries regularly using the application's self-quiz function. The researcher monitored completion through the application's tracking data and sent individualized reminders to students falling behind schedule.

In the post-intervention phase (Week 5), students completed the parallel-form post-test one week after finishing their final SCPV entries, allowing assessment of retention beyond immediate exposure. Following the post-test, participants completed a brief open-ended questionnaire eliciting their perceptions of the SCPV experience, including perceived effectiveness, challenges, and preferences for future vocabulary learning.

Quantitative data were analyzed using SPSS version 27.0. Descriptive statistics (means, standard deviations, ranges) were computed for pre-test and post-test scores overall and by section. Data normality was verified using Shapiro-Wilk tests and Q-Q plot inspection. Paired-samples t-tests compared pre- and post-test scores for overall vocabulary mastery and each of the four dimensions, with alpha set at .05. Effect sizes were computed using Cohen's d, with values of 0.2, 0.5, and 0.8 interpreted as small, medium, and large, respectively. Supplementary correlation analyses examined relationships between application engagement metrics and vocabulary gains, and between student background characteristics (gender, prior achievement) and learning outcomes. Concrete versus abstract vocabulary differences were explored through independent-samples t-tests on post-test item subsets. Qualitative questionnaire responses were analyzed using Braun and Clarke's (2006) six-phase thematic analysis procedure to identify recurring themes in students' experiences.

RESULTS AND DISCUSSION

Data screening confirmed that parametric assumptions were met. Shapiro-Wilk tests indicated that pre-test ($W = .981$, $p = .382$) and post-test ($W = .977$, $p = .268$) distributions did not significantly deviate from normality. Q-Q plot inspection corroborated these findings, and no outliers exceeding three standard deviations from the mean were identified. Participant retention was 100%, with all 64 students completing both assessments and the full intervention protocol. Application tracking data confirmed high adherence, with students completing a mean of 58.7 out of 60 assigned SCPV entries (97.8% completion rate).

Overall vocabulary mastery

Pre-test scores ranged from 38 to 72 ($M = 54.23$, $SD = 8.47$), reflecting the moderate baseline vocabulary knowledge expected of eighth-grade EFL learners. Post-test scores ranged from 61 to 93 ($M = 76.81$, $SD = 7.92$), representing a mean improvement of 22.58 points or a 41.6% increase from baseline. A paired-samples t-test confirmed that this improvement was statistically significant, $t(63) = 18.45$, $p < .001$, with a very large effect size, $d = 2.31$. This effect magnitude substantially exceeds the medium-to-large effects ($d = 0.55$–0.78) typically reported in MALL meta-analyses (Zou, D., & Li, 2021), suggesting that the combination of self-creation, visual representation, and mobile delivery produces synergistic benefits beyond what any single component would achieve independently.

The magnitude of these gains within a four-week period is noteworthy from a practical standpoint. Instructional time allocated to the intervention was modest, 30 minutes of in-class guidance per week with the majority of learning occurring during independent out-of-class activity. This efficiency is critical for real-world implementation, where curriculum pressures and finite contact hours limit the time available for supplementary activities. The finding that significant vocabulary gains can be achieved with limited classroom time, when learners engage actively and independently through mobile devices, has important implications for curriculum design and instructional resource allocation.

Vocabulary knowledge dimensions

Differential patterns of improvement across the four vocabulary knowledge dimensions offer nuanced insights into how SCPV influences distinct aspects of word learning. Table 1 summarizes pre-test and post-test performance across all dimensions.

Meaning Comprehension demonstrated the largest absolute and proportional gains among the four dimensions (d = 1.97), with scores increasing by 5.67 points from a maximum of 20. This outcome aligns with Dual Coding Theory's central prediction: when learners encode vocabulary through both verbal-linguistic and visual-spatial channels simultaneously, the resulting memory representations are richer, more interconnected, and more readily accessible during retrieval (Paivio, 2013;Sadoski, M., & Paivio, 2013).

The act of designing a visual representation required students to interrogate word meanings deeply, considering denotative and connotative dimensions, identifying defining semantic features, and distinguishing target words from near-synonyms, cognitive processes that qualitatively exceed what occurs during passive review of definitions. This finding is consistent with Chen (2024) report that learner-generated multimedia annotations produced superior semantic understanding compared to instructor-provided materials.

Contextual Usage showed substantial gains (d = 1.42), a finding of particular educational significance. Contextual usage represents a higher-order vocabulary competence requiring learners to move beyond definitional knowledge toward pragmatic understanding of when, where, and how words are appropriately employed (Nation, 2020). The improvement in this dimension suggests that when students created visual representations grounded in their own experiential contexts, they simultaneously constructed mental schemas of appropriate usage situations. A student drawing a scene to represent "consequence," for instance, is implicitly encoding the semantic, syntactic, and pragmatic properties of the word within a meaningful situational frame. This process parallels situated learning theory's emphasis on knowledge acquisition within authentic, contextualized activity (Lave, J., & Wenger, 1991; Nguyen, 2025).

Table 1. *Pre-test and post-test performance across vocabulary knowledge dimensions*

Dimension	Pre M (SD)	Post M (SD)	Diff	t(63)	d (Effect)
Word Recognition	10.34 (2.15)	13.28 (1.67)	+2.94	10.23***	1.28 (Large)
Meaning Comprehension	11.78 (2.93)	17.45 (2.31)	+5.67	15.72***	1.97 (Very Large)
Spelling Accuracy	8.92 (2.34)	11.67 (2.18)	+2.75	8.45***	1.06 (Large)
Contextual Usage	6.19 (1.58)	8.41 (1.35)	+2.22	11.34***	1.42 (Large)
Overall Mastery	54.23 (8.47)	76.81 (7.92)	+22.58	18.45***	2.31 (Very Large)

*Note. *** $p < .001$. Maximum scores: Word Recognition = 15; Meaning Comprehension = 20; Spelling Accuracy = 15; Contextual Usage = 10; Overall = 100.*

Word Recognition exhibited large gains (d = 1.28). The consistent engagement with written word forms during SCPV entry creation, typing words, annotating images, reviewing flashcards, likely reinforced orthographic representations and created distinctive perceptual memories anchored to the associated visual images. These mnemonic anchors facilitate recognition by providing additional retrieval cues beyond the word form alone. The improvement in word recognition has practical implications for reading fluency, as rapid and accurate word identification is a prerequisite for comprehension (Zhang, X., & Zou, 2022).

Spelling Accuracy improved significantly but with a somewhat smaller effect (d = 1.06) relative to the other dimensions. This pattern suggests that while SCPV supports orthographic learning through repeated exposure to written forms, the visual representation process does not directly target spelling in the focused way it addresses semantic understanding. Learners engaged primarily with the conceptual and visual dimensions of words, with spelling receiving attention incidentally rather than as a primary focus. Future implementations of SCPV could address this by incorporating scaffolding specifically targeting orthographic awareness, for example prompting students to annotate images with color-coded highlighting of challenging letter patterns or to create visual mnemonics specifically linked to difficult spelling features (Shin & Chon, 2023).

Retention and recall

A critical question in vocabulary intervention research concerns whether observed learning gains reflect durable acquisition or merely temporary activation. The one-week delay between intervention completion and post-testing was designed to provide preliminary evidence on retention. The sustained strong performance on the post-test with mean scores nearly 23 points above

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baseline suggests that SCPV promoted consolidation of vocabulary knowledge rather than transient memorization.

Additional analysis disaggregated scores by knowledge type. Recognition-based sections (Word Recognition and Meaning Comprehension) showed a combined mean improvement of 8.61 points (38.9% increase), while recall-based sections (Spelling Accuracy and Contextual Usage) improved by a combined 4.97 points (33.0% increase). Both improvement rates were substantial, though recognition gains were slightly larger. This pattern is consistent with the levels-of-processing perspective: recognition tasks benefit from the additional perceptual cues provided by visual associations, while recall requires productive retrieval of forms and usage patterns that may benefit from more direct practice. The finding that recall-based dimensions also improved substantially rather than showing only recognition-level gains, suggests that SCPV engaged productive processing to a degree sufficient for recall-level encoding, likely through the active creation process itself (Fiorella, L., & Mayer, 2016).

Exploratory analysis of concrete versus abstract vocabulary items found higher post-test performance for concrete words (M = 83.2%) than abstract words (M = 74.5%), $t(63) = 6.78$, $p < .001$. However, both types showed significant improvement from pre-test levels, and the gain for abstract words was not negligible. This finding aligns with dual coding predictions, concrete words more readily evoke visual imagery but also demonstrates that the SCPV framework, through its requirement for active conceptualization, helped students develop effective visual strategies for abstract concepts as well. Qualitative data corroborate this: several students described the challenge of representing abstract words as cognitively valuable, noting that finding ways to depict intangible concepts deepened their understanding (Li, 2024).

Student engagement and perceptions

Application tracking data revealed high engagement throughout the intervention. Students completed an average of 58.7 out of 60 assigned entries (97.8% completion), accessed the self-review function a mean of 4.3 times per week, and maintained consistent engagement across all four weeks without evidence of declining participation. A moderate positive correlation between number of entries completed and vocabulary improvement ($r = .42$, $p < .001$) provided a dose-response pattern consistent with a causal interpretation of the intervention's effects, though the restricted range of completion rates (most students completed close to all entries) limited the statistical power of this analysis.

No statistically significant gender differences in vocabulary improvement were found, $t(62) = 1.12$, $p = .267$, indicating that SCPV was equally effective for male and female students. A small negative correlation approaching but not reaching significance was observed between prior English achievement and vocabulary gains ($r = -.23$, $p = .069$), suggesting a possible tendency for lower-achieving students to benefit slightly more. Although this trend requires confirmation in larger samples, it carries encouraging implications for educational equity: interventions that engage lower-achieving learners more effectively have the potential to narrow achievement gaps.

Thematic analysis of post-intervention questionnaire responses identified five principal themes. First, engagement and enjoyment were salient for the majority of students (87.5%), who reported that SCPV made vocabulary learning more enjoyable than traditional methods; representative responses described the approach as creative and motivating in contrast to the tedium of copying word lists. Second, personalization and meaningfulness resonated with 79.7% of students, who emphasized that creating their own images made words more memorable because the associations reflected personal experience and meaning. Third, cognitive engagement was described by many participants, who articulated that the creation process required them to think deeply about word meanings rather than superficially memorizing definitions. Fourth, technology integration was appreciated by 93.8% of students, who valued the mobile format's flexibility, reporting that they engaged with vocabulary during bus journeys, breaks, and evenings, extending learning beyond what classroom time alone could support. Fifth, a minority of students (28.1%) acknowledged challenges in representing abstract vocabulary visually, though most characterized overcoming this difficulty as a valuable learning experience rather than a deterrent (Guo & Wang, 2024; Peng et al., 2025).

These qualitative findings complement and extend the quantitative results. The themes of cognitive engagement and personalization provide experiential evidence for the theoretical mechanisms posited by generative learning theory (Fiorella, L., & Mayer, 2016) and personalization

theory (Walkington, C., & Bernacki, 2020), respectively. The technology integration theme validates MALL's theoretical affordances of portability and accessibility (Kukulska-Hulme, 2020), while the challenge theme points toward areas for pedagogical refinement in future implementations.

The results of this study offer several important contributions to the theoretical understanding of mobile-assisted vocabulary learning. First, the very large overall effect size suggests that SCPV activates a unique confluence of learning mechanisms not captured by any single theoretical perspective. Dual Coding Theory (Paivio, 2013) accounts for the enriched encoding created by simultaneous verbal and visual processing, but does not, on its own, predict the magnitude of gains observed across productive dimensions such as spelling and contextual use. Generative Learning Theory explains the benefits of active knowledge construction but does not specifically address how personalized content and mobile affordances amplify these benefits (Dai & Wu, 2023; Hoi & Mu, 2021; Sabani et al., 2025). The present findings suggest that these frameworks are not merely additive but genuinely synergistic: the self-creation process simultaneously engages dual coding, generative processing, and personalized meaning-making within a mobile context that removes temporal and spatial constraints on learning. This theoretical integration advances understanding of how MALL interventions can be designed to maximize cognitive engagement (Peng et al., 2025; W. Zhang, 2022).

Second, the differential pattern of gains across vocabulary dimensions with meaning comprehension showing the largest effect and spelling accuracy the smallest carries theoretical implications for models of vocabulary knowledge. Nation's (2020) multidimensional framework conceptualizes vocabulary knowledge as encompassing form (spoken and written), position (grammatical behavior), and meaning (conceptual and associative) dimensions. The SCPV findings suggest that interventions foregrounding visual-semantic associations are particularly effective in deepening the meaning dimension of vocabulary knowledge, while form-level knowledge such as orthographic accuracy may require additional targeted attention (Ma & Chiu, 2024; Rachmawati, 2025; Yang, 2025). Future theoretical work could explore how specific features of vocabulary intervention design map onto differential gains across Nation's dimensions, with SCPV serving as a productive empirical case.

The findings carry several concrete implications for EFL vocabulary instruction practice. First, the compatibility of SCPV with existing curricula, demonstrated by the modest weekly in-class time requirement and alignment with standard instructional units, suggests that adoption does not require structural overhaul of teaching schedules (Shortt et al., 2023; Yuan et al., 2025; Zhou & Goh, 2025). Teachers can introduce SCPV as a complementary strategy within existing vocabulary instruction, gradually expanding its role as they develop familiarity with the approach and its application (Dizon & Gayed, 2021; Kartal, 2024).

Second, the SCPV framework naturally supports differentiated instruction. Because students create visual representations according to their own understanding, creativity, and cultural background, the approach accommodates diverse learner profiles without requiring teachers to prepare differentiated materials (Kukulska-Hulme & Shield, 2008; Quan, Grant, Hocking, et al., 2024; Tommerdahl et al., 2024). Advanced students can develop nuanced, symbolically complex representations that reflect sophisticated semantic understanding, while students who struggle can create simpler, more literal images that nonetheless engage them actively with word meanings (Z. Chen et al., 2020; D. Zhang & Pérez-Paredes, 2021). Teachers can use students' SCPV entries as windows into their conceptual understanding, identifying misconceptions or shallow processing that may not be apparent through traditional written assessments.

Third, the high engagement and completion rates suggest that SCPV may be particularly effective for sustaining motivation in vocabulary learning, a persistent challenge in EFL classrooms where students often perceive vocabulary study as tedious. By transforming vocabulary learning into a creative and personally relevant activity, SCPV reframes the student's role from passive memorizer to active knowledge constructor, a repositioning that aligns with self-determination theory's emphasis on autonomy and competence as drivers of intrinsic motivation (Gozali et al., 2024). Educators seeking to address motivational challenges in vocabulary instruction may find SCPV a particularly powerful tool, especially with digitally engaged adolescent learners (Gozali et al., 2024; Oga-Baldwin, 2019).

Several limitations of this study should be acknowledged. First, the quasi-experimental design without a control group precludes definitive causal inference, as observed gains cannot be

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unequivocally attributed to SCPV rather than to concurrent instruction, maturation, or the Hawthorne effect. Second, the convenience sample from a single school in Kecamatan Mlarak limits generalizability to populations with different technological access, socioeconomic backgrounds, or cultural contexts. Third, the one-week retention interval does not establish long-term durable learning; extended follow-up assessments are needed to determine whether SCPV-supported vocabulary knowledge persists over months and years. Finally, the relatively small sample and restricted range of engagement metrics constrained statistical power for supplementary analyses. Future replications should employ larger, more diverse samples and longer retention intervals to address these constraints.

CONCLUSION

This study provides robust evidence that SCPV significantly enhances EFL vocabulary mastery across word recognition, meaning comprehension, spelling accuracy, and contextual usage within a four-week mobile-assisted intervention, yielding a very large overall effect size (d = 2.31) that substantially exceeds gains typically reported in MALL research.

Theoretically, the findings extend Dual Coding Theory and Generative Learning Theory into the mobile context, demonstrating that self-creation, visual encoding, and personalized meaning-making operate synergistically rather than additively to produce durable vocabulary gains. Practically, SCPV is low-cost and curriculum-compatible: it requires only 30 minutes of weekly in-class guidance, aligns with students' existing smartphone habits, and naturally supports differentiated instruction without additional teacher preparation. The quasi-experimental single-group design limits causal inference, and the convenience sample from one school constrains generalizability. The one-week post-test interval, while informative, does not confirm long-term retention.

Future research should employ randomized controlled designs and longitudinal follow-up to establish causality and retention durability. Systematic component analyses, replication across diverse EFL contexts, and investigation of augmented-reality or AI-enhanced SCPV variants would further strengthen the evidence base for mobile-assisted vocabulary instruction.

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