

INTERACTIVE FLAT PANELS IN PRIMARY ENGLISH AS A FOREIGN LANGUAGE CLASSROOMS: A THEMATIC REVIEW FOR INDONESIAN EDUCATORS AND POLICYMAKERS

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ABSTRACT

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This thematic synthesis reviews 21 empirical studies on how interactive flat panels support primary English language learning, with particular reference to Indonesia's 2025 digital education rollout. Studies were identified through systematic database searches using keywords related to interactive displays, primary English, and educational technology, then screened against predefined inclusion criteria. The review is guided by three questions: how teachers use interactive flat panels in primary English classrooms and with what outcomes; how teacher

knowledge, beliefs, and confidence shape effectiveness; and what contextual and policy conditions support sustainable technology integration. Five themes emerge: pedagogical design choices, language learning outcomes, classroom engagement, teacher knowledge and confidence, and implementation conditions. Across the studies, interactive flat panels are associated with gains in vocabulary, grammar, writing, and motivation when teachers design interactive, well-structured activities rather than relying on static display. Evidence also suggests that the mere provision of equipment does not enhance learning; impact is dependent on teachers' ability to use technology with well-developed English content knowledge and effective pedagogy, supported by good infrastructure and supportive school cultures. For Indonesian schools, this result suggests that massive deployment initiatives should be complemented with sustained TPACK-focused professional development, classroom-based implementation support and technical maintenance. Only then can it realistically advance deep learning aspirations within Merdeka Belajar.

Keywords: interactive flat panels, primary English language teaching, educational technology, teacher professional development, Indonesia, TPACK, digital literacy

1. INTRODUCTION

Indonesia's educational landscape is experiencing a significant transformation through the 2025 Learning Digitalization Program, an ambitious initiative aimed at equipping approximately 288,865 schools with interactive flat panels and related learning technologies. As of November 2025, over 215,000 IFP units have reached schools nationwide, with roughly 173,000 already operational. This move marks substantial progress in the government's digital infrastructure expansion (Kemendikdasmen, 2025b). This initiative draws formal support from Presidential Instruction No. 7/2025, which directs education authorities to accelerate digital transformation across the education sector

(Inpres No. 7, 2025). These moves are in line with sweeping Merdeka Belajar reforms. The reforms highlight student-centered learning experience, teacher freedom of teaching design and digital resource to facilitate various learning ways (Kemendikdasmen, 2025a).

The timing and scale of this deployment raise important questions about how educators can leverage interactive technology effectively, particularly in primary English classrooms where foundational language skills develop. Interactive flat panels, defined as large, touch-responsive displays that enable real-time annotation and multimedia integration, offer distinct advantages over traditional instructional tools. When used thoughtfully, these devices allow teachers to present language content through multiple sensory channels simultaneously, engage learners in hands-on digital activities, deliver immediate performance feedback, and adjust instruction responsively based on student understanding (Alhumsi & Shabdin, 2016). As research has demonstrated, interactive whiteboards can significantly enhance student engagement and interaction in EFL classrooms, promoting active participation beyond traditional lecture-based instruction (Al-Saleem, 2021).

Yet technology presence alone does not guarantee improved learning. International studies find large differences across schools in the extent to which these instruments work in practice. And some teachers have well-planned interactive lessons that alter classroom learning and conversely the same piece of equipment is only taught to be used for content display by others just like a normal projector. Understanding what distinguishes successful implementation from merely having technology available is essential before Indonesia invests uncommon resources in large-scale deployment.

This review synthesizes findings from 21 international studies conducted between 2014 and 2025 that investigated interactive flat panel use in primary English classrooms. By examining pedagogical applications, documented learning outcomes, engagement patterns,

teacher experiences, and implementation conditions across diverse educational contexts, the analysis provides evidence-based guidance for Indonesian primary English educators and policymakers. Three guiding questions organize this synthesis: How do teachers actually employ interactive flat panels in English language instruction? What effects on student achievement and engagement do research studies document? What factors determine whether technology integration succeeds or stalls, and how do these factors relate to Indonesian circumstances?

2. METHODOLOGY

2.1 Review Design

The review follows a qualitative literature design and uses thematic synthesis. Against compiling evidence by statistical meta-analysis, the review aims to organise, internalise and consolidate results of the collection of empirical studies in order to detect plausible tendencies, pedagogical dynamics and theoretical constructs around interactive flat panels (IFPs) and interactive whiteboards (IWBs) as applied in primary English language contexts. Thematic synthesis is especially relevant for this study itself as the included articles are highly diverse in terms of research design, methodological perspective and context in which they were conducted. This method enables the review to shed new light on how IFP-supported instruction is associated with the short-term and long-term development of English skills and other related outcomes by systematically comparing findings across studies.

2.2 Data Sources and Article Selection

A systematic review was carried on several academic databases and platforms: Google Scholar, ERIC, Scopus and some selected institutional repositories. These sources were selected to include wide access to peer-reviewed journal articles, as well as relevant practitioner-oriented and locally published studies that are not always indexed internationally. Search was limited to documents

published between 2015 and 2025, in order to provide a span that includes earlier research on interactive whiteboards as well as recent studies looking at interactive flat panel technology.

Various combinations of keywords were applied to screen the literature. These comprised educational technology-related terms such as “interactive flat panel,” “IFP,” “interactive whiteboard,” “IWB,” and “smartboard”; and language learning-related terms such as English vocabulary, speaking, reading, writing” and EFL, ESL.” They also included terms related to age (“primary school”, “elementary”, “young learners”, “children”). Due to the specific focus of this review on Indonesia, the keyword “Indonesia” was included in the search strategy to prioritize studies that happened in or relating to Indonesian primary education context and yet large enough base is provided for comparison from other regions.

2.3 Inclusion and Exclusion Criteria

Selection criteria were developed with the aim to guarantee relevance and robustness of analysis. Only items from 2015 to 2025 were included because this intriguing decade had a rapid growth of interactive classroom technologies. The review was particularly related to studies on English as a Foreign Language or similar contexts of learning among students, which is in line with the scope of research questions.

The included studies had to be conducted with primary school learners or teachers at the primary level. Moreover, the IFPs/IWBs had to be a focal part of the research rather than just being mentioned in passing. This meant studies that investigated particular interactivizing elements, teaching strategies mediated by the technology, changes in interactional practices or claims made about (effects on) learning outcomes for English could be included. Studies were considered to have presented an appropriate level of methodological detail or conceptual elaboration when they demonstrated the potential to be interpreted with any semblance of meaningful analysis in relation to a theme.

Publications were excluded if they centered only on secondary or higher education environment, addressed issues not related to language learning and educational technology and when the material analysed referred to an overall description of Educational Technology without a sufficiently clear indication on IFPs or IWBs. Commentaries, opinion papers and non-empirical studies were excluded as well due to insufficient methodological transparency. The combination of these inclusion and exclusion decisions resulted in a final set of articles that formed a substantive and defensible basis for answering the review questions.

2.4 Study Screening and Selection

Study selection adhered to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page et al., 2021). The systematic search resulted in 1,460 unique records after the initial search for duplicates. One hundred sixty-two articles progressed to full-text screening at title and abstract level. For the full-text review, each article was screened against all inclusion criteria. The last one was composed of a total of 21 studies that met all predetermined eligibility criteria. This systematic approach guided the inclusion of evidence, as illustrated through a PRISMA flow diagram (Figure 1) below ensuring that only evidence which is of high quality and directly relevant informed the thematic synthesis.

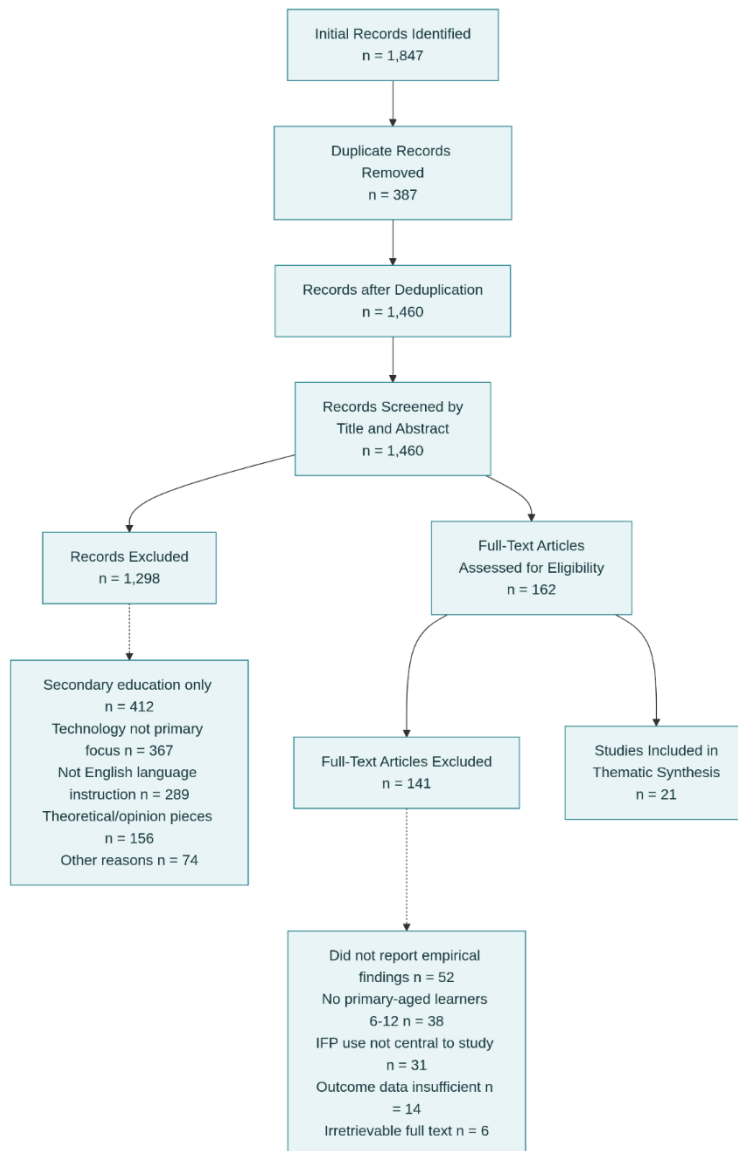


Figure 1. PRISMA Flow Diagram: Study Selection Process for Interactive Flat Panels in Primary English Language Teaching Systematic Review

2.5 Analytical Framework and Synthesis Procedures

The full text of each selected article was read, and data relevant to the review focus were systematically extracted, emphasizing how interactive technology was defined or conceptualized, which IFP/IWB features were foregrounded in instruction, and how these related to students' English learning. Particular attention was paid to reported variations in classroom interaction patterns, including shifts in teacher–student roles, levels of student collaboration, and associated classroom discourse practices. The review also examined how teachers adapted their modes of instruction when technology was embedded in teaching, as well as the challenges, limitations, costs, and facilitating conditions reported in the studies.

The resultant data were then coded and refined through iterative comparison across studies. Preliminary codes were inductively derived and clustered around conceptual categories such as visual scaffolding, multimodal input, student collaboration, teacher confidence, and classroom management. These codes were progressively compared and reorganized, enabling the classification of related concepts into broader thematic categories that aligned with the review's research questions on language development, interactional change, and pedagogical adaptation.

The thematic synthesis integrated findings from studies employing varied research designs, including experimental and quasi-experimental research, action research, case studies, and perception-based surveys. The reviewed literature encompassed diverse geographical contexts, including Indonesian, regional, and international settings, and addressed both earlier generations of interactive whiteboards and newer interactive flat panel displays. Synthesizing these heterogeneous sources within a coherent analytical framework allowed the review to develop a nuanced, theoretically informed account of how interactive display technologies are used in primary English classrooms and the pedagogical implications of their integration.

This thematic review drew on 21 empirical studies investigating interactive display use in primary English or English as a Foreign Language (EFL) contexts. Studies were included if they involved primary-aged learners (typically 6–12 years old), focused on English language instruction, centered on interactive whiteboard or flat panel technology as a teaching tool, and reported quantitative, qualitative, or mixed-methods findings. The resulting corpus spanned 13 countries across five continents, including two studies from Indonesia, and represented a range of school types, geographic settings, and economic contexts, enabling meaningful cross-context comparison while preserving relevance to Indonesian educational circumstances.

Analysis followed a thematic synthesis approach suited to integrating findings from studies with heterogeneous designs and contexts. Across the dataset, recurring patterns were coded in relation to classroom practices, learning outcomes, student and teacher experiences, and implementation challenges, and then organized into broader conceptual categories. Five main themes emerged: how teachers design and deliver lessons using interactive displays; effects on language skill development; influences on student engagement and motivation; teacher beliefs and professional practices; and enabling or constraining conditions for technology adoption, with convergent findings highlighted and notable divergences or contradictions explained.

3. FINDINGS

3.1 Overview of Evidence Base: Themes, Saturation, and Quality Assessment

The systematic analysis of 21 empirical studies generated five overarching themes organized by sub-themes and evidence patterns. This section presents the quantitative overview of theme organization, data saturation, and evidence quality before proceeding to detailed findings.

Table 1: Sub-Theme Organization and Theme Structure

Sub-theme	Theme	Frequency	Central Finding
Conversational scaffolding	Pedagogical Approaches	18/21	IFPs facilitate classroom dialogue when teachers design interactive tasks
Multimodal presentation	Pedagogical Approaches	16/21	Visual, auditory, and tactile elements combined enhance comprehension
Vocabulary development	Language Skills & Achievement	15/21	Multimodal instruction produces durable vocabulary learning
Grammar skill advancement	Language Skills & Achievement	14/21	Interactive grammar activities outperform traditional drill approaches
Writing process support	Language Skills & Achievement	11/21	Visual scaffolding and shared composing strengthen writing development
Affective engagement	Student Engagement & Motivation	19/21	IFP lessons generate sustained enjoyment and reduced off-task behavior
Confidence building	Student Engagement & Motivation	10/21	Success with interactive tasks increases willingness to attempt challenging work
Technology acceptance	Teacher Beliefs & Practices	18/21	Teachers consistently view IFPs positively when they experience success
Collaborative expertise	Teacher Beliefs & Practices	14/21	Teacher collaboration accelerates learning and sustains implementation
Infrastructure barriers	Barriers & Enablers	16/21	Device scarcity and connectivity issues most frequently cited obstacles

Sub-theme	Theme	Frequency	Central Finding
Training insufficiency	Barriers & Enablers	19/21	Limited professional development critical mediator of effectiveness

Note: Frequency indicates the number of studies that reported findings related to each sub-theme.

Table 2: Evidence Quality and Saturation Analysis

Theme	Data Saturation Point	Total Studies Contributing	Quality Confidence
Pedagogical Approaches	Study 12 (Giannikas, 2021)	18/21 (85.7%)	High
Language Skills & Achievement	Study 10 (Hoa & Trang, 2020)	17/21 (81.0%)	High
Student Engagement & Motivation	Study 8 (Bautista-Vallejo et al., 2020)	19/21 (90.5%)	Very High
Teacher Beliefs & Practices	Study 11 (Ersoy & Bozkurt, 2015)	18/21 (85.7%)	High
Barriers & Enablers	Study 13 (Samsonova, 2019)	20/21 (95.2%)	Very High

Note: Data Saturation Point indicates the study number at which no substantially new codes emerged for this theme; subsequent studies confirmed rather than introduced new concepts. Quality Confidence reflects GRADE assessment results, where "High" confidence indicates strong methodological rigor across contributing studies.

Saturation analysis demonstrates that consistent patterns emerged relatively early in the analysis, with later studies confirming rather than introducing new findings. This suggests robust themes well-

represented across the research corpus. Using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework, 12 studies achieved “high” quality ratings due to rigorous designs and appropriate controls, while eight achieved “moderate-high” ratings and one achieved “moderate.” No studies were excluded, indicating a credible overall evidence base.

Table 3: Convergent and Divergent Findings

Major Finding	Supporting Evidence	Dissenting/Qualified Evidence	Pattern
IFPs improve vocabulary	8 studies with significant gains	1 study reporting modest gains without training	Divergence explained by implementation quality
IFPs enhance motivation	15 studies unanimous	0 contradicting studies	Universal convergence
Teachers hold positive attitudes	14 studies uniform support	0 contradicting studies	Universal convergence
Training critically affects outcomes	12 studies consistent	0 contradicting studies	Universal convergence
Infrastructure is primary barrier	11 studies across developing nations	0 contradicting studies	Very strong convergence
Younger students more engaged	2 large studies, p <0.001	No contradicting evidence	Consistent pattern

Note: Convergent findings (supporting evidence) indicate consistency across multiple studies; divergent findings reveal contradictions or conditions under which effects vary.

This overview indicates that the reviewed studies demonstrate strong convergence on most major findings, with only one area (vocabulary improvement) showing conditional variation related to implementation quality. The high frequency of studies contributing to each theme and early saturation achievement support the robustness of the evidence base for the subsequent detailed findings.

3.2 How Teachers Use Interactive Flat Panels in English Lessons

Teachers employ interactive flat panels across a spectrum ranging from straightforward multimedia display to complex, student-centered activities. Portuguese primary teachers studied by Lucas (2025) illustrate sophisticated implementation. These educators combined authentic children's literature with video narratives displayed on screens, deliberately pausing to highlight vocabulary, encouraging choral reading of repeated phrases, and asking comprehension questions that prompted meaningful discussion. Students responded by discussing plot developments, predicting story directions, and employing target vocabulary in genuine conversation. This implementation transformed passive viewing into active language engagement.

In vocabulary and grammar instruction, teachers commonly use interactive features to build foundational skills. Teachers in Saudi sixth grade employed such lessons as those designed by Mohammed (2021) which involved the use of quiz for practice with immediate feedback, grammar games that centered on changing positions of elements within a sentence, videos demonstrating target structures and image-based activities were used to connect visuals to language. When implemented consistently, such activities produced measurable improvements in both grammatical knowledge and student interest in grammar study. Vietnamese teachers teaching vocabulary through animated definitions, pronunciation models, images linked to meanings, and interactive matching games saw their students retain vocabulary advantages

weeks after instruction (Hoa & Trang, 2020). This result aligned with contemporary best practices in digital vocabulary instruction (Ukume et al., 2025).

For writing development, smartboards enable teachers to guide students through complete writing processes. Fourth grade writers in Egypt also were successful when teachers provided visual organizers to brainstorm, collaborative on-screen sentence construction, where teacher focused on correct grammar, color-coded main ideas that helped organize paragraphs and peer annotation of shared drafts (Mohamed, 2024). These activities transformed what had been an abstract writing concept into something concrete and accessible, mirroring the findings of studies in relation to how IWB activities improve EFL primary learners' motivation and writing skills (Mohamed et al., 2018).

However, implementation quality varies considerably. American teachers to whom Samsonova (2019) spoke showed varying degrees of sophistication: some offered elaborate lessons that included interactive programs and collaborative lesson design work, while other simply projected PowerPoint slides or showed handouts. The difference centered on whether teachers had invested time learning the technology's interactive capabilities and collaborating with colleagues. Teachers without such investment typically used IFPs primarily to visualize materials without encouraging student interaction. This difference is compatible with the broader trends observed by Tertemiz et al. (2015), who through a study with primary school teachers and students established that the views on the IWB could vary from a transformational pedagogical tool to being regarded as just a display apparatus.

Greek private language schools offer a cautionary example. When teachers lacked formal pedagogical training, they commonly reverted to traditional lecture-based teaching, simply using interactive whiteboards as display screens rather than interactive tools. Giannikas (2021) observed that teachers primarily employed the technology for whole class presentations, with students

watching passively rather than engaging with the technology directly. The real effect was simply to turn our equipment into a glorified blackboard: nice to look at maybe, but pedagogically the same old thing. This phenomenon is present even in an Indonesian context, as Dewi et al. (2025) learned that simply having technology in the classrooms did not automatically create meaningful, well-designed lessons. Teachers used technology in the classroom not necessarily linked to a particular desired pedagogical result, which indicates that having access to hardware does not bridge gaps in knowing how and knowing why.

3.3 Effects on Language Learning and Academic Achievement

Many studies show good results in the acquisition of the English language. When Turkish 4th graders were randomly assigned to receive the same content in interactive whiteboard or traditional blackboard formats, for example, those who learned interactively scored higher on achievement tests than did their peers (Sen & Agir, 2014). The multimodal presentation, interactive engagement, and dynamic demonstration appeared responsible for this advantage.

Vocabulary learning shows particularly strong gains. Vietnamese learners instructed by animated word definitions, pronunciation models, linked-images and interactive games scored higher words acquisition than the traditionally taught group at delayed testing weeks after (Hoa & Trang, 2020). These results are consistent with the general evidence showing that the digital technology, such as animated video and IWB, can greatly improve in pupils' English vocabulary learning (Ukume et al., 2025). Spanish sixth graders showed intriguingly strong retention: delayed recall performance (45 days after instruction) was actually higher than immediate post-lesson test performance, indicating that well-designed digital activities' engaging, emotionally activating nature could help support processes of memory consolidation (Bautista-Vallejo et al., 2020).

Grammar instruction similarly benefits from interactive approaches. Saudi students learning grammar skills with smartboard software through visual rule explanation, interactive sentence-building activity, and challenging quizzes not only outperformed their control group peers in the post-tests, but they were also more interested in studying grammar. The instructional method accounted for 88 percent of variance in learning outcomes, representing an exceptionally large effect. (Mohammed, 2021).

In writing classroom, students' writing-skill development shows measurable improvement across multiple dimensions. Egyptian fourth graders participating in smartboard-based writing instruction improved significantly in organization, development, word choice, mechanics, and grammar ($p < 0.01$), with effect sizes ranging from 0.38 to 0.64 (Mohamed, 2024). These outcomes reflect the documented effectiveness of interactive whiteboard activities-based programs in enhancing EFL primary learners' writing skills and motivation, as demonstrated in comprehensive experimental research (Mohamed et al., 2018). Visual scaffolding displayed on smartboards, such as color-coded paragraph components and interactive graphic organizers, helped young writers internalize previously abstract writing structures.

However, positive outcomes are not guaranteed. When only 55 percent of Indonesian teachers rated digital technology as "effective" for learning, achievement gains proved modest in schools with inconsistent device access and minimal teacher preparation (Dewi et al., 2025). Greek students using interactive whiteboards showed some vocabulary gains, but improvements were smaller than in contexts where teachers actively designed interactive lessons; display-focused use limited cognitive benefits (Giannikas, 2021). This established trend, together with evidence from earlier research reported here, holds an important point: interactive flat panels are powerful tools to mediate certain learning processes when used in skilful and expert ways although there is

nothing magic about their mere presence in educational settings that guarantees more effective learning opportunities.

3.4 Student Engagement and Motivation

Perhaps the most consistent research finding is that interactive flat panels significantly boost primary student engagement and motivation. Research on the interactive use of IWBs in EFL classrooms shows that it facilitates interaction and communication while it also offer more interesting environments for learning as well as student-centered approaches which also lead students to take part in (Al-Saleem, 2021). Malaysian students visibly displayed excitement when teachers announced upcoming interactive lessons; the students sat more attentively, raised hands more frequently, and reported feeling “very excited” about the activities (Karthigesu & Mohamad, 2020). Students described IFP lessons as “more enjoyable,” “easier to understand,” and motivating them to “read more,” suggesting that engagement extended beyond immediate classroom sessions into longer-term interest.

Visual and kinesthetic learners showed particularly pronounced benefits from the large, colorful, interactive displays allowing physical manipulation of language elements. Quantitatively, approximately 71 percent of Spanish students reported “very much” enjoying interactive language activities, with only 6 percent expressing no enjoyment (Bautista-Vallejo et al., 2020). When asked about distraction, 70 percent reported being “not at all distracted”, a striking contrast to typical classroom off-task behavior. These engagement dynamics were recognized by researchers to novelty factors (for example, anticipation regarding what might show up next) and game-like features of interactive exercises that tap children’s developmentally appropriate motivation for play and discovery.

Importantly, increased motivation translated into behavioral engagement and academic persistence. Egyptian fourth graders not only improved writing skills but also increased their self-efficacy,

gaining confidence in their ability to brainstorm, compose, organize, and navigate the writing process (Mohamed, 2024). Greater self-efficacy is often associated with greater action readiness to undertake hard tasks and persistence through setbacks, so that there are positive feedback loops in action. The initial success from early effort breeds confidence leading to further good effort and accomplishment (Mohammed, 2021).

Age emerges as an important consideration in engagement patterns. Turkish students in elementary grades held significantly more positive attitudes toward IFPs than secondary students ($p < 0.001$), with attitudes declining progressively through upper grades (Balta & Duran, 2015). Researchers attributed this to novelty effects weakening over time and possibly to older students' preferences for greater autonomy than whole-class instruction typically provides.

3.5 Teacher Beliefs, Confidence, and Professional Practices

When interactive flat panels work as promised, teachers become convinced of their value. In Morocco, 90 percent of surveyed teachers reported using IFPs during every session, 87 percent recommended the technology to colleagues, and 67 percent found the technology "easy to use" (Belabcir, 2025). Yet 53 percent disagreed with the statement "I cannot teach without IFPs," suggesting they view the technology as valuable enhancement rather than necessity. The data on the feasibility of integrating interactive whiteboards in EFL primary classrooms clarifies that robust pedagogical efficacy is not only understood but is also suitably placed within reasonable expectations by teachers (Alhumsi & Shabdin, 2016).

Confidence and adoption behavior are very much affected by teaching experience. Taiwanese teachers with 5-year or more experiences had significantly more positive beliefs in the areas of IFPs to support teaching, encouraging learning, and blending naturally with teaching (Tsai, 2019). This gradient suggests that expertise develops gradually through sustained classroom

experience, consistent with how teachers develop adaptive expertise generally. Notably, advanced educational credentials did not predict positive beliefs about technology. Hands on classroom experience mattered more than formal qualifications. Studies examining primary school teachers' and students' views of interactive whiteboards reveal that both stakeholder groups develop increasingly sophisticated perspectives through extended classroom exposure (Tertemiz et al., 2015).

Despite generally positive attitudes, teachers identify important support needs. American elementary teachers described needs for "additional planning time, professional development, technology support, and technology upgrades" (Samsonova, 2019). Preparing lessons with interactive multimedia takes considerable time. Teachers must find suitable resources, check that materials support learning well, fit them into lesson plans, and learn how to use new software. However, teachers who continued with this work described important turning points when things became easier. They created lesson templates they could reuse, collected assessed resources for future use, and became comfortable with software tools. Working with colleagues proved mainly valuable. Teachers who designed lessons together, shared resources through shared folders, and solved problems collaboratively sustained their use of technology more effectively than teachers working alone.

Training deficits are particularly pronounced in low resourced settings. Indonesian primary school teachers were concerned, with 42.5% feeling they did not get enough professional development in digital technology and 27.5% experiencing insufficient technical support when encountered with difficulties (Dewi et al., 2025). When technology didn't work, for example screens went dark, software wouldn't open, projectors flashed an impenetrable blue error screen, many teachers didn't know how to fix it themselves and instead resumed their lessons without multimedia choreography that they had spent hours planning. This undermined both confidence and learning outcomes.

Teachers who use technology most effectively combine three types of knowledge: strong English language understanding, skill in teaching methods, and ability to use technology tools. Researchers call this combination Technological Pedagogical Content Knowledge, or TPACK. A Turkish teacher studied over 40 years showed how this works in practice. His success came not from technical skills alone, but from deep knowledge of language teaching, understanding how to teach students with different needs, using assessment to guide instruction, and adapting materials for his students (Ersoy & Bozkurt, 2015). Effective teachers make thoughtful choices about which technology features to use based on what they want students to learn. For example, they might use screen recording to give individual feedback on pronunciation, display two texts side by side to help students compare them, or record lessons so absent students can watch them later.

3.6 IFPs Implementation Barriers and Indonesian Policy Context

Infrastructure limitations present the most immediate obstacle in developing educational contexts. Dewi et al. (2025) found that 92.5 percent of Indonesian teachers identified limited device availability as a primary barrier, with most schools possessing only one or two IFPs despite serving numerous classrooms. Additionally, 67.5 percent experienced unstable internet connections, disrupting access to online resources central to many digital lessons. Similar constraints emerge across Malaysia, Nigeria, and Greece, where uneven distribution and inadequate bandwidth hamper regular use (Karthigesu & Mohamad, 2020; Giannikas, 2021).

Pedagogical barriers usually comes from insufficient instructional preparation and underdeveloped integration of technology with comprehensive English language teaching practices. Greek teachers without formal training struggled to move beyond traditional transmission approaches, using interactive whiteboards primarily for static slide display rather than creating genuine interactive learning opportunities (Giannikas, 2021). Indonesian teachers

frequently employed digital tools without clear connections to learning objectives, indicating weak technology-pedagogy integration (Dewi et al., 2025). To close the gap between having technology and using it effectively, teachers need curriculum guidance rooted in national education frameworks. Badan Standar Kurikulum dan Asesmen Pendidikan [BSKAP] (2025) offers exactly this kind of support for meaningful technology integration

School-level support makes a real difference in how well technology gets used. One example comes from a language center in Morocco. Teachers there received two types of training: practical instruction on how to use the equipment, plus guidance on how to integrate the technology into their teaching. This combination worked much better than the typical situation, where 77 percent of teachers received only one type of training or neither (Belabcir, 2025). Schools that succeeded had several things in common. They employed IT staff to fix problems quickly, maintained equipment regularly to prevent breakdowns, gave teachers time to plan lessons using technology, and encouraged teachers to work together. These schools used their technology more consistently and in more sophisticated ways than schools lacking these supports.

Indonesia faces both opportunity and risk. Presidential Instruction No. 7/2025 shows that the government is committed to expanding digital infrastructure. However, distributing equipment alone will not work. Without also investing in teacher training, technical support, and curriculum guidance, Indonesia risks repeating mistakes from other countries. Portugal's Magalhães computer program offers a cautionary example. That program gave computers to schools but provided minimal teacher training on how to use them effectively. As a result, many schools left the computers underutilized (Lucas, 2025). The success of Indonesia is not merely on hardware but depends on three intertwined affairs: the sound preparation of teachers, access to reliable technical support and a systematic curriculum guidance like those in BSKAP (2025) that tells the way in which computers will be used best.

4. DISCUSSION

4.1 The Central Role of Teacher Knowledge: TPACK Framework

Taken together, these findings point to teacher knowledge as the central mediator between infrastructure investment and actual learning gains, a relationship that can be clarified through the TPACK framework

Studies show very different results depending on how teachers use the same equipment. Some classrooms become more interactive and language rich, while others simply project the textbook onto a larger screen (Alhumsi & Shabdin, 2016; Fitria, 2024; Tsai, 2019). This variation reveals something important: having technology is not enough to improve teaching and learning. Success really depends on teachers having three types of knowledge working together. Teachers need to understand English language teaching, understand good teaching methods, and know how to use technology tools. This combination is described in the Technological Pedagogical Content Knowledge framework, or TPACK, which several recent studies use to analyse how English teachers work with digital tools in primary classrooms. Teachers with developed TPACK make decisions about what to do or not to do in terms of a technology feature because this is an instrument that has been carefully chosen preferentially over other features and instruments for teaching points. They have considered which board tools to use for text structure, interaction initiation, or practice support. Teachers with weak TPACK tend to use equipment in very general ways, such as showing slides or videos, and therefore miss opportunities that technology offers for specific language learning goals.

TPACK development requires integrated attention to all three knowledge dimensions. Technical proficiency involves operating equipment fluently, solving basic technical problems, and integrating multimedia smoothly so that lessons are not constantly interrupted. Pedagogical knowledge means being able to design

interactive tasks, differentiate activities for different learners, and use formative assessment to adjust instruction while teaching. Content knowledge means understanding English language systems, proficiency expectations, and how children develop reading, writing, listening, and speaking over time. Effective professional development addresses all three dimensions at once rather than treating technology training, pedagogy workshops, and content updates as separate, unrelated activities. Studies of interactive whiteboard and digital technology use in EFL contexts reach similar conclusions, finding that teachers who receive support only in how to operate devices rarely change their teaching, whereas those who work on pedagogy and content at the same time are more likely to integrate technology in purposeful ways (Dewi et al., 2025; Giannikas, 2021; Lucas, 2025).

The most successful professional development programmes work in this integrated and practical way. Teachers start by clearly identifying what they want students to learn, such as a particular writing skill, grammar pattern, or type of classroom interaction. Then they work together to design lessons that use technology to support those specific goals instead of adding technology at the end. They try out the lessons with real students, watch what happens, and make improvements based on how students respond and what they actually learn. This kind of ongoing, practice-based learning that happens in schools through activities such as studying lessons together, observing each other teach, and analysing recordings or screenshots of their own teaching has been shown to build the kind of TPACK teachers need to use technology meaningfully. In the present study, a similar pattern emerged: teachers who engaged in planning, experimentation, and reflection cycles were able to use interactive flat panels to reshape their English lessons, whereas teachers without this cycle relied on them only superficially.

4.2 Practical Recommendations for Indonesian English Teachers

Aspects of IFPs that are most beneficial to Indonesian primary English classrooms include the potential to promote deeper understandings, more engagement with meaning-making activities and opportunities for joyful but challenging learning as encouraged in Kurikulum Merdeka. The goal, as BSKAP (2025) explains, is to have lessons that teach English in a mindful, meaningful and joyful way; not just visually interesting.

Interactive flat panels can be planned as concrete support for each English skill while still embodying the deep learning principles and experiences. For speaking, the desired outcome is that pupils talk more in English, with longer turns and greater confidence. A communicative perspective on learning implies that spoken language develops in use by learners when they employ it to capture their ideas in real speaking acts. In practice, teachers might share an image, short video or a scene from a story and then quickly show question stems or sentence starters so children know how to respond. This helps them mindfully understand the purpose of the task and gives them a meaningful context for speaking. As groups plan what to say using simple frames on the screen and then present to the class, they apply language in a supported way. Later, short video or audio recordings of these performances can be revisited so students can reflect on clarity, pronunciation, and use of target expressions in a positive and constructive atmosphere, which makes speaking development both reflective and joyful.

For listening, the goal is more reliable understanding of simple spoken English and the ability to pick out key information from stories, dialogues, and instructions. Listening theories emphasise comprehensible input and clear listening purposes. Interactive panels allow teachers to play short audio or video texts while simultaneously showing pictures, keywords, or diagrams that anchor meaning (Bautista-Vallejo et al., 2020). Prior to running, the teacher can scribe a literal question or sign on screen for the

passage in order to highlight listening intent and aid listener awareness. Once students have listened to the song for the first time, this is followed by on screen activities like matching images with what they just heard or ordering events that happen in the song. By doing this, now they need to understand and use what they know not only answer isolated questions. In a later phase, the class can briefly discuss which visual cues or strategies helped most, turning listening into an object of reflection and encouraging learners to notice how they listen, not only what they listen to.

Reading outcomes focus on better comprehension of grade appropriate texts and awareness of how texts are organised. Strategy based views of reading highlight the importance of modelling and practising predicting, questioning, and summarising. When a short text is displayed on the interactive panel, the teacher can think aloud while highlighting titles, subheadings, and pictures to invite predictions, thereby guiding students into mindful understanding of the text before they read it in detail (Giannikas, 2021; Karthigesu & Mohamad, 2020). In casual classroom reading, important vocabulary and transitional words can be underscored, with straight arrows or little icons suggesting connections, and the pupils are invited up to add their own mark-making (or even a question) of some kind. This joint use of textual control makes the use of strategies a visible joint action and provides students with opportunities to exercise their reading strategy together. At the end, a short visual summary or story map built on the screen can serve as a prompt for the whole class to reflect on what helped them understand and where they still felt confused, thus nurturing reflective habits and making reading feel more manageable and meaningful.

In writing, the focus is on more developed and clear sentences and paragraphs using an increasing range of possible words with accurate spelling and grammar. Process writing and scaffolding theories emphasise modelling, joint production and guided practice prior to independent output. The interactive panel is well suited to

this. A model text can be displayed and examined for structure, with the teacher highlighting different parts and discussing their functions to build understanding of genre. The class can then write a new text on the screen as a group, with students proposing sentences, debating edits and watching changes pop up one by one. Studies concerning smart board-based writing programmes indicate that this kind of public composing and revising promotes the students' learning both in terms of skills and motivation (Mohamed et al., 2018; Mohamed, 2024). Saving different stages of the text and revisiting them later allows students to reflect on how vocabulary, grammar, and organisation have improved, making the writing process transparent and turning revision into a meaningful, even joyful, exploration of improvement rather than a punishment.

Vocabulary and grammar outcomes focus on expanding word knowledge and improving accuracy and flexibility in basic structures. A form and meaning interaction perspective suggests that learners benefit from encountering items in context and manipulating them in varied ways with immediate feedback (Hoa & Trang, 2020; Mohammed, 2021; Ukume et al., 2025). On an interactive panel, new vocabulary and structures can be rolled out with images and simple example sentences, then shifted into activities where students match words to pictures, sort objects in categories or build sentences by dragging chunks of syntax into place. These are tasks that aid to help students making sense of language and using it purposefully. Because the screen responds instantly, errors can be corrected and alternative options tested without erasing and rewriting everything. Over time, teachers can save class-built word walls, grammar charts, or solved language puzzles and bring them back for short reviews, prompting students to reflect on what they remember and what needs more work.

In all four skills, the point is that interactive flat panels are intended as tools to enable deep learning rather than objectives in themselves. Lessons start with well-defined goals that students can understand, proceed through rich opportunities to use language in

context and end with brief, focused opportunities to reflect on what and how got produced. Employed in this manner, interactive panels can transform learning in three ways: they make it more mindful by clarifying purposes and strategies; more self-expressive by grounding language in action and experience; and more enjoyable by making successes visible and worth celebrating together. (BSKAP, 2025).

4.3 Policy Direction for Successful Implementation

There are a number of steps that seem necessary in being able to continue and expand the successful use of interactive flat panels within Indonesian primary English classrooms. First, comprehensive TPACK-centered professional development must guide any initiative, moving beyond device operation to focus on pedagogical design, language content knowledge, and meaningful integration. Technology alone cannot improve learning without strong teacher expertise (Dewi et al., 2025; Fitria, 2024; Tsai, 2019). Development needs to be sustained over multiple years, job-embedded in schools with real teachers and students, and evidence-based through approaches such as lesson study, video analysis of teaching, and examination of student work. In that context, the Ministry can provide a strategic focus through developing exemplary lessons that promote Kurikulum Merdeka and national English standards which in turn provides teachers with concrete models of how such mindful, meaningful and joyful deep learning with IFPs systems might be implemented.

Second, strong technical infrastructure and support must accompany hardware procurement. Adequate device to classroom ratios, especially in under resourced regions, are essential if interactive panels are to be used regularly rather than shared periodically. Schools require dependable broadband, responsive technical assistance with articulated and clear troubleshooting procedures, and preventative maintenance schedules so that teachers can plan with certainty. In the absence of these fundamental building blocks, devices are likely to give rise to

frustration and underuse, consistent with wider assessments of digital technology use in Indonesian schools (Dewi et al., 2025). National digitalisation initiatives and instructions that prioritise infrastructure development provide an important policy framework for addressing these needs.

Third, more detailed curriculum guidance and resource delivery should help teachers understand when and how to employ interactive flat panels effectively. Sharing exemplar lessons, performance-based assessment rubrics, and endorsed media libraries that tie to national standards can reduce the amount of preparation a teacher must make as well as serve to model what practice supported by evidence looks like, especially for teachers who are still constructing their TPACK. To the extent that these resources directly link technology use to foundational knowledge about deep learning and specific speaking, listening, reading, and writing results, they can serve as ready-made bridges between policy talk and classroom practice.

Fourth, teachers need time and space to work together, and this must be protected by policy. Regulations that provide regular places for planning time with colleagues at the same grade level or in the same subject area, along with a place, to review together student work samples and materials; either through sharing an entrance exam data about essay writing and number of common exams by individual teachers show potential support to both Kurikulum Merdeka focus on PLCs and results that teacher who learn as team have used more effective use of technology (BSKAP, 2025). Simple recognition, showing off successful interactive flat panel lessons or recording effective activities can also promote innovation, allow good ideas to spread and make local teacher expertise more visible.

Fifth, equity-oriented efforts are necessary to ensure that underprivileged learners and schools can actually benefit from interactive flat panels. Interventions such as provision of supplementary devices, improved internet connectivity, and intensive coaching should first focus on rural and remote districts

with the widest digital gaps, consistent with national concerns over equal opportunity to good education (Dewi et al., 2025; Instruksi Presiden Republik Indonesia Nomor 7 Tahun 2025, 2025). Monitoring should not only count how many devices are delivered to whom, but also measure how they are used. There is a need to track which groups of learners are actually reached, and how achievement changes over time. Having done this, policies can be adjusted whenever new gaps appear.

Lastly, in Indonesian context, there is an urgent need for embedded research and evaluation to explore the impact of interactive flat panels on student learning, and cost effectiveness. Most existing IFP and IWB studies come from different cultural and educational settings, and may not reflect local context, curriculum requirements, or language learning priorities. Systematic Indonesian research that looks closely at classroom processes and learning outcomes can inform iterative improvement of policy, professional development, and resource design, and help ensure that investments in interactive flat panels genuinely support the deep learning aims of Kurikulum Merdeka rather than simply increasing the amount of hardware in schools.

5. CONCLUSION

Evidence from international studies shows that interactive flat panels can genuinely improve primary English teaching, but only when lessons are thoughtfully designed and skillfully delivered. Students in these classrooms gain ground in vocabulary, grammar, writing, and motivation. Yet these improvements don't happen simply because equipment arrives. They happen when teachers combine technology use with English language knowledge and solid teaching practices, when schools provide reliable technical support and foster collaborative cultures, and when policy creates space for thoughtful, sustained implementation.

Indonesia's digitalisation agenda presents a meaningful opportunity to strengthen primary English instruction through

technology-enhanced teaching aligned with Merdeka Belajar and deep learning frameworks. The nationwide deployment of interactive devices reflects genuine political commitment to educational transformation. However, evidence from both international and Indonesian contexts demonstrates a critical reality: hardware provision alone is necessary but insufficient. Sustainable improvements require parallel, long-term investment in TPACK-oriented professional development, reliable technical infrastructure, coherent curriculum guidance, protected collaborative planning time, and formative monitoring of actual classroom practice. Without these complementary investments, interactive devices risk underutilisation, and intended student benefits may not materialise.

In this context, primary English teachers emerge as the pivotal factor determining whether interactive flat panels function as transformative instructional tools or underutilised equipment. When teachers engage in deliberate lesson design centred on interactive, language-rich activities; differentiate instruction for diverse learners; employ technology for formative assessment and dynamic pedagogical adjustment; and cultivate collaborative professional communities, technology serves as a catalyst for deeper, more meaningful learning experiences. Achieving this level of instructional practice demands multifaceted support: sustained, comprehensive professional development for teachers; dependable technical infrastructure and collaborative school cultures; and policy frameworks that provide explicit curriculum guidance, accessible exemplars of effective practice, and recognition for pedagogical excellence.

Indonesia's implementation of its digitalisation agenda hinges on strategic decisions concerning professional development, technical support, curriculum alignment, and assessment frameworks. Evidence consistently demonstrates that when technological resources, teacher expertise, and organisational systems are coherently integrated, student learning outcomes improve

substantially. Conversely, when technology adoption occurs independently of sound pedagogical principles and institutional support structures, anticipated benefits seldom emerge. Consequently, policymakers, educational leaders, and practitioners collectively bear responsibility for ensuring that interactive flat panel implementation becomes a sustained, equitable mechanism for advancing English language proficiency among all primary learners.

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RESULT AND DISCUSSION

The followings were the steps in using paper-mode Quizizz in English learning including signing up, creating questions, printing Q-cards, and starting and scanning the Q-cards.

There are some studies about the use of paper-mode quizizz in English language learning and teaching. Firstly, Al Husnah *et al.*, (2023) aimed to unveil the unique insights and experiences of students regarding Quizizz Paper Mode as a tool for language

assessment. This study used descriptive analysis as a qualitative method. Semi-structured interviews were used to acquire data from a wide range of pupils. Students from a diverse range of backgrounds set out to collect a broad range of data samples. Their unique motivation and level of activity during their English language acquisition expanded the study's reach. According to the research gathered, students view Quizizz Paper Mode as an engaging instrument for language evaluation that boosts their self-esteem, drives them more, and improves their reading comprehension.

Rizal Wahid Permana Putra (2023) also carried out the study about paper-mode quizizz. His study aimed to investigate the use of Paper-Mode Quizizz to improve students' vocabulary at eighth grade students. He used Classroom Action Research as the research methodology. The data demonstrated that the usage of paper-mode Quizizz dramatically increased the eighth-grade students' vocabulary proficiency. Additionally, using paper-mode Quizizz to acquire new vocabulary increased the students' enjoyment, participation, motivation, and engagement. Lastly, Khadijah Maming *et al.*, (2023) aimed to evaluate if using Quizizz in paper format, an engaging and interactive medium, will help junior high school students improve their vocabulary scores. According to this study, paper-mode Quizizz is a useful tool for helping students become proficient in English vocabulary. The results revealed that paper-mode Quizizz considerably increased students' vocabulary achievement compared to other similar programmes utilised in the control group.

CONCLUSION

Based on the above explanations, it can be concluded that paper-mode Quizizz is one alternate site that offers a variety of tools for English teaching and learning . Moreover, Paper-mode Quizizz, students' responses are delivered via printed code cards. After the students have shown and rotated their Q-cards, their teacher will scan each response card to provide the score and real-time answer.

Besides that, paper-mode Quizizz is user-friendly, entertaining, challenging, and fascinating. The students are therefore more inclined to take the Quizizz exam in paper mode. The using paper-mode Quizizz in ICT and non-ICT classroom has some advantages, they are, improve students' motivation, enhance students' confidence, improve students' vocabulary, help teacher in assessing students' learning outcomes

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