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SCIENTIFIC APPROACH AND STUDENT-CENTERED LEARNING IN ELT: A SYSTEMATIC LITERATURE REVIEW OF INDONESIAN RESEARCH (2013–2025)

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Abstract

The integration of the scientific approach into English Language Teaching (ELT) has played a transformative role in Indonesian education since the implementation of the 2013 Curriculum. This systematic literature review explores how the scientific approach aligns with student-centered learning principles and its pedagogical implications in the Indonesian ELT context from 2013 to 2025. A total of 52 peer-reviewed journal articles indexed in SINTA 1 to 3 and international databases were analyzed using the PRISMA model. The review focuses on the pedagogical strategies, learning outcomes, teacher readiness, and classroom practices associated with the scientific approach. Findings indicate that the scientific approach supports learner autonomy, critical thinking, and communicative competence when implemented with contextual sensitivity and adequate teacher training. However, various challenges persist, including misalignment in assessment, limited resources, and superficial understanding of scientific stages. The paper provides implications for curriculum designers, teacher educators, and policymakers to strengthen scientific pedagogy in Indonesian ELT

Keywords: Scientific Approach, Student-Centered Learning, ELT, Systematic Literature Review

INTRODUCTION

The transformation of educational paradigms in Indonesia has been significantly influenced by the introduction of the 2013 Curriculum (Kurikulum 2013), which emphasizes the scientific approach as a central teaching model across subjects, including English Language Teaching (ELT). This curriculum reform aims to enhance the quality of education by promoting a more dynamic and interactive learning environment.

The shift from teacher-centered to student-centered learning is a response to the global demand for 21st-century skills such as critical thinking, creativity, communication, and collaboration (Trilling & Fadel, 2009). The scientific approach, comprising five interrelated stages—observing, questioning, experimenting, associating, and communicating—embodies these competencies and places learners at the center of the learning process (Kemdikbud, 2013).

In the context of ELT, this pedagogical transition is particularly complex. English, as a foreign language in Indonesia, is often taught in large classes with varying student proficiency levels and limited resources. While the scientific approach aims to develop learner autonomy and engagement through inquiry-based learning, its effective application in ELT depends heavily on teacher competence, curriculum support, and institutional readiness (Suherdi, 2015). Some studies have highlighted the approach's potential to enhance communicative competence and classroom interaction (Siregar, 2017), while others note discrepancies between theoretical frameworks and classroom realities (Rahmawati, 2020).

Therefore, this study aims to provide a comprehensive and critical synthesis of research published between 2013 and 2025 regarding the implementation and impact of the scientific approach in Indonesian ELT. The objective is to assess how the approach aligns with student-centered learning, identify implementation patterns, and highlight barriers and innovations across diverse educational settings.

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RESEARCH METHODS

This research follows the methodological framework of a systematic literature review (SLR), applying the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) model to ensure transparency and reproducibility (Moher et al., 2009). The review is based on qualitative and thematic analysis of relevant literature that meets predefined inclusion and exclusion criteria.

Data Sources and Selection Criteria

Articles were collected from a range of academic databases, including Google Scholar, SINTA (Science and Technology Index), Scopus, DOAJ, and Garuda. The search terms used were "scientific approach," "student-centered learning," "English language teaching," and "Indonesia," combined using Boolean operators to optimize the search results.

The inclusion criteria required that the selected articles be peer-reviewed and published between 2013 and 2025. The studies had to focus on English Language Teaching (ELT) within the Indonesian context, particularly those discussing the implementation, challenges, or outcomes of the scientific approach. Furthermore, only articles indexed in SINTA 1 to 3 or international journals were considered.

A total of 126 studies were initially retrieved. After applying inclusion/exclusion filters and removing duplicates, 52 articles were selected for in-depth review. These articles were coded and analyzed using NVivo software to identify recurring themes and insights.

Analytical Framework

The articles were analyzed based on four major thematic categories, namely pedagogical implementation; student engagement and outcomes; teacher perceptions and professional development; and institutional and contextual challenges. The synthesis emphasized the identification of both recurring patterns and distinct innovations across these themes.

RESULT AND DISCUSSION

Implementation of the Scientific Approach

Susanti and Sugirin (2017) highlight that the implementation of the scientific approach in English Language Teaching has generally followed curriculum mandates, particularly in urban schools. However, they note that many teachers still carry out the stages superficially, often due to limited instructional time and lack of concrete examples in training modules.

Similarly, Sulastri (2018) observes that although the five procedural steps of the scientific approach are widely recognized among teachers, their application remains uneven. For example, while the "observing" and "questioning" stages are commonly practiced, the "experimenting" and "associating" phases are frequently misunderstood or omitted altogether, especially in under-resourced classrooms. This inconsistency points to a gap between theoretical understanding and practical implementation.

Wardani and Fauziati (2017) further confirm these findings, emphasizing that inadequate training often leads to fragmented instruction that fails to capture the holistic nature of the scientific approach. Teachers may be aware of the framework but lack the pedagogical tools to translate it into meaningful classroom practice.

Nevertheless, some schools have found creative ways to embed the scientific approach into ELT, such as project-based learning (PBL), role-playing, and thematic teaching (Putri & Amalia, 2019). These methods encourage inquiry and student participation, fulfilling the core objectives of the approach. However, implementation fidelity remains inconsistent across regions and school levels.

Overall, the reviewed studies suggest that while the scientific approach is conceptually embraced in Indonesian ELT, its practical execution remains uneven and context-dependent. Successful implementation appears to hinge on teachers' pedagogical

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understanding, access to contextualized training, and institutional support. Without addressing these foundational gaps, the scientific approach risks becoming a procedural formality rather than a transformative pedagogical model.

Student-Centered Learning Outcomes

Numerous studies affirm that the scientific approach fosters a student-centered learning environment by promoting curiosity, interaction, and active engagement (Yuliana & Lestari, 2021). Tasks structured around exploration and problem-solving enhance learners' metacognitive awareness and autonomy (Nuryani, 2016). Learners become more responsible for their learning process and demonstrate improved language performance, especially in speaking and writing skills.

Moreover, the use of contextual and real-life themes in ELT, such as environmental issues or cultural heritage, has increased student motivation and relevance of language use (Hastuti & Nurkamto, 2016). This indicates that the scientific approach, when properly contextualized, can contribute significantly to authentic and meaningful language learning experiences.

A number of studies support the claim that the scientific approach contributes to more active and student-centered learning, particularly when integrated with appropriate lesson planning and authentic materials. For instance, Sodik et al. (2020) observed that the English teachers implemented all five stages of the scientific approach in teaching speaking, in line with the 2013 curriculum. While the stages were generally applied well, challenges remained in the communicating stage, often due to students' lack of confidence and limited pronunciation skills—factors that directly affect their ability to engage actively in classroom interactions. Complementing this, Ryandani et al. (2018) found that the use of authentic materials in reading classes positively influenced students' motivation and task orientation, despite vocabulary and time constraints. Students demonstrated greater perseverance, ego involvement, and tolerance of ambiguity when exposed to real-world texts, showing how contextualized learning materials can strengthen learner autonomy and engagement—two essential aspects of student-centered learning.

While student-centered learning offers significant potential for enhancing engagement and autonomy, several studies indicate that its successful implementation requires both institutional support and learner readiness. Tadesse (2020), in the context of social studies education, found that despite policy emphasis on active learning, traditional teacher-centered methods still dominate due to structural constraints such as limited resources, rigid schedules, large class sizes, and insufficient instructional materials. These barriers often prevent students from fully assuming responsibility for their learning. Similarly, Ang et al. (2021) highlight that shifting from lecture-based instruction to a more constructivist, workshop-based model in higher education can yield improved engagement and learning outcomes, but only when students are adequately scaffolded. Their study shows that students perform better in flipped learning environments when they are prepared for the shift, suggesting that autonomy in learning must be supported by strategic transition measures. These findings underscore that student-centered approaches, while effective, require careful planning, teacher facilitation, and contextual adaptation to be truly impactful.

In summary, the scientific approach has shown considerable promise in promoting student-centered learning within the Indonesian ELT context by encouraging learner autonomy, contextual engagement, and deeper cognitive processing. However, its effectiveness is not guaranteed by design alone; it depends heavily on contextual factors such as teacher preparedness, availability of authentic materials, institutional flexibility, and students' readiness to embrace more active roles. Therefore, maximizing the potential of student-centered learning through the scientific approach requires not only curricular alignment but also sustained support systems

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that address the practical, cultural, and pedagogical challenges in diverse learning environments.

Teacher Readiness and Professional Support

Teacher competence is a determining factor in the successful implementation of the scientific approach. Fatimah (2019) found that many teachers lack confidence and understanding in operationalizing scientific steps, leading to fragmented and teacher-centered instruction. Several studies report that professional development programs have been insufficient or overly theoretical (Harun & Mujiyanto, 2020).

Structural and contextual challenges also play a crucial role in shaping teacher readiness, particularly for those placed in under-resourced and remote areas. Febriana et al. (2018) highlighted the experiences of teachers participating in the SM-3T program, who were deployed to rural and disadvantaged regions of Indonesia. Despite their dedication, many faced significant obstacles such as limited infrastructure, scarce teaching materials, and a lack of professional support systems—factors that hindered the effective implementation of learner-centered pedagogies like the scientific approach. These findings echo Bell and Smith's (2021) argument that when frontline actors such as teachers operate within bureaucratic systems that are unequally resourced, their ability to reduce structural burdens is constrained. In contexts where administrative support is minimal and decentralization leads to uneven resource distribution, even the most motivated educators may struggle to translate training into meaningful practice. These insights reinforce the need for policy interventions that not only offer pedagogical training but also address systemic inequities that affect teachers' professional capacities, particularly in marginalized educational settings.

The readiness of pre-service and early-career teachers plays a critical role in the effective implementation of student-centered approaches such as the scientific method. Sari and Wulandari (2022) found that EFL pre-service teachers in encountered various challenges during their internships, particularly in facilitating student inquiry, maintaining focus during group activities, and encouraging students to confidently share conclusions. However, these teachers also developed adaptive strategies such as guided questioning and active monitoring to support student engagement. Similarly, Slowik et al. (2020) revealed that novice teachers across multiple countries often feel underprepared to meet diverse classroom needs, particularly in inclusive education settings, and require structured professional support early in their careers. These findings underscore the importance of targeted training and mentorship programs that not only build pedagogical competence but also foster confidence and adaptability in future educators.

Recent studies highlight the need for more holistic and context-sensitive teacher development programs to enhance professional competence and classroom effectiveness. Eliyawati et al. (2023) emphasized that while current teacher training in environmental education has focused primarily on knowledge transmission, it lacks components that promote awareness and sustainable action, underscoring the importance of integrating environmental, economic, and sociocultural perspectives. Similarly, Wahyudi et al. (2023) demonstrated that well-designed blended learning models, such as the 3CM (Cool-Critical-Creative-Meaningful) approach, can foster creativity and character development in students, provided teachers are equipped with the right tools and support. These findings suggest that professional development must not only deliver content knowledge but also empower teachers with innovative strategies to create meaningful, student-centered learning experiences.

In conclusion, teacher readiness is a decisive element in the successful implementation of the scientific approach in ELT. While various studies highlight gaps in confidence, pedagogical understanding, and institutional support, others also emphasize the

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need for context-aware, practice-oriented training models. Challenges faced by teachers—whether due to geographic isolation, limited resources, or shifting pedagogical paradigms—underscore the importance of systemic efforts to build both professional competence and resilience. Strengthening teacher development programs with sustained mentoring, inclusive training content, and access to innovative learning strategies will be essential in preparing educators to enact meaningful, student-centered instruction across diverse classroom settings.

Institutional and Contextual Barriers

Implementation challenges are not only pedagogical but also systemic. Large class sizes, lack of resources, time limitations, and rigid assessments hinder the application of learner-centered scientific instruction (Kurniawati, 2021). Moreover, top-down policy implementation often results in superficial compliance rather than deep pedagogical change.

Recent developments in educational technology offer potential solutions. Online platforms and blended learning modalities enable interactive experimentation and communication stages, especially during remote or hybrid learning (Sari & Wulandari, 2023). However, digital literacy and infrastructure disparities remain major concerns.

Educational inequality remains a persistent issue in Indonesia, particularly in the disparity between urban and rural areas. Janah (2022) notes that while the national curriculum may be uniformly applied, its implementation often falters due to systemic flaws and unequal resource distribution, causing rural schools to lag behind in achieving educational goals. Additionally, institutional factors such as poor work–life balance and lack of organizational support can impact teacher performance and overall instructional quality. Irfan et al. (2021) emphasize that burnout and time constraints, if not addressed through supportive policies, may hinder the consistent and meaningful application of innovative teaching approaches like the scientific method. These findings suggest that institutional reform must not only address infrastructure but also consider teacher well-being and context-sensitive support systems.

Institutional leadership and access to external knowledge are critical in shaping how well schools implement innovative approaches like the scientific method. Hadijah (2024) found that leadership styles such as transformational and servant leadership significantly influence teacher motivation, job satisfaction, and engagement in professional development—factors that contribute to a school's readiness for pedagogical change. Meanwhile, Pietsch et al. (2023) emphasize that schools often struggle to innovate in isolation and benefit greatly from external knowledge sources. Their findings support the idea that adopting open innovation models—particularly in digital integration—can increase the likelihood of successful instructional transformation. Together, these studies underscore the importance of school leadership and collaborative innovation as institutional levers for overcoming contextual barriers in education.

The success of implementing innovative instructional approaches like the scientific method also depends on how well educational institutions evolve to support such reforms. Peurach et al. (2019) emphasize that while systemic reform efforts often face resistance from legacy educational structures, sustained political and institutional commitment can gradually shift school systems toward more ambitious, equity-driven instructional goals. Complementing this, Zakaria (2020) highlights the importance of reflective practice within professional development (PD) programs, noting its potential to improve both teaching quality and student outcomes. These insights point to the need for long-term structural support and reflective teacher development as essential conditions for meaningful pedagogical transformation.

In sum, institutional and contextual barriers remain significant obstacles to the meaningful implementation of the scientific

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approach in Indonesian ELT. From infrastructural disparities and rigid policy frameworks to leadership dynamics and teacher well-being, these systemic factors shape the success or failure of pedagogical innovation. While technology and professional development offer promising pathways forward, sustainable change requires a coordinated effort involving school leadership, government policy, and community support. Addressing these barriers holistically is essential to create equitable and enabling environments where student-centered learning can truly flourish.

CONCLUSION

This review highlights that the scientific approach, when effectively aligned with student-centered learning principles, holds significant potential to enhance English Language Teaching (ELT) in Indonesia. It fosters learner autonomy, critical thinking, and meaningful language use. However, successful implementation depends not only on curriculum design but also on teacher readiness, contextual adaptation, and systemic support. Addressing these interconnected factors through responsive policy, sustained professional development, and reflective practice is essential for the approach to create lasting pedagogical impact.

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