

**DIGITAL SUSTAINABILITY IN ENGLISH READING PEDAGOGY:
EXPLORING TECHNOSTRESS AND AI-ANXIETY AMONG EFL LEARNERS****Abdul Hamid Aly¹, Zainal Rafli², Liliana Muliastuti³**Universitas Negeri Jakarta^{1,2,3}Email: abdul.hamid@mhs.unj.ac.id, zainal.rafli@unj.ac.id, liliana.muliastuti@unj.ac.id**ABSTRACT**

This study investigates digital sustainability in English reading pedagogy by exploring EFL learners' lived experiences of AI-supported reading platforms, with particular attention to technostress and AI-anxiety. Using a qualitative phenomenological design, the study draws on semi-structured interviews, classroom observation, and document analysis involving about 17 undergraduate EFL learners who used AI tools for vocabulary clarification, translation, text simplification, summarization, comprehension checking, and feedback support. The findings reveal that AI-supported reading platforms provided immediate pedagogical assistance by lowering linguistic barriers, supporting personalized reading, and helping learners engage with difficult English texts. However, the same platforms also produced psychological and pedagogical tensions. Learners experienced technostress through digital overload, platform complexity, technical disruption, screen fatigue, and excessive AI feedback. AI-anxiety emerged through uncertainty about AI accuracy, distrust of automated feedback, privacy concerns, dependency fear, and reduced reading confidence. The study further shows that sustainable AI-supported reading requires teacher mediation, peer discussion, critical AI literacy, ethical guidance, and psychologically safe task design. These findings indicate that AI should function as a scaffold rather than a substitute for learner interpretation, teacher expertise, and textual engagement. The study contributes to applied linguistics by integrating AI-supported reading pedagogy, technostress, AI-anxiety, learner autonomy, and digital sustainability into a human-centered pedagogical framework. It also supports SDG 4 and SDG 9 by promoting inclusive quality education and responsible digital innovation in EFL reading contexts.

Keywords: *AI-supported reading; technostress; AI-anxiety; digital sustainability; EFL learners.*

INTRODUCTION

The rapid integration of artificial intelligence into English reading pedagogy has reshaped the ways English as a Foreign Language learners access, process, interpret, and evaluate texts. In contemporary EFL classrooms, reading is no longer limited to a linear interaction between the learner and a printed text. It increasingly occurs within digitally mediated ecosystems where learners use AI-supported platforms to clarify vocabulary, translate complex expressions, simplify academic sentences, generate summaries, check comprehension, receive automated feedback, and monitor their own learning progress.

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These developments have expanded the pedagogical possibilities of English reading instruction because AI can reduce linguistic barriers, provide immediate scaffolding, and offer personalized learning support for students with different proficiency levels, reading needs, and digital experiences (Asad et al., 2024; DR. M. Anto Juliet Mary & Joyce, 2024; Hardaker & Glenn, 2025; McInnes et al., 2023; Ning et al., 2024a). AI-supported reading platforms may help learners engage with authentic English texts that were previously difficult to access due to limited vocabulary, low confidence, unfamiliar academic genres, or weak comprehension strategies (Alshahrani et al., 2024; Kucirkova & Gray, 2023; Ng et al., 2023).

The increasing use of AI in language education is part of a broader transformation in digital learning. AI-enabled systems have been widely discussed as tools for personalization, adaptive support, automated assessment, learning analytics, and self-directed learning. In English reading pedagogy, these features are especially relevant because reading requires the interaction of linguistic knowledge, background knowledge, metacognitive control, inference-making, and critical interpretation. AI tools can assist these processes by offering context-sensitive vocabulary explanations, simplified versions of difficult texts, AI-generated questions, paragraph summaries, and real-time feedback. Such affordances align with current educational demands for flexible, inclusive, and technology-enhanced learning environments that support diverse learners (Asad et al., 2024; DR. M. Anto Juliet Mary & Joyce, 2024; McInnes et al., 2023; Ning et al., 2024b). From this perspective, AI-supported reading appears to offer significant pedagogical value because it can help learners continue reading when they encounter lexical, syntactic, or conceptual difficulty.

However, AI-supported reading should not be understood only as a matter of efficiency or technological innovation. Reading is a cognitive, affective, social, and interpretive practice. Learners do not merely decode texts. They construct meaning, evaluate information, negotiate interpretation, and develop confidence as readers. When AI enters this process, it changes the relationship between learner, text, teacher, and digital system. AI can support comprehension, but it can also create confusion when its explanations are excessive, inaccurate, or inconsistent with learners' own interpretations. AI can increase learner autonomy, but it can also produce dependency when learners use automated summaries before reading the original text. AI can provide immediate feedback, but it can also generate anxiety when students feel judged by machine-generated corrections or uncertain about the reliability of AI responses (Deák & Kumar, 2024; Hennessy et al., 2020; Henriksen et al., 2024; Hezam & Alkhateeb, 2024; Sarı et al., 2024a).

This complexity makes digital sustainability a central issue in AI-supported English reading pedagogy. Digital sustainability refers to the long-term, responsible, inclusive, ethical, and psychologically safe integration of digital technologies into education. It does not only involve access to tools or infrastructure. It also requires learner well-being, teacher readiness, ethical governance, privacy protection, critical literacy, equitable access, and pedagogical integrity. In AI-mediated reading, digital sustainability means that AI should enhance reading development without weakening learner agency, reducing human interaction, increasing psychological burden, or encouraging superficial task completion. Sustainable digital pedagogy therefore requires a balance between technological affordance and human-centered educational values (Allison et al., 2025; Alshahrani et al., 2024; Capinding & Dumayas, 2024; Deák & Kumar, 2024; Henriksen et al., 2024). This balance is essential because AI innovation becomes pedagogically

meaningful only when it supports durable literacy, ethical practice, emotional safety, and inclusive participation.

Within this context, technostress and AI-anxiety emerge as two critical constructs. Technostress refers to the cognitive, emotional, and behavioral pressure caused by the use of digital technology. In AI-supported reading, technostress can appear through digital overload, platform complexity, constant notifications, technical disruption, screen fatigue, excessive AI feedback, and difficulty managing multiple digital tools. Learners may feel overwhelmed when AI produces long explanations, multiple interpretations, or repeated suggestions that increase cognitive load rather than reduce it. They may also experience frustration when platforms respond slowly, require complicated prompts, or interrupt reading concentration through unstable internet and device-related distractions (Hennessy et al., 2020; Henriksen et al., 2024; Hezam & Alkhateeb, 2024; McInnes et al., 2023). These experiences can weaken learners' motivation, confidence, and willingness to engage deeply with English texts.

AI-anxiety is closely related to technostress, but it focuses specifically on learners' fear, uncertainty, and discomfort toward artificial intelligence. In AI-mediated reading, AI-anxiety may emerge when learners doubt the accuracy of AI explanations, worry about privacy and data use, fear becoming dependent on AI, or feel that machine feedback weakens their own reading confidence. Learners may also experience anxiety when AI output contradicts their interpretation of a text. This situation can make students unsure whether they should trust their own reasoning or accept the AI response. In addition, AI-anxiety may involve ethical concerns about plagiarism, originality, surveillance, and the possible replacement of teacher guidance in reading instruction (Alshahrani et al., 2024; Bulathwela et al., 2021; Deák & Kumar, 2024; Hezam & Alkhateeb, 2024; Sari et al., 2024b). These concerns show that AI-supported reading is not neutral. It shapes learners' sense of competence, autonomy, trust, and interpretive identity.

Although AI in education has received increasing scholarly attention, there remains an important research gap in applied linguistics. Existing studies have examined AI affordances, automated feedback, language learning personalization, AI-supported comprehension, digital learning innovation, and teacher readiness. Other studies have addressed ethical AI, democratic learning, equity, privacy, and sustainable technology integration (Allison et al., 2025; Awad et al., 2022; Capinding & Dumayas, 2024; Eguchi et al., 2021; Kucirkova & Gray, 2023; Sari et al., 2024b). However, the specific intersection of AI-supported English reading, technostress, AI-anxiety, learner autonomy, and digital sustainability remains insufficiently explored in EFL contexts. Many discussions still focus on what AI can do, while fewer studies examine how learners emotionally and cognitively experience AI during reading. This gap is important because the success of AI-supported reading depends not only on technological affordances but also on learners' psychological responses, ethical awareness, and ability to use AI critically.

This study addresses that gap by exploring EFL learners' lived experiences of AI-supported reading platforms. It examines how learners experience AI tools during English reading, what forms of technostress and AI-anxiety emerge, and how these experiences can inform sustainable digital English reading pedagogy. The study positions learners' voices as central evidence for understanding AI integration. Rather than treating AI

merely as a tool for improving reading speed or comprehension scores, this study investigates how AI reshapes reading confidence, autonomy, dependency, interpretation, ethical awareness, and classroom interaction. This focus is necessary because sustainable AI-supported reading should not depend only on the availability of digital tools. It should depend on the quality of pedagogy, the role of teacher mediation, the development of critical AI literacy, and the protection of learner well-being (Alshahrani et al., 2024; Ning et al., 2024; Hardaker & Glenn, 2025; Zhang & Liu, 2025) (Alshahrani et al., 2024; Hardaker & Glenn, 2025; Ning et al., 2024b; Zhang & Liu, 2025).

The theoretical framework of this study integrates several interconnected perspectives. First, AI-supported reading pedagogy provides the foundation for understanding how AI tools can scaffold vocabulary development, comprehension monitoring, summarization, text simplification, and reading strategy use. AI can help learners decode unfamiliar vocabulary, understand complex texts, compare interpretations, and receive immediate feedback. However, AI support must be embedded in meaningful pedagogical design. Learners should not merely accept AI-generated answers. They should compare AI output with textual evidence, reflect on differences, revise their understanding, and maintain responsibility for interpretation (Asad et al., 2024; DR. M. Anto Juliet Mary & Joyce, 2024; McInnes et al., 2023; Ning et al., 2024b). This principle is important because reading development requires active cognitive engagement, not passive dependence on machine output.

Second, AI-TPACK serves as a theoretical lens for understanding teacher knowledge in AI-integrated reading pedagogy. AI-TPACK extends technological pedagogical content knowledge by emphasizing the distinctive characteristics of AI, including automation, adaptivity, data use, feedback generation, and ethical risk. Teachers need to understand not only how AI tools work but also how these tools align with reading objectives, content knowledge, assessment practices, and learner needs. In English reading instruction, teachers must decide when AI should support vocabulary learning, when students should read without assistance, when AI output needs verification, and how feedback should be used for learning rather than dependency. Teacher mediation is therefore central to sustainable AI-supported reading because AI tools cannot independently guarantee deep reading, ethical use, or psychological safety (Alshahrani et al., 2024; Capinding & Dumayas, 2024; Ning et al., 2024b).

Third, technostress theory helps explain how digital learning environments can create pressure and fatigue. In AI-supported reading, technostress may take the form of techno-overload, techno-complexity, techno-uncertainty, techno-interruption, techno-dependence, and techno-insecurity. Learners may feel overloaded by long AI responses, confused by platform features, uncertain about output accuracy, interrupted by technical problems, dependent on automated support, or insecure when comparing their AI skills with peers. These experiences can affect reading concentration, motivation, self-efficacy, and task persistence. The study therefore treats technostress not as a minor inconvenience but as a central factor in determining whether AI-supported reading can become sustainable (Deák & Kumar, 2024; Hennessy et al., 2020; Henriksen et al., 2024; Hezam & Alkhateeb, 2024; McInnes et al., 2023).

Fourth, AI-anxiety provides a conceptual theory for understanding learners' uncertainty toward AI systems. AI-anxiety in this study includes accuracy anxiety, evaluation anxiety, dependency anxiety, ethical anxiety, identity anxiety, and replacement anxiety. Accuracy anxiety refers to doubts about whether AI explanations correctly represent the text. Evaluation anxiety refers to discomfort with AI-generated

scores, corrections, or feedback. Dependency anxiety refers to fear that learners may lose independent reading ability. Ethical anxiety refers to concerns about plagiarism, privacy, surveillance, and responsible AI use. Identity anxiety refers to the feeling that AI may weaken learners' own interpretive voice. Replacement anxiety refers to concern that AI may reduce the role of human teachers in reading instruction. These dimensions show that AI-anxiety is not a single emotional response. It is a complex psychological experience shaped by tool design, teacher guidance, institutional governance, and learner readiness (Alshahrani et al., 2024; Barjesteh, 2026; Bulathwela et al., 2021; Deák & Kumar, 2024; Hennessy et al., 2020; Hezam & Alkhateeb, 2024; Kızıl et al., 2025; Liu & Fan, 2024; Sarı et al., 2024b; Zhai & Razali, 2023).

Fifth, Self-Determination Theory and Self-Regulated Learning support the conceptualization of learner autonomy in AI-mediated reading. In this study, autonomy does not mean using AI independently without teacher guidance. It means using AI critically, selectively, and reflectively. Learners demonstrate autonomy when they read the original text first, identify specific difficulties, ask AI targeted questions, verify AI responses with textual evidence, revise answers in their own words, and reflect on whether AI helps or weakens their reading ability. This form of critical AI-mediated autonomy aligns with the principles of autonomy, competence, and relatedness in motivation theory, as well as planning, monitoring, evaluating, and reflecting in self-regulated learning (Alshahrani et al., 2024; Bulathwela et al., 2021; Hardaker & Glenn, 2025; Liu & Fan, 2024; McInnes et al., 2023). It also prevents AI from becoming a shortcut that reduces reading effort and interpretive growth.

Sixth, democratic pedagogy and culturally responsive AI provide the ethical and social foundation of the study. AI-supported reading should respect learner agency, privacy, fairness, cultural background, linguistic diversity, and classroom participation. It should not impose a single interpretation of a text, silence learners' voices, or privilege machine-generated meaning over human reasoning. Learners should be invited to question AI output, compare different interpretations, discuss meaning with peers, and connect reading materials to their own social and cultural contexts. Ethical AI use also requires clear data-use policies, transparent feedback, academic integrity rules, and equitable access to digital tools (Allison et al., 2025; Awad et al., 2022; Eguchi et al., 2021; Kızıl et al., 2025; Kucirkova & Gray, 2023; Liu & Fan, 2024; Rienties et al., 2020; Sarı et al., 2024b; Zhai & Razali, 2023). These principles are essential for ensuring that AI-supported reading contributes to inclusion rather than inequality.

The conceptual framework of this study positions AI-supported reading platforms as the primary input, learner engagement as the process, technostress and AI-anxiety as psychological experiences, learner responses as outcomes, and sustainable digital reading pedagogy as the intended implication. The input consists of AI tools for vocabulary support, translation, summarization, text simplification, automated feedback, AI-generated questions, and reading analytics. The process involves learners' interaction with AI through reading, highlighting, prompting, comparing, verifying, discussing, and revising. The psychological experience includes technostress and AI-anxiety, which may affect learners' confidence, motivation, autonomy, and engagement. Learner responses include coping strategies, reflective judgment, dependency risk, critical AI literacy, and digital resilience. These responses inform sustainable pedagogy by identifying how AI

can support English reading without compromising learner agency, ethical awareness, and emotional well-being.

The main problem addressed in this study is that AI-supported reading is often introduced as an educational innovation without sufficient attention to learner psychology. AI platforms may help learners read faster, understand difficult texts, and access immediate support. Yet the same tools may also create overload, distrust, dependency, privacy concerns, reduced confidence, and shallow engagement with texts. This problem becomes more serious when learners treat AI feedback as final authority, copy AI summaries without reading the original text, or lack the skills to evaluate machine-generated output. It also becomes more serious when teachers do not receive adequate AI-TPACK training and institutions do not provide clear ethical guidelines for AI use in learning (Alshahrani et al., 2024; Hennessy et al., 2020; Ning et al., 2024a; Sari et al., 2024b). Therefore, this study asks how AI-supported English reading can remain pedagogically meaningful, psychologically safe, ethically responsible, and digitally sustainable.

Based on this problem, the study has three objectives. First, it aims to explore EFL learners' lived experiences of using AI-supported reading platforms. Second, it aims to identify the forms of technostress and AI-anxiety that emerge during AI-mediated English reading activities. Third, it aims to formulate pedagogical implications for sustainable digital English reading pedagogy. These objectives are consistent with the need to understand AI integration from the perspective of learners who directly experience both its benefits and its psychological risks. The study therefore contributes to a more nuanced understanding of AI-supported reading by examining not only what learners gain from AI, but also what pressures, uncertainties, and ethical concerns they encounter.

The significance of this study is theoretical, methodological, practical, and global. Theoretically, it contributes to applied linguistics by integrating AI-supported reading pedagogy, technostress, AI-anxiety, learner autonomy, AI-TPACK, Self-Determination Theory, Self-Regulated Learning, democratic pedagogy, and digital sustainability into one coherent framework. This integration advances current discussions by showing that sustainable AI-supported reading depends on the relationship between technological affordance, learner psychology, teacher mediation, ethics, and institutional governance. Methodologically, the study contributes by using qualitative phenomenology and thematic analysis to capture the lived experiences of learners. This approach is important because it allows the study to examine learners' feelings, perceptions, coping strategies, and meaning-making processes rather than reducing AI use to test scores or frequency of tool adoption (Alam, 2024; Alharbi, 2023; Kadir et al., 2021).

Practically, this study offers guidance for EFL lecturers, curriculum designers, and educational institutions. Lecturers can design AI-supported reading activities based on a "read first, AI second, verify third, discuss fourth, and reflect last" routine. This routine encourages learners to engage with the original text before using AI and to treat AI output as support rather than final authority. Curriculum designers can integrate critical AI literacy, prompt discipline, privacy awareness, reflective journals, and textual evidence into reading syllabi. Institutions can support sustainable AI use by providing teacher training, ethical AI policies, reliable infrastructure, privacy protection, and inclusive access for learners with different digital readiness levels (Abrar-ul-Hassan & Nassaji, 2021; Hui et al., 2022; Stofiana et al., 2025; Wang et al., 2022; Zhao & Li, 2021).

At the global level, the study supports SDG 4 and SDG 9. It contributes to SDG 4 by promoting inclusive and quality English reading education that supports learner

autonomy, confidence, critical literacy, and psychological safety. It contributes to SDG 9 by advancing responsible digital innovation and sustainable educational infrastructure in AI-mediated learning. However, this study argues that sustainable development goals cannot be achieved through technology access alone. Quality education and responsible innovation require ethical governance, teacher professionalism, equitable access, human-centered pedagogy, and protection of learner well-being. Therefore, the central argument of this study is that AI-supported English reading pedagogy becomes sustainable only when AI functions as a scaffold for deeper reading, critical interpretation, and learner agency, rather than as a replacement for human judgment, teacher mediation, and ethical responsibility.

METHOD

This study employed a qualitative phenomenological design to explore EFL learners' lived experiences in using AI-supported reading platforms. Phenomenology was selected because the study did not aim to measure AI effectiveness through test scores alone, but to understand how learners perceived, felt, interpreted, and negotiated AI-mediated reading activities. This design was appropriate because AI-supported reading involves not only cognitive processes, such as vocabulary recognition and comprehension monitoring, but also affective and psychological experiences, including technostress, AI-anxiety, confidence, dependency, and learner autonomy. In this sense, the study positioned learners' subjective experiences as the main source of knowledge for understanding digital sustainability in English reading pedagogy. This approach aligns with the argument that AI-supported reading should be examined through learner experience, teacher mediation, ethical awareness, and psychological safety, not only through technological affordance (Asad et al., 2024; DR. M. Anto Juliet Mary & Joyce, 2024; Henriksen et al., 2024; Ning et al., 2024b). The study uses qualitative phenomenology to illuminate how EFL learners perceive and negotiate AI-supported reading platforms, especially in relation to technostress and AI-anxiety.

The research context was an EFL higher education setting where students had experience using AI-supported reading platforms. These platforms included AI chatbots, automated reading assistants, translation tools, text simplification tools, AI vocabulary support tools, digital annotation tools, and learning management systems with AI-based reading features. Such a context was relevant because AI-supported reading tools are increasingly used to support vocabulary clarification, translation, automated summaries, adaptive text presentation, AI-generated questions, and comprehension feedback. Previous studies have shown that these features can reduce linguistic barriers and support personalized reading practices when they are integrated with clear pedagogical purposes. However, the same tools may also create psychological challenges when learners experience excessive feedback, unclear explanations, platform complexity, or uncertainty about AI accuracy.

The participants were undergraduate EFL learners who had used AI-supported reading platforms in English reading-related courses. The empirical findings were based on 17 EFL learners, classroom observation, and document analysis. Participants were selected through purposive sampling because the study required learners who had direct and meaningful experience with AI-mediated reading. This sampling technique was

suitable for phenomenological research because it enabled the researcher to obtain rich descriptions from participants who had personally encountered the phenomenon under investigation. Maximum variation was also relevant because learners may differ in digital literacy, reading proficiency, frequency of AI use, confidence, and prior experiences with technology-assisted learning. These differences helped the study capture both shared and diverse patterns of experience in AI-supported reading.

Data were collected through three techniques: semi-structured interviews, classroom observation, and document analysis. Semi-structured interviews were used to explore learners' perceptions, emotions, challenges, coping strategies, and interpretations of AI-supported reading. This technique allowed students to explain how they used AI for vocabulary support, translation, summarization, feedback checking, and text simplification. It also allowed them to describe moments of confusion, overload, distrust, dependency, and anxiety. Classroom observation was used to examine how learners interacted with AI tools during reading activities. Observation focused on students' behavior when using AI, such as highlighting vocabulary, checking AI output, comparing summaries, asking for lecturer confirmation, discussing with peers, and showing signs of hesitation or overload. Document analysis was used to examine reading task sheets, AI feedback, student outputs, reflective journals, platform guidelines, lecturer instructions, and digital records. This technique strengthened the study because it showed whether learners used AI reflectively or simply copied AI-generated responses.

The study used thematic analysis to analyze the qualitative data. The analysis began with reading and rereading interview transcripts, observation notes, reflective journals, and relevant documents. The researcher then identified initial codes related to AI use, reading support, digital overload, AI-anxiety, dependency, confidence, coping strategies, teacher mediation, and sustainable pedagogy. These codes were grouped into broader categories and then developed into major themes. Ten major themes across three research questions: learners' experiences of AI-supported reading platforms, forms of technostress and AI-anxiety, and implications for sustainable digital English reading pedagogy. This analytical procedure was appropriate because it allowed the researcher to connect learners' lived experiences with theoretical constructs such as technostress, AI-anxiety, self-regulated learning, critical AI literacy, and digital sustainability (Bulathwela et al., 2021; Hardaker & Glenn, 2025; Sari et al., 2024b; Zhang & Liu, 2025).

To ensure trustworthiness, the study applied credibility, transferability, dependability, and confirmability strategies. Credibility was supported through triangulation among interviews, observation, and document analysis. Member checking and peer debriefing could also strengthen the validity of interpretation by ensuring that the themes reflected participants' actual experiences. Transferability was supported through thick description of the research context, participants, AI tools, and classroom practices. Dependability was ensured through systematic coding procedures and an audit trail. Confirmability was strengthened through reflexive memoing and transparent interpretation of data. Ethical considerations were also central to the study. Participants gave informed consent, joined voluntarily, and had the right to withdraw. The study protected anonymity and confidentiality. Since AI-supported learning may involve digital traces, the research also considered privacy, responsible data use, and the protection of students' learning records. These ethical concerns were consistent with the broader literature on responsible AI, data governance, democratic pedagogy, and sustainable digital education.

RESULT AND DISCUSSION

1. Results

This section presents the findings from semi-structured interviews with 17 EFL learners, classroom observation, and document analysis. The analysis generated three broad findings aligned with the research questions: learners' experiences of AI-supported reading platforms, forms of technostress and AI-anxiety, and pedagogical implications for sustainable digital English reading pedagogy. The data show that AI-supported reading helped learners access English texts more easily through vocabulary support, translation, summarization, text simplification, comprehension checking, and automated feedback. However, the same tools also created digital overload, uncertainty, distrust, dependency, and reduced reading confidence when learners lacked critical AI literacy and teacher mediation. These results confirm that AI-supported reading is pedagogically useful but psychologically complex. The findings are structured according to the thematic organization.

Table 1. Summary of Emergent Themes Across Research Questions

Research Question	Main Themes	Core Finding
<i>RQ1: How do EFL learners experience AI-supported reading platforms?</i>	AI as immediate reading assistance; AI as personalized reading companion; AI as pedagogical ambiguity	AI helped learners read faster, clarify meaning, and personalize support, but it also created uncertainty when feedback differed from learners' interpretations.
<i>RQ2: What forms of technostress and AI-anxiety emerge?</i>	Digital overload; platform complexity; uncertainty and distrust; dependency and loss of confidence	Learners experienced overload, technical disruption, uncertainty, distrust, dependency, and reduced reading confidence.
<i>RQ3: How can these experiences inform sustainable digital reading pedagogy?</i>	Teacher-mediated AI reading; critical AI literacy; psychologically sustainable design	Sustainable AI reading requires teacher mediation, ethical guidance, peer discussion, critical AI literacy, and psychological safety.

A. Learners' Experiences of AI-Supported Reading Platforms

The first finding shows that learners experienced AI as immediate reading assistance. AI helped them deal with vocabulary, difficult phrases, long paragraphs, unfamiliar academic expressions, and complex sentence structures. During classroom observation, students used AI chatbots, translation tools, text simplification features, vocabulary support tools, and AI summarizers while reading English texts. Many learners used AI when they felt stuck, especially when they could not infer word meaning from context. This finding supports the argument that AI can lower linguistic barriers and make English texts more accessible for EFL learners (Mary & Joyce, 2024; Asad et al., 2024; Ning et al., 2024; McInnes et al., 2023).

AI also functioned as a personalized reading companion. Learners used AI in different ways. Some students used it only to clarify vocabulary. Others used it to simplify paragraphs, check interpretations, compare summaries, or prepare for discussion. This variation shows that AI-supported reading can respond to different learning needs, proficiency levels, and affective conditions. For learners with lower confidence, AI provided private support before they participated in classroom discussion. For learners

with stronger academic reading needs, AI helped them compare ideas, summarize articles, and evaluate meaning. This finding is consistent with the view that AI can support personalized learning when it is aligned with pedagogical purposes (Kucirkova & Gray, 2023; Ng et al., 2023; Alshahrani et al., 2024).

However, AI also became a source of pedagogical ambiguity. Some learners felt uncertain when AI explanations were too long, too general, or inconsistent with their own interpretation. In several cases, students hesitated after AI marked their answer as incorrect, even though they had found textual evidence in the original passage. Documentation data also showed that some student outputs reflected thoughtful AI use, while others closely followed AI wording and lacked textual support. This indicates that AI can support reading, but it can also weaken deep engagement when learners treat AI as the final authority. Therefore, AI-supported reading requires structured guidance that directs students back to the original text.

B. Forms of Technostress and AI-Anxiety

The second finding concerns technostress and AI-anxiety. Technostress emerged through digital overload, platform complexity, technical disruption, screen fatigue, and device distraction. Some learners felt burdened when AI gave long explanations and multiple suggestions. Instead of helping them read more efficiently, excessive AI output sometimes created another layer of work. Students needed simple clarification, but AI often provided extended explanations that increased cognitive load. This finding supports previous claims that digital tools can create strain when they produce information overload or require continuous adaptation (Henriksen et al., 2024; Hezam & Alkhateeb, 2024; Hennessy et al., 2020).

Platform complexity and technical disruption also shaped learners' reading experiences. Some learners struggled to write effective prompts. Others experienced slow responses, login problems, unstable internet, and mobile notifications. These disruptions interrupted reading concentration and reduced the continuity of comprehension. The finding shows that technostress does not come only from AI content. It also comes from the broader digital environment, including device ecology, internet access, screen fatigue, and notification culture.

AI-anxiety emerged through uncertainty, distrust, dependency, privacy concern, and reduced confidence. Learners became anxious when AI output contradicted their answers or when AI gave confident explanations that were not supported by the text. Some learners began to doubt their own reading ability after repeatedly checking their answers with AI. Others feared that they might become too dependent on AI summaries, translation, and automated correction. These findings align with the argument that AI-anxiety relates to accuracy, evaluation, privacy, dependency, and loss of learner agency (Deák & Kumar, 2024; Hezam & Alkhateeb, 2024; Alshahrani et al., 2024; Sarī et al., 2024; Bulathwela et al., 2021).

Table 2. Pattern of AI-Supported Reading Experience and Psychological Risk

AI Reading Support	Positive Experience	Psychological Risk
<i>Vocabulary support</i>	Faster lexical access	Reduced guessing from context
<i>Translation</i>	Easier sentence comprehension	Overreliance on translated meaning
<i>Summarization</i>	Faster main idea identification	Shallow reading and shortcut use
<i>Automated feedback</i>	Immediate correction	Accuracy anxiety and evaluation pressure

<i>Text simplification</i>	Better access to difficult texts	Reduced confidence in original text reading
<i>Reading analytics or scores</i>	Progress monitoring	Feeling judged or monitored

C. Pedagogical Implications for Sustainable Digital English Reading Pedagogy

The third finding shows that sustainable AI-supported reading depends strongly on teacher mediation. The lecturer played a central role in reducing anxiety, correcting misunderstandings, explaining ethical AI use, and guiding students back to textual evidence. Observation data showed that teacher guidance helped students use AI as a scaffold rather than a shortcut. When students copied AI summaries or accepted AI feedback without checking the original text, lecturer intervention encouraged them to reread, verify, and revise. This supports the AI-TPACK perspective, which emphasizes that teachers need to integrate AI tools with pedagogy, content, ethics, and learner support (Ning et al., 2024; Alshahrani et al., 2024; Capinding & Dumayas, 2024).

The findings also show the need for critical AI literacy. Learners must know how to question AI output, compare it with textual evidence, detect possible inaccuracies, avoid plagiarism, protect privacy, and maintain their own interpretive voice. Critical AI literacy is not an additional skill. It is a core condition for sustainable AI-supported reading. Without it, learners may become dependent on AI and lose confidence in their own reasoning.

Psychologically sustainable design also emerged as an important implication. Reading tasks should provide clear sequences, manageable AI feedback, prompting guidance, privacy explanation, peer discussion, and reflective activities. Sustainable AI reading should protect learner confidence, reduce overload, and support autonomy. The most effective classroom routine identified in the data can be summarized as: read first, use AI selectively, verify with evidence, discuss with peers and lecturer, revise in one's own words, and reflect on AI use.

Table 3. Pedagogical Implications from the Findings

Finding	Pedagogical Implication
<i>AI helps with vocabulary, translation, summary, and comprehension checking</i>	Integrate AI as a scaffold within structured reading tasks.
<i>AI feedback can be long and confusing</i>	Limit AI output through prompt discipline and short response formats.
<i>Learners distrust AI when feedback differs from their interpretation</i>	Train students to verify AI output with textual evidence.
<i>Some students copy AI summaries</i>	Require annotation, reflection, and explanation of the reading process.
<i>Learners worry about dependency</i>	Use “read first, AI second, reflect third” as a classroom routine.
<i>Privacy information remains unclear</i>	Provide simple AI ethics and data-use guidelines.
<i>Teacher mediation reduces anxiety</i>	Keep lecturer guidance central in AI-supported reading pedagogy.
<i>Peer discussion supports confidence</i>	Use collaborative verification and group interpretation tasks.

2. Discussion

The findings show that AI-supported reading is both a pedagogical support and a psychological challenge. On one hand, AI helped EFL learners access difficult English texts through vocabulary clarification, translation, summarization, text simplification, and comprehension feedback. These functions supported learners who struggled with academic vocabulary, sentence complexity, and confidence. This confirms earlier studies that AI can reduce linguistic barriers and support personalized reading in EFL contexts (Mary & Joyce, 2024; Asad et al., 2024; Ning et al., 2024; McInnes et al., 2023; Hardaker & Glenn, 2025). On the other hand, the same tools created ambiguity and dependency when learners accepted AI output without checking textual evidence. This means that AI affordance alone does not guarantee deep reading. The quality of AI-supported reading depends on how learners use AI, how teachers mediate AI use, and how tasks require critical engagement with the original text.

Technostress and AI-anxiety also emerged as central issues in digital sustainability. The findings show that learners did not experience digital reading only as a convenience. They also experienced cognitive pressure, uncertainty, and emotional discomfort. Long AI explanations, multiple tabs, unstable internet, login problems, mobile distraction, and unclear feedback created stress. AI-anxiety appeared when learners distrusted AI accuracy, feared dependency, worried about privacy, or doubted their own reading ability. This confirms that digital sustainability cannot be reduced to infrastructure or access to technology. It must include psychological safety, ethical governance, and learner well-being (Henriksen et al., 2024; Deák & Kumar, 2024; Hezam & Alkhateeb, 2024; Hennessy et al., 2020; Alshahrani et al., 2024; Sarī et al., 2024).

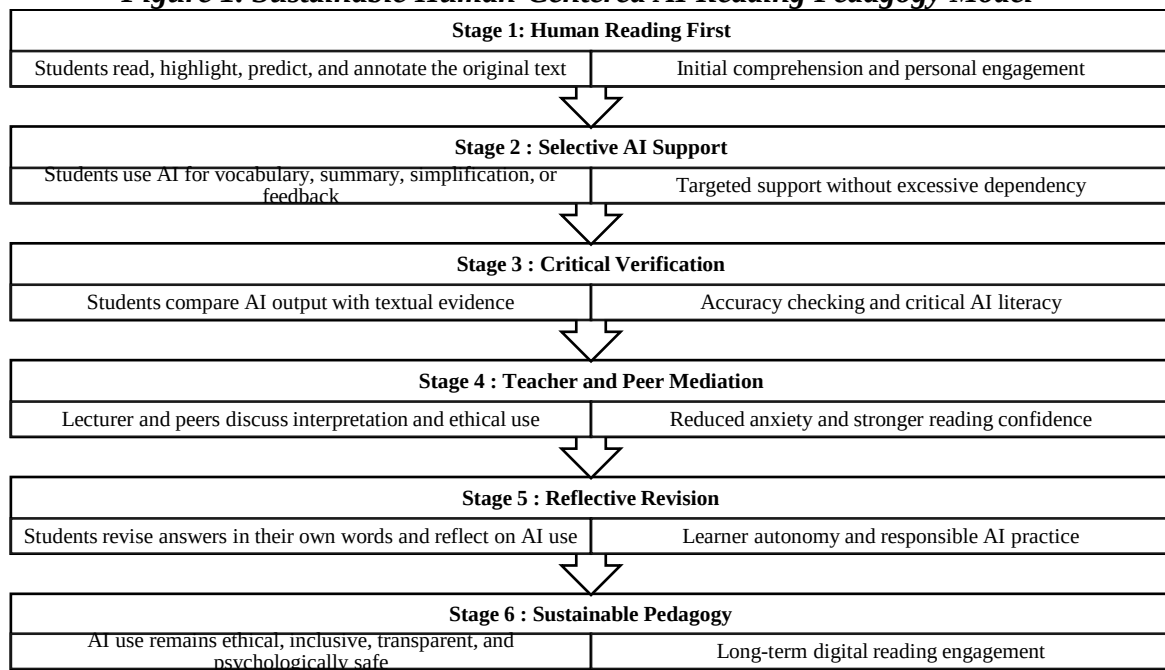
The study also reframes learner autonomy in AI-mediated reading. Autonomy does not mean that students use AI independently without guidance. In this context, autonomy means the ability to use AI critically, selectively, and reflectively. Learners showed stronger autonomy when they read the original text first, used AI for specific support, compared AI responses with textual evidence, revised answers in their own words, and reflected on whether AI helped or weakened their reading process. This form of autonomy aligns with self-regulated learning because it involves planning, monitoring, evaluating, and reflecting (Hardaker & Glenn, 2025; McInnes et al., 2023; Bulathwela et al., 2021; Zhang & Liu, 2025; Liu & Fan, 2024). Therefore, AI-mediated autonomy should be understood as critical and evidence-based autonomy, not unrestricted dependence on digital tools.

The findings further support a human-centered AI reading pedagogy. AI becomes sustainable when it supports human interpretation, not when it replaces it. Teacher mediation helped reduce confusion, dependency, copying, and anxiety. Peer discussion also helped learners compare interpretations and build confidence. This indicates that AI-supported reading should remain dialogic, ethical, and socially grounded. The teacher's role becomes more important, not less important, in AI-integrated reading classrooms. Teachers act as pedagogical designers, ethical guides, feedback interpreters, and protectors of learner agency. This finding supports democratic and culturally responsive perspectives that place learner voice, fairness, privacy, and inclusion at the center of AI education (Kucirkova & Gray, 2023; Eguchi et al., 2021; Awad et al., 2022; Capinding & Dumayas, 2024; Allison et al., 2025; Sarī et al., 2024; Barjesteh, 2026; Kızıl et al., 2025; Zhai & Razali, 2023).

The study contributes to SDG 4 and SDG 9. For SDG 4, AI-supported reading can promote inclusive quality education by helping EFL learners access English texts, develop confidence, and receive individualized support. However, quality education also requires emotional safety, critical literacy, teacher mediation, and ethical awareness. AI cannot support SDG 4 if it increases anxiety, dependency, or superficial reading. For SDG 9, the study highlights responsible digital innovation in educational infrastructure. Sustainable AI infrastructure requires reliable platforms, privacy protection, teacher training, prompt guidance, inclusive access, and ethical policy. This aligns with the view that innovation must serve human development and social inclusion (Wang et al., 2022; Stofiana et al., 2025; Hui et al., 2022; Abrar-ul-Hassan & Nassaji, 2021; Zhao & Li, 2021; Alharbi & Ahmad, 2022; Kadir et al., 2021; Alam, 2022).

Based on these findings, the study proposes a Sustainable Human-Centered AI Reading Pedagogy model. The model includes seven components: AI as scaffold, teacher mediation, critical AI literacy, psychological safety, reflective autonomy, ethical governance, and sustainable infrastructure. The model suggests that students should first read and annotate the original text, then use AI selectively for vocabulary, summary, simplification, or feedback. After that, they should verify AI output with textual evidence, discuss interpretation with peers and the lecturer, revise answers in their own words, and reflect on AI use. This process helps AI remain ethical, inclusive, transparent, and psychologically safe.

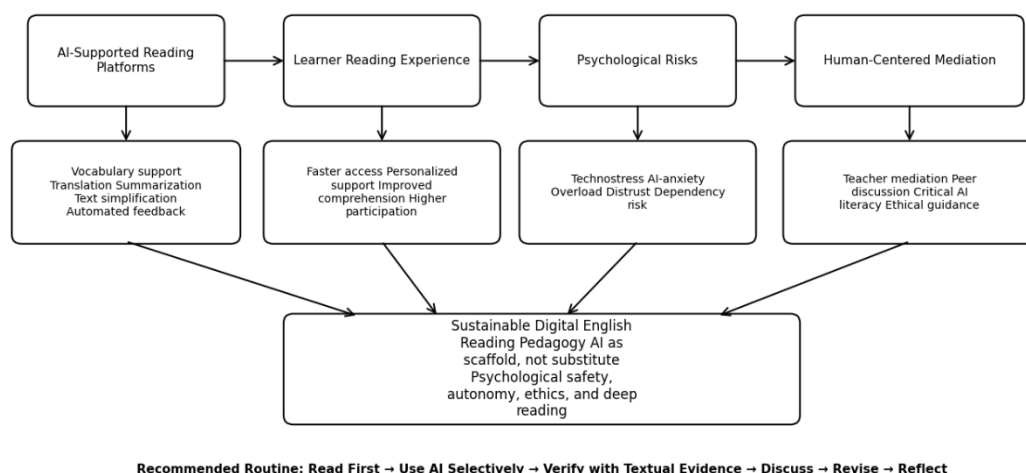
Figure 1. Sustainable Human-Centered AI Reading Pedagogy Model



Overall, the results and discussion indicate that AI-supported reading should not be judged only by its capacity to accelerate comprehension. Its sustainability depends on whether it strengthens learner agency, protects psychological well-being, supports ethical judgment, and preserves human interpretation. AI can expand access to English texts, but it can also create overload, uncertainty, dependency, and anxiety. Therefore, sustainable

digital English reading pedagogy requires a human-centered approach where AI functions as a scaffold, teacher mediation remains central, peer discussion supports interpretation, and learners develop critical autonomy in using AI responsibly.

Figure 2. Sustainable Human-Centered AI Reading Pedagogy Model Based on EFL Learners' AI-Supported Reading Experiences



CONCLUSION

This study concludes that AI-supported reading pedagogy in EFL contexts offers meaningful pedagogical value, but it also presents important psychological and ethical challenges. Based on semi-structured interviews with 17 EFL learners, classroom observation, and document analysis, the findings show that AI-supported reading platforms helped learners access English texts through vocabulary clarification, translation, text simplification, automated summaries, comprehension checking, and feedback support. These features enabled students to continue reading when they faced difficult vocabulary, complex sentences, unfamiliar academic texts, or low confidence. In this sense, AI functioned as a practical scaffold that supported reading access, comprehension, and personalized learning (Mary & Joyce, 2024; Asad et al., 2024; Ning et al., 2024; McInnes et al., 2023; Hardaker & Glenn, 2025). The article file also confirms that AI-supported reading helped learners read faster, clarify meaning, and personalize support, although it also created ambiguity when AI feedback differed from learners' own interpretations.

However, the study also confirms that AI-supported reading cannot be understood only as a technological solution. Learners experienced technostress through digital overload, long AI explanations, platform complexity, technical disruption, mobile distraction, unstable internet, and screen fatigue. They also experienced AI-anxiety through uncertainty about AI accuracy, distrust of automated feedback, privacy concern, dependency fear, and reduced reading confidence. These findings show that AI may support reading while also increasing psychological pressure when learners lack guidance, critical AI literacy, or confidence in evaluating AI output. Therefore, digital sustainability in English reading pedagogy must include learner well-being, emotional safety, ethical guidance, and responsible AI use (Henriksen et al., 2024; Deák & Kumar, 2024; Hezam & Alkhateeb, 2024; Hennessy et al., 2020; Alshahrani et al., 2024; Sarī et al., 2024).

Theoretically, this study contributes to applied linguistics by integrating AI-supported reading pedagogy, technostress, AI anxiety, learner autonomy, and digital sustainability into a single human-centered framework. It extends the discussion of AI in language education by showing that the success of AI-supported reading depends not only on the availability of digital tools, but also on how learners interpret, question, verify, and reflect on AI output. The study reframes learner autonomy as critical AI-mediated autonomy. Learners become autonomous not when they rely freely on AI, but when they read first, use AI selectively, compare AI output with textual evidence, revise answers in their own words, and reflect on the learning process (Bulathwela et al., 2021; Zhang & Liu, 2025; Liu & Fan, 2024).

Practically, this study recommends that EFL lecturers position AI as a scaffold, not as a substitute for reading effort, teacher expertise, or learner interpretation. AI-supported reading activities should follow clear stages: human reading first, selective AI support, critical verification, teacher and peer mediation, reflective revision, and sustainable ethical use. Lecturers should train students in critical AI literacy, prompt discipline, textual verification, privacy awareness, academic integrity, and reflective AI use. Institutions should also provide clear AI-use policies, teacher training based on AI-TPACK, privacy protection, and reliable digital infrastructure (Ning et al., 2024; Alshahrani et al., 2024; Capinding & Dumayas, 2024).

This study has limitations. It focused on 17 undergraduate EFL learners in one AI-supported reading context, so interpret the findings with contextual sensitivity. Future research should include larger, more diverse samples, mixed-methods designs, longitudinal analysis, and comparisons across AI reading platforms. Future studies should also examine the relationship between AI-anxiety, technostress, reading achievement, motivation, self-efficacy, and learner autonomy. Overall, this study affirms that sustainable AI-supported English reading pedagogy requires a balance between innovation and human values. AI can enrich English reading when it supports access, confidence, and comprehension. Yet it becomes truly sustainable only when it protects learner agency, psychological safety, ethical judgment, and deep engagement with texts.

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