

# AI-Enhanced Development of 4Cs-Based Listening Materials: EFL Teachers' Practices in Flex Blended Learning Contexts

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## Abstract

Drawing upon the data collected, this qualitative case study investigates how EFL teachers utilize AI aided tools to develop 4Cs-based online listening materials under flex blended learning. Using semi-structured interviews and one focus group discussion with ten Indonesian tertiary EFL teachers, the study elucidates pedagogical practices as well as challenges in introducing creativity, critical thinking, communication and collaboration within AI-supported listening lesson. Thematic analysis shows AI acts as a generative design trigger, rather than an independent instructional agent. Teachers actively curate, calibrate, scaffold and surf AI outputs towards curricular alignment, cognitive depth, communicative continuity and meaningful convergence. AI offers possibilities for multimodal forms of production, analytic prompts, interactive simulation and digital co-production but its educational value relies on the mediation of teachers and appropriate context enactment. The study proposes the AI-Mediated 4Cs Listening Orchestration Model, conceptualizing AI integration as governance-based orchestration. Results highlight teacher agency as the main medium that connects AI affordances, 4Cs competencies acquisition, and flex blended listening pedagogy.

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## **Introduction**

Blended learning is increasingly being implemented in recent years due to the explosive progression of digital age. Blended learning fuses traditional classroom with online training, thus enabling students to take the advantage of traditional and technology-assisted environment (Albatti, 2023; Wei, 2023). The flex model is one of its models that has been served a lot of interest due to its flexibility and student-centered design. In this model the online learning is used as the backbone of the instruction with teachers offering small group tutoring, support and guidance in a classroom setting (Hrastinski, 2019). In this way, most of the content and exercises are individualized online with students at their own pace; teachers will spend more time on facilitating rather than lecturing one by one (Haftador et al., 2023).

The efficiency of flex blended learning is highly reliant on the quality of asynchronous engagement materials developed for online (Al-Amrani & Al-Ghaithi, 2023). Well-designed materials promote students' engagement and skill development (Al-Okaily et al., 2034). This is especially crucial for listening where students need to have continuous exposure, attention and understanding of authentic input (Tran et al., 2024). In flex environments where online features configure learning progression, the creation of listening materials is a key driver of meaningful outcomes.

Meanwhile, modern education systems stress the development of 21st century skills, or the 4Cs (critical thinking, communication, collaboration and creativity) (Trilling & Fadel, 2009). These are the skills EFL learners need to be capable of making critical decisions on information, working in partnership and applying creative solutions in a range of settings (Kocak et al., 2021; Nahar & Machado, 2025; Thornhill-Miller et al., 2023; Varas et al., 2023). Thus, listening instruction should not solely address comprehension, but instead incorporate opportunities to develop these higher order skills.

The use of AI tools presents an opportunity to support this objective. AI tools, like text-to-speech generators, transcription tools, adaptive listening systems or automated feedback components may assist teachers in providing interactive and personalized learning experiences (Chen et al., 2024; Triberti et al., 2024). In flex blended settings AI can enhance listening skills and add the 4Cs to online materials, supporting linguistic as well as cognitive development.

However, little is known how EFL teachers make use of the opportunities to design listening materials in a purposeful manner that incorporates the 4Cs in flex blended learning environments using AI tools. To date, the research has primarily on students' perceptions of AI enhanced learning or teachers' general attitudes towards technology (Joseph et al., 2024; Marrone et al., 2025; Rienties et al., 2025; Vázquez-Parra et al., 2024). What is less well accounted for however, are the pedagogical processes through which teachers orientate AI affordances towards equipping students with 21st century

learning goals in resource design. If AI integration is to advance from technical emulation towards pedagogical innovation, understanding such practices is vital.

In order to fill this gap, the current study explores EFL teachers' use of AI tools in creation of 4Cs oriented listening materials mainly in flex blended learning. The study is guided by the following questions:

**RQ1:** How do EFL teachers leverage AI tools to design online listening materials that embed the 4Cs within flex blended learning environments?

**RQ2:** How do EFL teachers navigate challenges in integrating AI tools with the 4Cs when developing online listening materials?

This research suggests how AI can be pedagogically embedded into 4Cs-oriented listening teaching within flex blended learning. The findings provide implications for teachers and teacher-educators to cultivate both digital and pedagogical design capacity in AI-enhanced EFL settings.

## **Literature Review**

### *The 4Cs in Teaching and Learning Listening Skills*

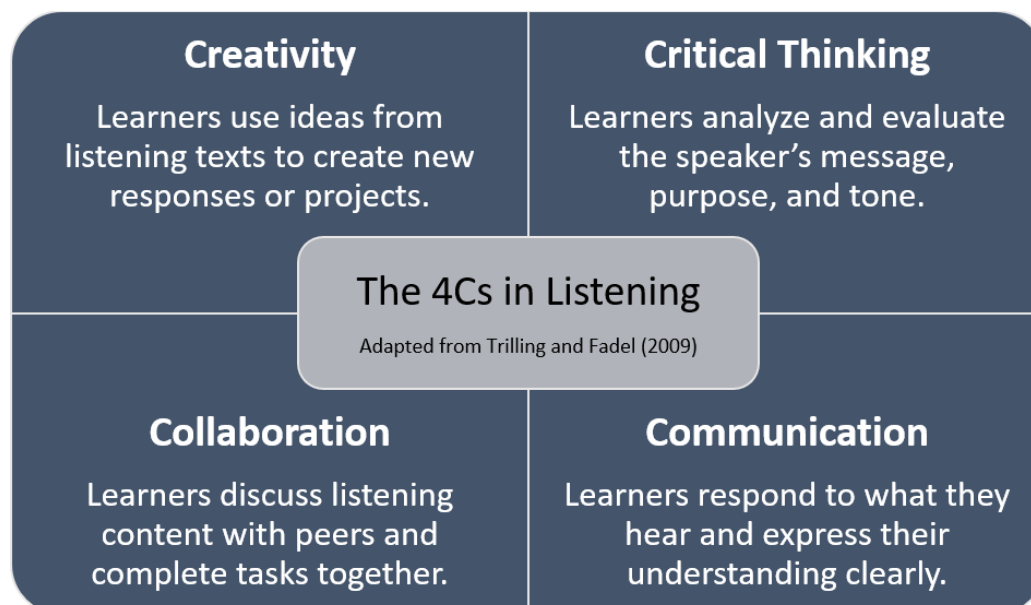
Trilling and Fadel (2009) pinpoint these four critical learning and innovation skills as 21st century's 4Cs that are of primary importance: Critical Thinking, Communication, Collaboration, and Creativity. They are the skills that help prepare students to be adaptive, problem-solving people who can succeed in a constantly changing world. Critical thinking and problem solving is the ability to analyze, evaluate, create new situation and as well decision-making (Arthi & Gandhimathi, 2025; Gerlich, 2025; Jauhariyah et al., 2026). Communication refers to clear speech, writing, and consumption and understanding of digital media, as well as the ability to listen effectively to others' points-of-view (Gadot & Tsybulsky, 2025; Yilik & Tanriverdi-Koksal, 2026). Collaboration encourages working in teams, respecting different perspectives and reaching consensual decisions (Abdeta et al., 2026), similar to that required in real life employment. The focus of creativity and innovation is on creating new ideas, testing them and re-enforcing learning conditions (Hershkovitz et al., 2025; Komura & Yamada, 2026). Taken together, the 4Cs prepare students to succeed in learning and for becoming contributing members of society (Dadelo, 2025; He & Wang, 2026).

Figure 1 shows the application of 4Cs (collaboration, communication, creativity and critical thinking) model to teach and learn listening skills. It demonstrates that listening means more than just comprehending the spoken word; it also involves learners in thinking, communicating and creating. Through the complete system, listening can be well used to cultivate, analyze, communicate, cooperate and create (Baki, 2025; Hu & Shu, 2025; Molina-Mateo et al., 2026). Such approach suggests the development of listening tasks which facilitate greater understanding and active involvement in learning among learners. Previous research emphasizes the importance of integrating the 4Cs into listening pedagogy in order to promote higher-order thinking and active learner

participation, but focuses largely on task design or learner outcomes rather than how teachers pedagogically design 4Cs-oriented technology-enhanced or AI-supported listening materials, which is the focus of the current study.

**Figure 1**

*The 4Cs in Listening*



#### *Flex Blended Learning in EFL Contexts*

Through flex blended learning online instruction takes a predominant role in daily teaching and teachers continue to be the essential guiding force. It affords students a self-paced learning environment to learn by means of interactive and feedback-based online- or face-to-face combined activities. Studies in EFL contexts have demonstrated that this approach improves fluency, autonomy, and motivation to learn the language. Studies by as Alshehri et al. (2025), Nusong and Watanapokakul (2025), and Rafique et al. (2026) described an improvement in oral production, reading, vocabulary, and motivation for students, while Faro et al. (2025), Robinson (2025), and Lin and Liu (2026) stressed the importance of learner preparation, engagement, and self-efficacy. Coe et al. (2025), Maina Mwangi et al. (2026) and Mohammadi et al. (2025) identified teacher readiness, infrastructure and professional development were crucial factors for success. Similarly, Xiaoying et al. (2025) found no significant differences between flex designs and traditional designs in promoting interaction and critical thinking. Although research has indicated the promise of flex blended learning for general language acquisition and engagement, few have focused on listening teaching, integration of 21st-century skills into an actual pedagogy such as flex blended learning, and teachers' AI-based material design practice within this mode; thus, the need for the current study.

#### *Leveraging AI for Educational Content Development*

Recent studies reveal that AI is used more and more to develop the English Language Teaching (ELT) material, which pave the way for adaptive, creative, student-centered

formatted contents. Williyen et al. (2024), Yetkin (2026), and Zhou and Hou (2025) who discovered that AI tools like ChatGPT are employed by EFL teachers for creating materials, task design and interactions in classroom with different degrees of dependency. Rahmawati et al. (2025) combined AI with Nation's Four Strands Model for organized content creation in flipped classrooms. Condorelli and Berti (2025), Ouyang (2025), Jain and Braden (2026), and Shafiee Rad (2025) showed that the AI platforms improve understanding, engagement and cultural confidence with both audio-visual and literature. Similarly, Alqurni (2026) and Gkintoni et al. (2025) illustrates AI and learner autonomy as well as situated learning. Nevertheless, issues of cultural bias, limited interaction and necessity for teacher mediation remain (Msambwa et al., 2025; Yetkin (2026). Despite AI's positive potential in the development of ELT materials, however, the current available research has been mostly learner- or tool-driven rather than teacher-driven, with little emphasis on teachers' pedagogical rationale and mediating roles between technology and learning processes in AI-based listening instruction; further, the intersection of AI use, listening skills, and the 4Cs within flex blended learning contexts remains underexplored, forming the focus of the present study.

## Methodology

### *Design of the Study and Participants*

This is a qualitative case study that delves into how EFL teachers utilize AIs in the development of 4Cs-based online listening materials in flex blended learning classes. The qualitative case study design was deliberately chosen with the aim to gain an in-depth and context-bounded insight of teachers' pedagogical practice and decision-making, not to measure learning effects or look for causal relations (Råbu & Binder, 2025). The case study approach is considered to be holistic in nature when examining how AI can be utilized for promoting enhanced listening proficiency and 21st-century competencies (Blundell, 2025). Ten participants were EFL teachers, teaching 30–40 students once or twice a week following detailed criteria presented in Table 1.

**Table 1**

### *Criteria for Participant Selection*

Selection Criterion	Description / Rationale
EFL teaching experience	currently teach EFL at a formal institution
Teaching focus on listening skills	regularly teach listening as a core skill
Class size and frequency	handle classes of 30–40 students meeting once or twice weekly
Experience with online/blended learning	have experience with blended or flex blended learning
Familiarity with AI tools	possess basic familiarity with AI-based teaching tools
Familiarity with 4Cs framework	apply 21st-century skills, especially the 4Cs, in teaching
Willingness to participate	voluntarily participate in all study procedures

The purposive sampling was used to locate information-rich cases that would provide deep insights into how AI is used in teaching and 4Cs-based principles in flex blended listening instruction (Herchline et al., 2025). This strategy targets teachers with

background in AI-aided education and teaching 21st-century skills. Variation in institutional background, teaching experience, and AI tool use was considered to enhance contextual richness rather than statistical representativeness. Pseudonyms were used to ensure confidentiality.

### *Context of the Study*

The research was carried out at Indonesian EFL tertiary education levels, within which flex blended learning has become more common after post-pandemic instructional reformation. In this context, listening instruction comes in the form of an integrated English skills course where there are some online learning activities combined with face-to-face or virtual contact hours. Institutions' policies mitigate in most cases towards the employment of digital learning technologies such as AI tools, even though technological infrastructure, AI platform availability and institutional support vary among educational settings. These setting conditions affected the way teachers conceived, adopted and used AI-based listening materials as part of their teaching.

### *Data Collection and Analysis*

The data was obtained using two types of qualitative methods, semi-structured interviews and a focus group discussion (FGD). The initial interviews examined how EFL teachers utilize AI tools to create flex blended learning environments with 4C-embedded online listening materials, and the adversity they encounter. The questions were rooted in Trilling and Fadel's (2009) 4Cs framework. Interviews lasted about 60 minutes, were recorded with consent at enrolment and transcribed verbatim. The semi-structured interview guide is contained in Table 2.

**Table 2**

#### *Interview Protocol*

Focus Area	Example Guiding Questions	Intended 4Cs Dimension
Teachers' use of AI tools in designing online listening materials	How do you use AI tools when developing listening materials for your students?	Creativity
Integration of 4Cs in listening instruction	In what ways do your listening materials encourage students to think critically, collaborate, communicate, or be creative?	Critical Thinking, Collaboration, Communication, Creativity
Teachers' perceptions of AI-assisted material development	What advantages do you find when using AI in designing listening materials?	Critical Thinking
Challenges in integrating AI with 4Cs principles	What challenges do you face when trying to integrate AI tools while also promoting 4Cs in your listening lessons?	All dimensions
Strategies to address challenges	How do you overcome the challenges you mentioned when integrating AI tools and 4Cs?	Collaboration, Creativity
Reflection and future potential	How do you see the role of AI in supporting 4Cs-oriented listening instruction in the future?	Creativity, Critical Thinking

Following up with the interviews, an FGD was conducted to verify and elaborate on interview information. It brought together participants to share experiences and exchange challenges in integrating AI-tools and 4Cs into the design of listening materials (Korzenevica et al., 2025). The FGD was used to triangulate methodology and compare similarities and differences across data sources. It took place over 100 minutes and was moderated so both sides contributed equally. The detailed FGD guide is shown in Table 3.

**Table 3**

*Focus Group Discussion (FGD) Protocol*

Focus Area	Example Guiding Questions	Purpose
Reflection on AI integration practices	How do your experiences with AI tools in designing listening materials compare with what was shared in the interviews?	To confirm and elaborate on individual interview responses
Shared experiences in promoting 4Cs	What are some effective ways you have found to embed the 4Cs through AI-assisted listening materials?	To explore collaborative perspectives and best practices
Challenges in practice	What common obstacles or constraints have you all encountered when integrating AI tools and the 4Cs framework in listening instruction?	To identify shared challenges and contextual barriers
Problem-solving and strategies	How have you or your colleagues addressed these challenges in your teaching contexts?	To gather collective solutions and coping strategies
Reflections on AI's future role	How do you envision the future of AI-assisted 4Cs-based listening instruction in flex blended learning contexts?	To validate and expand the thematic findings from the interviews

Thematic analysis (Braun & Clarke, 2021) of the interview and FGD data was used to identify themes. This flexible but theoretically-grounded approach allowed for a rich analysis of how teachers utilized the AI tools to develop 4Cs-oriented listening materials and overcome pedagogical-technological obstacles in flex blended learning. The six stages of evaluation are presented in Table 4.

**Table 4**

*Phases of Thematic Analysis*

Phase	Description
1. Familiarization with the data	Reading and re-reading transcripts to gain overall understanding
2. Generating initial codes	Identifying and labeling meaningful data segments
3. Searching for themes	Grouping related codes into potential themes
4. Reviewing themes	Checking themes against coded data and the full dataset
5. Defining and naming themes	Refining and clearly articulating theme meanings
6. Producing the report	Selecting representative excerpts and synthesizing findings

Thematic analysis, instead of statistical generalization, was adopted in order to support theory-driven interpretation about the ways in which teachers construct and mediate AI-supported 4Cs- informed listening pedagogy within context. This process followed a path from raw data to patterned meaning, which revealed both similarities in teacher practices and variation by context. To improve analytic transparency and transferability, AI integration was understood as being influenced by contextual factors; digital literacy,

curriculum congruence, institutional capacity, access to AI tools, and students' ability. These were included as qualitative themes, rather than statistical coefficients within instructional decision-making.

## **Findings**

Analytically-interpreted interview and focus group findings are presented in this section, considered from a perspective not of tool adoption or perception reporting, but instead of teachers' pedagogical decision making. It explores how EFL teachers make use of AI application to design online listening materials performing the 4Cs in flex blended learning settings and how such designs are pedagogically mediated by teachers' orchestration, adaptation, and judgment. Also, this study investigates how teachers solve the difficulties that installing AI tools poses to 4Cs, revealing common patterns shown among mediation of creativity, critical thinking, communication and collaboration.

### *RQ1: Utilization of AI by EFL Teachers in the Design of 4Cs-Oriented Online Listening Materials*

#### *Creativity through AI-enhanced listening materials*

The results indicated that, EFL teachers intentionally utilized the AI tools (*ChatGPT, Copilot, Gemini, ElevenLabs and Synthesia*) to produce authentic and visually stimulating content in an attempt to support students' creativity in flex blended learning. Rather than just checking comprehension, teachers used AI to create adventurous storylines and open-ended prompts designed to stimulate creative responses. AI was therefore not simply a means to the end of efficiency, but a creative collaborator in the production of lessons. These practices can be seen in Table 5.

AI tool Integration revealed that creativity in listening activity was promoted by active involvement and transposition of content. Students went beyond understanding by creating new stories through story extension, interpretation of language and multimodal production. AI was not seen by teachers as a substitute, but rather as an enabler and augments of listening instruction.

*"I generated short story scripts with ChatGPT, and had students think about new endings. They got really creative after they heard it," (Interview).*

*"Students appreciated the way in which AI voices allowed them to remix dialogues through testing out different tones, emotions and also being more expressive, creative"(FGD).*

These quotes analytically show a move from AI as content generator to the form of AI being explored as pedagogically mediated design resources. Teachers and students constructed AI as a device to engage in creative active exploration rather than as structured language input, suggesting that creativity arose from teachers' orchestration of task openness, modality and learner agency. Through the creation of creative, multimodal and open-ended listening tasks, teachers repositioned listening outside

comprehension as a generative activity. This suggests that AI-enhanced listening's creativity is not a generic technological affordance but a pedagogical accomplishment through teacher mediation of 4Cs framework and flex blended learning environments.

**Table 5**

*AI Use in Designing Online Listening Materials for Creativity*

AI Use in Material Design	What Teachers Do with AI (Design Process)	What Students Do in Listening Activity	Focus of Listening Activity	Creative Skill Promoted
Generating authentic and imaginative listening scripts (ChatGPT, Copilot, Claude)	Teachers use AI to generate imaginative and context-rich listening texts (stories, interviews, or debates) and adjust complexity to student level.	Students listen to imaginative stories or dialogues, identify the main ideas, visualize scenes, and predict what might happen next.	Listening for gist and interpretation	Imaginative and divergent thinking
Personalizing listening materials to learners' interests and contexts (ChatGPT, Gemini, Canva Magic Write)	Teachers adapt AI-generated listening materials to reflect students' local contexts, hobbies, or cultural experiences.	Students listen for details related to their lives, compare with their own experiences, and create personalized responses or alternative storylines.	Listening for specific information and personalization	Personal expression and idea generation
Creating multimodal listening materials through AI audio/video tools (ElevenLabs, Play.ht, Pictory, Synthesia)	Teachers transform AI-generated texts into audio or video materials using expressive AI voices and visuals.	Students listen or watch multimodal content, identify tone and emotion, and design their own visual or audio interpretations.	Listening for mood, tone, and imagery	Visual-auditory creativity and imagination
Designing open-ended listening tasks with AI support (ChatGPT, Copilot)	Teachers use AI to generate open-ended comprehension and reflection questions that invite multiple interpretations.	Students infer speakers' intentions, evaluate opinions, and produce creative continuations such as new endings or reflective recordings.	Listening for inference and evaluation	Divergent thinking and originality
Encouraging learner co-creation and remixing of AI-generated content (ChatGPT, Canva, ElevenLabs)	Teachers guide students to collaborate with AI to rewrite or remix listening scripts and record new versions using AI voices.	Students analyze original materials, identify structure and language features, then creatively reconstruct and record their own versions.	Listening for structure and language use	Innovation, ownership, and creative production

***Enhanced AI Listening Materials for Promoting Critical Thinking***

The results indicated that EFL teachers employed the AI tools to develop listening materials which encouraged students' critical thinking in flex blended learning. They leveraged tools such as *ChatGPT*, *Copilot* and *Perplexity AI* to formulate assignments that require analysis, evaluation and decision-making. Rather than drilling memory with rote

factual learning, teachers used AI to develop thought-provoking problem and case-based activities that promoted reasoning and interpretation. This caused learners to employ listening as an active tool of investigation and analysis. Table 6 summarizes these practices.

**Table 6**  
*AI Use in Designing Online Listening Materials for Critical Thinking*

AI Use in Material Design	What Teachers Do with AI (Design Process)	What Students Do in Listening Activity	Focus of Listening Activity	Critical Thinking Skill Promoted
Generating analytical and problem-based listening texts (ChatGPT, Copilot)	Teachers prompt AI to create listening materials centered on real-world issues or problem scenarios.	Students listen to problem situations, identify causes, and propose possible solutions based on evidence.	Listening for main ideas and problem identification	Analytical reasoning and problem solving
Producing inferential and evaluative listening questions (ChatGPT, Perplexity AI)	Teachers use AI to generate comprehension questions that target inference, evaluation, and reasoning beyond literal understanding.	Students infer implied meanings, detect bias or speaker attitude, and justify their interpretations.	Listening for inference and evaluation	Logical reasoning and interpretation
Designing comparative and perspective-taking tasks (ChatGPT, Gemini)	Teachers generate multiple listening perspectives on one topic, such as debates or contrasting viewpoints.	Students compare different perspectives, analyze argument strength, and express evaluative opinions.	Listening for contrasting viewpoints	Argument analysis and perspective-taking
Creating reflection-based listening journals and prompts (ChatGPT, Copilot)	Teachers use AI to produce reflective listening prompts that require personal interpretation and reasoning.	Students maintain AI-assisted listening journals summarizing key points and evaluating ideas critically.	Listening for interpretation and reflection	Critical reflection and synthesis

By introducing AI technologies, listening activities evolved from skimming to analyzing. Reading between the lines by inferring tone, intent and bias, students connected inputs to broader questions. Participants used AI-assisted question generation and feedback to assess credibility, and then compose evidence-based answers. Teachers viewed AI as a model for analytical learning and thinking.

*“When I am making listening questions with ChatGPT, I always include things like ‘why’ and ‘how’ questions to think about meaning.” (Interview)*

*“In blended sessions, students read two AI-generated essays and discussed which argument was stronger.” (FGD)*

A consistent pattern across the data indicates that critical thinking was not produced by AI automation, but through deliberate pedagogical scaffolding. Teachers embedded

questioning, evaluation, and reflection into listening tasks, transforming AI outputs into cognitive prompts rather than final answers. Within flex blended designs, this enabled a cyclical process in which students engaged in online analysis and extended their reasoning through face-to-face reflection. Consequently, critical thinking development depended on teachers' analytical oversight and scaffolding strategies, positioning AI as a facilitator of reflection rather than an independent instructional agent.

### *Communication through AI-enhanced listening materials*

It was found that EFL teachers employed the AI tools such as *ChatGPT*, *Copilot*, *ElevenLabs* and *Speechify* to develop listening materials in renewing students' communication skills in flex blended learning. Listening was considered a communicative process that promoted interaction and expression, apart from being treated as an isolated skill. AI offered authentic input, interactive feedback and opportunities for learners to express meaning and produce speaking. This set of practices is summarized in Table 7.

**Table 7**

*AI Use in Designing Online Listening Materials for Communication*

AI Use in Material Design	What Teachers Do with AI (Design Process)	What Students Do in Listening Activity	Focus of Listening Activity	Communication Skill Promoted
Creating interactive listening-response tasks (ChatGPT, Speechify, Copilot)	Teachers design listening materials that include follow-up dialogue or oral response prompts using AI voice tools.	Students listen to audio content and respond orally or in writing to express opinions, reactions, or clarifications.	Listening for gist and interaction cues	Expressive listening and response formulation
Designing AI chatbot-based listening simulations (ChatGPT, Poe, TalkPal)	Teachers use AI chatbots to simulate interactive listening scenarios, such as interviews or role plays.	Students engage with AI chatbots by listening to simulated dialogue and responding in real time.	Listening for comprehension and interaction	Interactive communication and meaning negotiation
Integrating collaborative listening discussions (Google Meet with AI summaries, Padlet with AI)	Teachers design group listening activities supported by AI summaries or prompts that guide discussion.	Students listen to shared audio materials, exchange interpretations, and co-construct understanding collaboratively.	Listening for shared meaning and discussion	Collaborative communication and peer interaction
Providing AI-assisted pronunciation and feedback tools (Speechify, ELSA Speak, Copilot)	Teachers integrate AI tools that analyze pronunciation, intonation, and fluency in post-listening speaking tasks.	Students listen to models, record their responses, and receive AI-generated feedback to improve clarity and accuracy.	Listening for pronunciation models and accuracy	Oral communication and feedback-based improvement

The embedding of AI tools suggested that listening materials were designed for authentic interaction, rather than mere understanding. The link between listening and speaking meant that teachers were encouraging students to make input into interaction. AI feedback and simulations supported meaning negotiation, spontaneity in the responses, and pronunciation correction to promote communicative proficiency and confidence.

*"I use AI chatbots after listening practices. The conversation continues so students can practice natural replies."* (Interview)

*"For group tasks we utilized Padlet with AI summaries to share information & stimulate discussion."* (FGD)

Interpretationally, the findings reveal that participants take AI as an instance of communicative mediation but not a model of language. Through simulation, feedback and scaffolded collaboration, teachers intervened on listening as dialogic sense-making online and face-to-face contexts. Communicative gains were not made in the AI interacting itself, but when teachers organized listening, response, reflection sequences in ways that made explicit the role of pedagogical orchestration in effecting communicative outcomes.

#### *Collaboration through AI-enhanced listening materials*

The results indicated that EFL teachers incorporated AI tools to develop online listening resources, which supported cooperability in flex blended learning. Tools like *Google Meet with AI summaries, Padlet with AI features, Miro AI, and ChatGPT* enabled team effort and mutual sense-making and problem-solving. AI mediated exchange and supported learners in collaboratively constructing meaning during group negotiation or task accomplishment. These assisted AI activities encouraged team work, negotiation and consensus. The summary is shown in Table 8.

The implementation of AI tools revealed that listening materials can serve as a means for promoting collaboration through shared analysis, co-production and feedback. The AI features, such as summarization, shared editing and visual co-design facilitated equal contributions from all students as they learnt from each other, listening became a social process of making shared meaning and understanding.

*"Students listened, then discussed and refined their ideas using Padlet (and AI summaries) before writing a group response."* (Interview)

*"We also love that we were able to use Canva AI for adding ideas post listening. It made people feel like they were doing something together and not just responding."* (FGD)

The data highlight that collaboration was sustained through pedagogical governance rather than technological connectivity alone. Teachers structured roles, regulated interaction norms, and incorporated reflective follow-up to ensure balanced participation. As a result, collaboration in AI-assisted listening was socially constructed, with AI functioning as a mediating layer while teachers ensured accountability, interactional depth, and shared meaning-making aligned with the 4Cs framework.

**Table 8**

*AI Use in Designing Online Listening Materials for Collaboration*

AI Use in Material Design	What Teachers Do with AI (Design Process)	What Students Do in Listening Activity	Focus of Listening Activity	Collaboration Skill Promoted
Designing AI-supported group listening discussions (Google Meet with AI summaries, Padlet with AI)	Teachers use AI to generate discussion prompts and summaries to guide collaborative listening tasks.	Students listen to shared materials, exchange ideas, and build collective summaries or conclusions.	Listening for shared meaning and key information	Cooperative meaning-making and idea sharing
Creating collaborative problem-solving listening tasks (ChatGPT, Miro AI)	Teachers use AI to create real-life, problem-based listening scenarios that require teamwork and decision making.	Students listen to a problem situation, discuss possible solutions in groups, and use AI tools to document or present outcomes.	Listening for problem identification and reasoning	Negotiation and joint decision-making
Developing collaborative multimodal listening projects (Canva Magic Studio, Pictory, ChatGPT)	Teachers guide students to co-create listening-based multimedia projects that integrate audio, visuals, and text using AI.	Students work together to design multimedia presentations or podcasts that reinterpret listening content creatively.	Listening for integration of ideas and presentation	Co-creation and digital collaboration

*Research Question 2: Navigating AI-4Cs Integration Challenges in Online Listening Materials*

*AI integration for creativity: Challenges and strategies*

The results indicated that EFL lecturers considered AI tools useful for providing creative online listening materials in flex blended learning. However, they encountered difficulties in matching content to AI-generated learning outcomes, combating idea overload through curation and instruction of excessive content, preserving coherence among curriculum elements, and ascertaining appropriate depth. These issues and responses are described in Table 9.

**Table 9***Challenges and Strategies in Integrating AI for Creativity*

Theme		Nature of Challenge (Pedagogical Tension)	Strategic Response (Teacher Navigation)
Managing abundance while maintaining meaningful creativity	AI while	AI generated abundant creative content quickly, but teachers sometimes found it overwhelming to select and refine the most suitable materials for their context.	Teachers curated, filtered, and refined AI outputs to ensure relevance, balance, and student-centered creativity.
Aligning generated materials with curricular objectives	AI-generated materials	Some AI-generated listening texts were imaginative and engaging but not always aligned with lesson objectives or learning outcomes.	Teachers restructured and contextualized AI-generated content to ensure alignment with syllabus goals, language focus, and target competencies.
Adjusting generated materials to appropriate difficulty levels	AI-generated materials	AI outputs occasionally contained vocabulary or structures that were too complex or too simple for the intended student group.	Teachers calibrated AI prompts and edited outputs to adjust language difficulty and maintain an optimal level of challenge for learners.

These results reveal that although AI massively supported teachers to create creative and engaging listening materials, its generative over-saturation brought in new issues of pedagogical decision-making. Teachers acted as site-specific curators and planners in shaping such black box outputs, selecting, modifying, and refining AI scripted ideas with an eye to ensure creativity was employed for instructionally relevant purposes rather than newness alone.

*"I have a lot of storylines in AI, but then I need to cater them at a level and in respect to the field my students are in." (Interview)*

*"AI would come up with ideas beyond the syllabus, and I would adjust it to suit my lesson objectives." (FGD)*

The findings suggest that teachers did not resist AI, but approached it as a resource requiring careful selection and adaptation. By negotiating between AI-generated possibilities and curricular demands, teachers exercised pedagogical judgment that transformed AI use from passive adoption into purposeful regulation. This process underscores the intentional nature of creativity within the 4Cs framework and highlights the central role of teacher mediation in aligning AI outputs with instructional goals in flex blended contexts.

*AI integration for critical thinking: challenges and strategies*

It was found that, although AI application tools were adopted in creating tasks pertaining to listening materials causing inferential and evaluative thinking, EFL teachers were challenged on the precision, depth, as well as the correct steps of guiding instruction. While AI was helpful in lending a hand, teachers brought their discerning eye to assist with higher levels of thinking. There were three main aspects, which we incorporated on Table 10.

**Table 10***Challenges and Strategies in Integrating AI for Critical Thinking*

Theme	Nature of Challenge (Pedagogical Tension)	Strategic Response (Teacher Navigation)
Ensuring logical accuracy and reliability of AI-generated analytical prompts	Some AI-generated analytical questions contained factual errors or misleading assumptions, which could confuse learners.	Teachers verified and revised AI-generated questions for factual accuracy and logical coherence before including them in listening materials.
Balancing AI efficiency with teachers' analytical involvement	Although AI tools saved time, teachers were concerned that relying too much on AI-generated prompts might reduce their own analytical involvement in task creation.	Teachers used AI primarily for brainstorming and idea generation but retained full pedagogical control in refining, sequencing, and finalizing questions.
Designing scaffolding to support students' critical engagement with AI-generated materials	Even with well-crafted analytical questions, teachers recognized that students often needed additional guidance to engage in reasoning and evaluation.	Teachers added pre-listening and post-listening scaffolds such as guiding prompts, reflection sheets, and follow-up discussions to help students process AI-generated analytical content critically.

These results suggest that teachers viewed AI as a creator partner for critical-thinking listening learning materials, but that the cognitive and logical aspects of research activities were reliably controlled by teachers. They were evaluators and scaffold designers who quality-assured AI-generated content for both accuracy and pedagogy.

*"At times the AI questions sound academic but the reasoning is not totally accurate so I proofread and revise them before I use those," (Interview)*

*"AI enables me to develop questions that focus on the reasoning faster, but I do have to add in tasks for reflection or discussion so students really think about what they're listening to," (FGD)*

The excerpts further demonstrate that AI functioned as a supplementary tool rather than a substitute for teachers' analytical design practices. Through continuous evaluation and refinement of AI-generated outputs, teachers maintained cognitive rigor and ensured that tasks sustained meaningful reasoning processes. This reinforces the positioning of AI as a supportive cognitive resource while affirming teacher agency as essential in preserving the depth and quality of critical thinking in listening instruction.

*AI integration for communication: Challenges and strategies*

The findings revealed that the EFL teachers used AI tools in the preparation of online listening materials and thereby fulfilled communication-oriented learning, yet they had pedagogical and technical issues in promoting active communication. Tools like *ChatGPT*, *TalkPal*, *Speechify* and *AI pronunciation analyzer* allowed students to practice having conversations, receive follow-up prompts and reflect on their speaking. The analysis yielded three guiding themes represented in Table 11.

**Table 11***Challenges and Strategies in Integrating AI for Communication*

Theme	Nature of Challenge (Pedagogical Tension)	Strategic Response (Teacher Navigation)
Coordinating AI integration across online and offline communication tasks	Teachers found it challenging to maintain coherence between AI-assisted listening activities conducted online and follow-up communicative tasks in face-to-face sessions.	Teachers synchronized AI-generated dialogues and voice simulations with classroom-based follow-ups such as role-plays and group discussions to create continuity across modes.
Monitoring and sustaining communicative engagement beyond AI-assisted listening	While AI helped generate dialogue prompts and interaction tasks, teachers needed to ensure that students' communication extended beyond scripted AI interactions.	Teachers designed reflective or improvisational post-listening tasks that required spontaneous communication, ensuring authentic engagement after AI-assisted listening.
Managing technical and logistical barriers in AI-based communication design	Occasional internet instability, software limitations, or restricted access to AI voice tools disrupted task development or implementation.	Teachers prepared offline versions of AI-generated materials and selected lightweight, accessible tools to maintain task continuity in flex blended contexts.

These results suggested that AI was used as a partner to learn by communicating in the listen mode, and that its introduction needed to be optimized. The teachers positioned AI as a co-author of the listening experiences for speaking, reflection, and interaction support. However, they needed to ensure design coherence across modes, continuity of communicative engagement and robust technicality if these designs were going to work.

*“Even as I am beginning to incorporate AI in those discussions and voice purposes, it would still be part of class activities, where the language is being kept alive.”* (Interview)

*“Sometimes the vocabulary on internet or AI talk is not stable, so I prepare to back up in advance to avoid any possibility of reading and speaking.”* (FGD)

The data indicate that teachers prioritized continuity and authenticity in communication over the linguistic sophistication of AI-generated content. Instructional designs emphasized interactional clarity, real-world relevance, and opportunities for learner expression across modalities. In this sense, AI contributed to communication only when embedded within coherent pedagogical sequences, highlighting that communicative value emerged from teacher-led orchestration rather than from technological interactivity alone.

*AI integration for collaboration: Challenges and strategies*

The results indicated that the EFL teachers succeeded in mediating students' cooperation skills when designing online listening materials in flex blended learning environments. There were three central themes identified in the data. The summary is presented in Table 12.

**Table 12***Challenges and Strategies in Integrating AI for Collaboration*

Theme	Nature of Challenge (Pedagogical Tension)	Strategic Response (Teacher Navigation)
Ensuring balanced participation and accountability in AI-supported group work	Some students became passive or relied on more digitally skilled peers to manage AI tasks during group listening projects.	Teachers assigned clear group roles (e.g., AI operator, note-taker, presenter) and assessed both process and product to ensure equal participation.
Coordinating group workflow and communication using multiple AI tools	Managing collaborative listening tasks across various AI applications sometimes caused confusion about roles, content integration, and progress tracking.	Teachers used shared digital spaces (e.g., Padlet, Google Workspace) to centralize group work, clarify responsibilities, and monitor collaboration systematically.
Facilitating meaningful interaction within AI-supported collaboration	While AI tools simplified coordination, teachers needed to ensure that collaboration remained idea-focused and interactive rather than merely procedural.	Teachers guided students to discuss, critique, and expand AI-generated materials collaboratively, emphasizing reasoning, negotiation, and joint decision-making.

These results reveal that, while teachers valued AI as an effective tool to structure and strengthen collaborative learning, their value in mediating quality of engagement and pedagogical depth was regarded as indispensable. Teachers were facilitators who juggled the efficiency of AI with the social exchange that comes from human collaboration.

*“In some cases where we use AI the group work can become rather mechanical and so I set critical tasks for students to discuss and put their own interpretations in to keeps it interactive,”* (Interview)

*“AI platforms such as Padlet will make it easier in terms of organization, yet I still need to remind students to concentrate on sharing ideas rather than just doing a task,”* (FGD)

Evidence from the data suggests that teachers positioned AI as an augmentation of collaboration rather than a replacement for human interaction. By structuring roles, guiding discussion, and incorporating reflective follow-up, teachers ensured that listening tasks remained dialogic and accountable. This indicates that effective collaboration in AI-assisted environments is pedagogically regulated, with AI serving as a coordinating tool while teachers sustain meaningful interpersonal engagement in flex blended learning contexts.

Throughout RQ2, the findings contributed to overall pattern: problems connected with AI integration did not lead to lower pedagogical quality; on the contrary activated teachers and their mediating roles. Teachers mediated tensions around creativity, critical thinking, communication and collaboration through curating, scaffolding, orchestrating and contextualizing. This finding suggests that the impact of AI-assisted listening materials depended on teachers’ interpretive judgment and pedagogical decision, which

strengthens teacher agency as a core mechanism responsible for the connection between AI affordances, the 4Cs, and flex blended learning.

## **Discussion**

This study contributes to the growing body of research on AI integration in EFL listening by identifying a central causal mechanism: AI contributes to 4Cs-oriented learning only when mediated through teachers' intentional orchestration (Williyan et al., 2025). This finding suggests that AI does not function as an autonomous pedagogical agent, but rather as a source of generative potential that requires continuous professional regulation. The need for such mediation arises from the inherent nature of AI systems, which produce abundant, context-independent outputs that are not automatically aligned with pedagogical goals. As a result, the effectiveness of AI is contingent not on its technical sophistication, but on teachers' capacity to interpret, adapt, and govern its use within flex blended learning environments. This extends prior work by emphasizing that teacher agency is not merely supportive, but constitutive of meaningful AI integration (Williyan et al., 2026).

In the domain of creativity, while AI enabled the rapid generation of imaginative scripts, multimodal materials, and open-ended prompts, this generativity simultaneously introduced a paradox of abundance. The large volume of AI-generated content often led to misalignment with curricular objectives and risks of cognitive overload for learners. This explains why teachers in this study did not adopt AI outputs directly, but engaged in processes of selection, refinement, and contextualization. In contrast to studies that position AI as inherently creativity-enhancing (Zhou & Hou, 2025), the findings here suggest that creativity emerges through pedagogical curation rather than technological provision. This supports and extends Choi (2025) by demonstrating that alignment work is not supplementary, but central to instructional design in AI-supported environments. However, this also places additional cognitive and professional demands on teachers, indicating that AI-enabled creativity is both facilitated and constrained by human mediation. Pedagogically, this highlights the need for developing teachers' competencies in content curation and prompt design to manage AI-generated abundance effectively (Aqajani Delavar et al., 2025).

With respect to critical thinking, AI-supported materials such as inferential questions and problem-based listening tasks created opportunities for higher-order reasoning. However, the findings reveal that AI-generated prompts were not always logically consistent or factually reliable, requiring teachers to perform epistemic verification before classroom use. This indicates that while AI can simulate the structure of analytical questioning, it cannot guarantee the validity of reasoning processes. Consequently, critical thinking operated on two interconnected levels: students engaged in interpretation and evaluation of listening input, while teachers ensured the epistemic integrity of the materials themselves. This extends Shin et al. (2025) by highlighting the

limitation of AI in sustaining trustworthy cognitive engagement. Furthermore, higher-order thinking did not emerge from AI prompts alone, but from structured scaffolding, sequencing, and reflective activities designed by teachers (Monib et al., 2025). This suggests that critical thinking in AI-mediated environments is not automated, but carefully constructed, reinforcing the role of teacher professionalism as a form of cognitive quality control.

In terms of communication, AI tools such as simulations and feedback systems facilitated interactive listening-response cycles, supporting principles of communicative language teaching (Shago et al., 2025). However, the findings indicate that communicative competence did not arise from AI interaction itself, but from the continuity between AI-mediated input and subsequent human interaction. Without this pedagogical sequencing, communication risks becoming scripted and superficial. This challenges assumptions that technological interactivity alone can foster authentic communication (Aperstein et al., 2025). Instead, teachers played a crucial role in transforming AI-generated exchanges into meaningful communicative practice by extending them into discussion, reflection, and real-world application. Therefore, communication gains were dependent on the alignment between online and face-to-face components within the flex blended model, highlighting the importance of cross-modal coherence rather than isolated technological use.

Similarly, in the domain of collaboration, AI tools supported coordination, shared meaning-making, and multimodal co-production. However, the findings reveal that such tools did not inherently ensure equitable participation or meaningful interaction. In some cases, collaboration risked becoming procedural rather than dialogic, particularly when students relied on AI outputs without deeper engagement. This supports concerns raised by Msambwa et al. (2025) regarding the limitations of AI in fostering genuine collaborative learning. To address this, teachers implemented governance strategies such as role assignment, structured discussion, and accountability mechanisms, ensuring that collaboration remained cognitively and socially meaningful. This extends Cao and Phongspatha (2025) by demonstrating that collaboration in AI-supported environments is socially regulated rather than technologically guaranteed. Thus, AI functions as a mediating tool, while the quality of collaboration is determined by pedagogical design and interactional management.

Taken together, these findings reveal a consistent pattern across all four domains: AI introduces both opportunities and tensions that must be actively managed through teacher agency (Williyan et al., 2025). Creativity is enabled but requires curation, critical thinking is supported but requires verification, communication is facilitated but requires continuity, and collaboration is enhanced but requires governance. This pattern underpins the proposed AI-Mediated 4Cs Listening Orchestration Model (A4LO), which conceptualizes AI integration not as tool adoption, but as a process of pedagogical

orchestration. The model therefore reframes AI-enhanced learning as a negotiated and mediated practice, where educational value emerges from the dynamic interplay between technological affordances and teacher-led instructional design.

**Figure 2**

*AI-Mediated 4Cs Listening Orchestration Model*

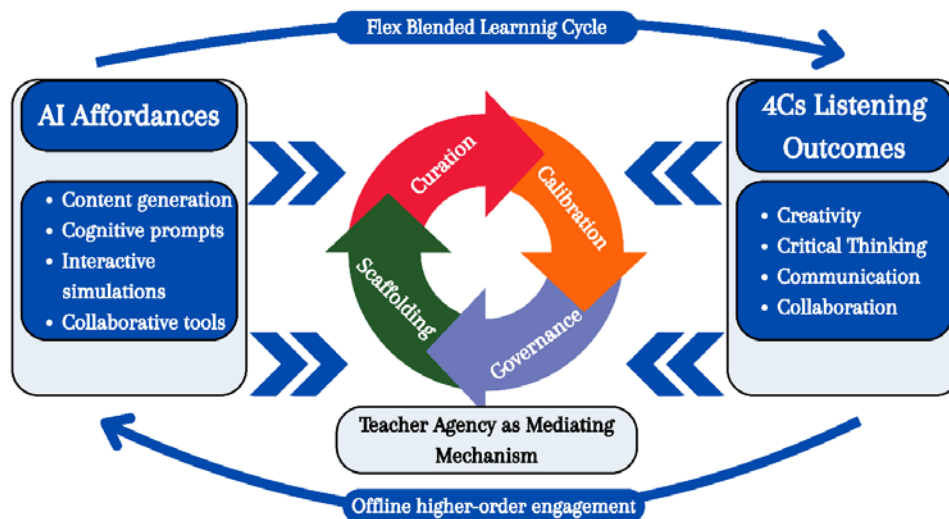


Figure 2 depicts the AI-Mediated 4Cs Listening Orchestration Model (A4LO), a conceptual model proposed as a result of recurring mediation principles in findings. Teacher agency is the main actor that activates AI affordances in flex blended listening environments, as indicated by the model. Contrary to seeing AI as an independent engine for innovation, teachers place AI as a tool of instruction that depends on purposeful orchestration.

On the left, AI affordances represent technological capabilities such as content generation, cognitive prompting, interactive simulations, and collaborative tools. These affordances provide the basis for scripts, inferential questions, chatbot talk-back exchanges, feedback architecture and group digital space but they do not become raw material without pedagogic mediation. There are four iterative processes that constitute teacher agency at its core: curation, calibration, scaffolding and governance. Curation requires AI outputs to be sifted, curated and brought into relevance. Calibration adjusts linguistic complexity and task challenge to align with curricular demands. scaffolding includes structure support to encourage more reflection and engagement. Governance positions form and interaction customs for the sustainability of quality involvement. The circular nature of these processes represents the cyclical and interconnectedness of mediation.

In this way, AI-enabled listening tasks are enacted for the 4Cs. Creativity is enacted as imaginative reinterpretation and multimodal production, critical thinking is realized through inferential and evaluative reasoning, communication features dialogic exchange and feedback-informed expression, and collaboration occurs through negotiated co-

construal. Listening is reconfigured from a passive act of reception to an active, socially-mediated one. The model is nested within a flex blended learning cycle, in which AI-supported online input links to face-to-face higher-order engagement. This cyclic pursuit reinforces the insight that aspired AI integration rely on cross-modal alignment, not technology alone.

Taken together, the A4LO model seeks to suggest that effective AI Listening environments are pedagogically driven not technology lead. In positioning teacher mediation as the mediating force that connects AI affordances with 4Cs development, the model provides an infrastructure-based description to how and why AI becomes pedagogically relevant within flex blended EFL environments.


The AI-Mediated 4Cs Listening Orchestration Model is a pragmatic design model for EFL instructors to assimilate AI tools into flex blended listening teaching. The model can inform and guide teachers in building AI prompt design, scaffolding cognitive engagement, connecting listening tasks to 4Cs competencies and developing governance guidelines for pedagogical control. In that sense it is more than a concept but a practical guide to AI inflected listening pedagogy.


## **Conclusion**


This study further supports that how AI can be effectively integrated in listening material design after the 4Cs is not so much a question of technological capability, but rather depends on teachers' pedagogical decision. AI is a partner in design that enhances creativity, personalization and interaction in flex blended learning, its value comes as well from teachers' critical appropriations to AI's outputs and the consideration of how these are aligned with educational intentions. In focusing on teacher agency, the study contributes to the literature concerned with how teachers exploit affordances of AI for deep learning that supports critical, creative, communicative and collaborative skills.

The study was a qualitative exploratory theory-building case study. Instead of its results or causal relationships, it aimed to produce rich descriptions of teachers' pedagogical practices, instructional decision-making process, and situational concerns as they implemented AI in 4Cs listening instruction. While this method allowed for a nuanced contextualization, it does not easily lend itself to generalization or empirical measure. Future research might replicate these findings and examine them to a greater depth through mixed or quasi-experimental methodologies, either at different proficiency levels of learners or 21st century skills level in order to decide whether the positive impact continues on the learners by AI-mediation via 4Cs based listening materials. Longitudinal or design-based research could investigate how continued AI integration influences teacher professional development and instructional innovation in varied EFL environments.

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Aprilia Riyana Putri: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Visualization, Writing – Original Draft, Writing – Review & Editing

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During the preparation of the manuscript, the authors utilized ChatGPT (OpenAI) to support language editing, improve structural organization, and refine academic expression. The prompts were designed to enhance the clarity and coherence of content originally developed by the authors. The AI tool was not employed to generate data, perform statistical analyses, create references, or interpret results. All aspects of the research design, data collection, analysis, interpretation, and final scholarly decisions remained entirely under the authors' responsibility.

## **Ethics Declarations**

### **World Medical Association (WMA) Declaration of Helsinki–Ethical Principles for Medical Research Involving Human Participants**

This study was conducted in accordance with the ethical principles of the World Medical Association Declaration of Helsinki. Ethical approval was granted by the Research Ethics Committee of Universitas Islam Nahdlatul Ulama Jepara (Approval No. 010/EC/UNISNU/2025). Informed consent was obtained from all participants.

## Competing Interests

The authors declare that they have no competing interests.

## Data Availability

The data generated and analyzed in this study can be obtained from the corresponding author upon reasonable request.

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