

REDEFINING EFL IN THE 5.0 SOCIETY: AN ECOLOGICAL APPROACH TO INTEGRATING GENERATIVE AI

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ABSTRACT

This conceptual paper proposes a novel approach to English as a Foreign Language (EFL) teaching in Society 5.0, integrating Generative Artificial Intelligence (AI) through an ecological perspective. As technological advancements reshape educational landscapes, traditional EFL methodologies face challenges in meeting the evolving needs of learners. This study addresses this gap by introducing the Eco-Generative EFL (EG-EFL) model, a comprehensive framework that reimagines language learning as a dynamic ecosystem. The EG-EFL model leverages the capabilities of Generative AI to create immersive, adaptive, and personalised learning environments while maintaining a holistic view of the interdependencies within the educational system. Through a rigorous theoretical analysis and synthesis of existing literature, this paper explores the potential applications of Generative AI in EFL contexts and examines their ecological impact. The proposed model offers innovative strategies for enhancing learner engagement, autonomy, and language acquisition. Furthermore, this study discusses the pedagogical implications, technological considerations, and ethical concerns associated with implementing the EG-EFL model. By presenting a forward-thinking approach to language education, this paper contributes to the ongoing dialogue on educational innovation in the era of Society 5.0. It provides a foundation for future empirical research in AI-enhanced language learning ecosystems.

Keywords: *Artificial Intelligence, Ecological Approach, English as a Foreign Language, Generative AI, Society 5.0*

1. INTRODUCTION

In the ever-evolving language education landscape, English as a Foreign Language (EFL) teaching is pivotal in our increasingly interconnected world. Over the past few decades, EFL methodologies have transformed from traditional grammar translation to communicative and task-based approaches (Richards & Rodgers, 2014). These shifts have been driven by our deepening understanding of language acquisition processes and the changing needs of learners in a globalised society.

As we stand on the cusp of a new era, often called Society 5.0, the demands placed on language learners and educators are again evolving. Society 5.0, a concept initially proposed by the Japanese government, envisions a human-centred society that balances economic advancement with resolving social problems through a system that highly integrates cyberspace and physical space (Fukuyama, 2018). This new societal paradigm challenges us to reconsider how we approach education, particularly in language learning.

Concurrent with the emergence of Society 5.0, we are witnessing the rapid development of Generative Artificial Intelligence (AI). These AI systems, exemplified by models like GPT-3 and its successors, have demonstrated remarkable capabilities in natural language processing and generation (Brown et al., 2020). The potential of Generative AI to revolutionise various sectors, including education, is immense and largely untapped in the context of EFL teaching.

Despite the advancements in pedagogical approaches and technological tools, EFL teaching continues to face significant challenges. Many learners struggle to achieve communicative competence, often unable to effectively use English in real-world contexts despite years of study (Lightbown & Spada, 2021). Additionally, the increasing diversity of learner needs and the demand for personalised learning experiences pose substantial challenges for educators working within traditional classroom structures (Tomlinson, 2014).

Moreover, the rapid pace of technological change and the evolving linguistic landscape of the digital age have created a disconnect between traditional EFL curricula and the language skills required for success in Society 5.0. This gap is particularly evident in digital literacy, intercultural communication in online spaces, and the ability to interact effectively with AI-powered language tools (Chapelle & Sauro, 2017).

In light of these challenges and the transformative potential of Generative AI, there is a pressing need for innovation in language education. We must reimagine EFL teaching in ways that not only harness the power of new technologies but also prepare learners for the linguistic and communicative demands of Society 5.0.

This study aims to address these challenges by pursuing two primary objectives. First, we seek to redefine EFL teaching within the context of Society 5.0, considering how language education's goals, methods, and outcomes must evolve to meet the needs of learners in this new era. Second, we propose an ecological framework for integrating Generative AI into EFL classrooms, viewing language learning as a complex, interconnected system rather than a linear process.

The significance of this study lies in its potential to reshape EFL pedagogy fundamentally. Integrating Generative AI within an ecological framework opens new possibilities for personalised, adaptive, and immersive language learning experiences. This approach can enhance learner engagement, accelerate language acquisition, and develop the critical AI literacy skills essential in Society 5.0.

Furthermore, this research contributes to the broader field of educational technology by providing a theoretically grounded and practically oriented model for integrating AI into language education. As AI continues to permeate various aspects of our lives, effectively leveraging these technologies in educational contexts becomes increasingly crucial. Our proposed framework offers a starting point for educators and researchers navigating the complex intersection of language learning, artificial intelligence, and societal change.

2. METHODS

In developing our ecological framework for integrating Generative AI in EFL classrooms, we adopted a multifaceted methodological approach grounded in systems thinking and ecological perspectives on language learning.

Conceptual Framework

Our research is underpinned by an ecological approach to language learning, which views language acquisition as a complex, dynamic system of interrelated elements rather than a linear process (van Lier, 2004). This perspective aligns with the work of researchers like Cameron and Larsen-Freeman (2007), who apply complexity theory to second language acquisition, emphasising the interconnected and emergent nature of language learning.

We also draw on systems thinking in educational contexts, as Senge et al. (2012) articulated, which provides a framework for understanding the intricate relationships between various components of the learning environment. This approach is particularly relevant when considering the integration of Generative AI, as it allows us to examine how this new element interacts with and influences other aspects of the EFL ecosystem.

By combining these perspectives, we aim to create a holistic understanding of EFL teaching that accounts for the complex interplay between learners, teachers, technology, and the broader sociocultural context of Society 5.0.

Literature Review Methodology

Our literature review employed a systematic approach to ensure comprehensive coverage of relevant research. We utilised major educational and linguistic databases, including ERIC, Scopus, Web of Science, and Google Scholar. Search terms included combinations and variations of "EFL teaching," "Generative AI," "language learning ecology," "Society 5.0," and "educational technology."

Inclusion criteria focused on peer-reviewed articles published within the last decade, with seminal works in ecological approaches to language learning included regardless of publication date. We excluded studies that did not specifically address EFL contexts or those that only tangentially mentioned AI without substantive discussion of its educational applications.

Theoretical Analysis

Our theoretical analysis involved a synthesis of existing theories across three main areas: EFL pedagogy, ecological approaches to education, and AI in language learning. Through an ecological lens, we examined contemporary EFL methodologies, including communicative language teaching (Nunan, 1991) and task-based language teaching (Ellis, 2003).

We then integrated these insights with ecological perspectives on language learning, drawing heavily on van Lier's (2004) work on the ecology of language learning and Kramsch's (2003) concept of ecological validity in language education. This ecological framework was further enriched by incorporating theories of AI in education, particularly those addressing the potential of Generative AI in language learning contexts (Chapelle, 2001).

Through this synthesis, we aimed to identify points of convergence and tension between these theoretical strands, laying the groundwork for our integrated EG-EFL model.

Model Development Process

The development of our Eco-Generative EFL (EG-EFL) model followed an iterative process involving several vital steps:

1. Initial conceptualisation based on our theoretical analysis
2. Mapping of potential interactions between Generative AI and other components of the EFL ecosystem
3. Refinement of the model through internal review and discussion among our research team
4. Consultation with experts in EFL pedagogy, educational technology, and AI ethics
5. Further refinement based on expert feedback

To validate our model, we employed a combination of face validity checks with experienced EFL practitioners and content validity assessments by experts in educational technology and AI. While full empirical validation is beyond the scope of this conceptual paper, we have identified critical testable propositions for future research.

3. RESULTS

Current State of EFL about Society 5.0

The landscape of English as a Foreign Language (EFL) teaching has evolved significantly over the past few decades, with approaches such as Communicative Language Teaching (CLT) and Task-Based Language Teaching (TBLT) gaining prominence (Richards, 2005). These methodologies have aimed to develop learners' communicative competence and provide more authentic language experiences. However, as we transition into Society 5.0, characterised by the fusion of physical and cyber spaces (Fukuyama, 2018), existing EFL approaches reveal certain limitations.

While CLT and TBLT have made strides in contextualising language learning, they often fall short in preparing learners for the digital literacy demands of Society 5.0. The ability to navigate multilingual digital spaces, interact with AI-powered language tools, and communicate effectively in virtual environments is increasingly crucial yet often overlooked in traditional EFL curricula (Chapelle & Sauro, 2017).

Moreover, personalising learning experiences, an essential aspect of Society 5.0's educational vision, remains challenging in many EFL contexts. Despite recognising individual learner differences (Dörnyei, 2014), practical implementation of truly personalised instruction at scale has been limited. This gap is particularly evident in the face of diverse learner needs, learning styles, and the varying pace of individual language acquisition processes.

Another significant shortcoming is the limited integration of advanced technologies, particularly AI, in everyday EFL practices. While Computer-Assisted Language Learning (CALL) has been a part of EFL for decades (Warschauer & Healey, 1998), the transformative potential of more recent AI advancements, especially in natural language processing and generation, remains largely untapped in most EFL classrooms.

These gaps highlight the need to reimagine EFL teaching that aligns more closely with the realities and demands of Society 5.0, integrating advanced technologies while focusing on effective language acquisition and communication.

Ecological Framework for EFL

We propose an ecological framework to address the challenges posed by Society 5.0 and create a more holistic approach to EFL teaching. This framework builds upon van Lier's (2004) ecology of language learning, which views language acquisition as a complex, dynamic system of interrelated elements.

Key components of our ecological system include:

1. Learners: At the system's centre, each with unique needs, motivations, and learning styles.
2. Teachers: Facilitators and guides in the learning process.
3. Language Content: The linguistic and communicative competencies being developed.
4. Learning Environment: Both physical and digital spaces where learning occurs.
5. Sociocultural Context: The broader social, cultural, and technological context of Society 5.0.
6. Generative AI: A new component that interacts with and influences all other system elements.

The interactions between these components are complex and multidirectional. For instance, learners interact not only with teachers and content but also with the learning environment and AI tools. The sociocultural context influences language use and perception, affecting content selection and teaching methodologies.

This ecological perspective allows us to consider the emergent properties of the EFL learning process. As Cameron and Larsen-Freeman (2007) argue, language learning is not a linear accumulation of knowledge but a complex adaptive system where changes in one component can have far-reaching effects.

By adopting this ecological framework, we can better understand and leverage the interconnections between different aspects of EFL learning. It provides a foundation for integrating new elements, such as Generative AI, in a way that considers their impact on the entire learning ecosystem.

Integration of Generative AI

The integration of Generative AI into our ecological framework for EFL opens up a range of potential applications that could significantly enhance the language learning experience (Baskara, 2023a; 2023b; 2023c; Godwin-Jones, 2024; Le-Khanh et al., 2024). These AI systems, capable of understanding and generating human-like text, offer unprecedented opportunities for personalised, interactive, and immersive language learning (Brown et al., 2020; Chen et al., 2024; Loor et al., 2024; Zhai & Wibowo, 2023).

Potential applications of Generative AI in EFL include:

1. Personalized Content Generation: AI can create reading materials, dialogues, and exercises tailored to individual learner's interests, proficiency levels, and learning goals (Liu et al., 2022).
2. Intelligent Tutoring Systems: AI-powered tutors can provide instant, personalised feedback on language production, helping learners identify and correct errors in real-time (Crossley, 2020).
3. Simulated Conversation Partners: Generative AI can act as a conversational partner, allowing learners to practice speaking and writing in a low-stress environment (Bibauw et al., 2019).

4. Adaptive Assessment: AI can generate and adapt assessment tasks based on learner performance, providing a more accurate and dynamic evaluation of language proficiency (Chapelle & Voss, 2016).
5. Language Model Fine-tuning: Teachers can fine-tune AI models to focus on specific linguistic features or vocabulary relevant to their learners' needs.

The ecological impact of integrating Generative AI into EFL is profound and multifaceted. It influences:

1. Learner Autonomy: AI tools can empower learners to take greater control of their learning process, exploring language at their own pace and in areas of personal interest (Wei, 2023).
2. Teacher Roles: Educators may shift towards becoming facilitators and curators of AI-enhanced learning experiences, focusing more on higher-order skills and personalised guidance.
3. Content Delivery: The traditional linear curriculum may evolve into a more dynamic, adaptive content model that responds to individual learner progress and interests.
4. Assessment Practices: Continuous, AI-supported assessment could provide more comprehensive insights into learner progress, moving beyond traditional testing methods.
5. Learning Environments: The boundary between formal and informal learning spaces may blur as AI-powered tools enable learning anytime, anywhere.

However, it is crucial to note that the integration of AI should enhance, not replace, human interaction in language learning (De la Vall & Araya, 2023; Mageira et al., 2022; Markauskaite et al., 2022; Yang & Kyun, 2022). The ecological approach ensures that AI is considered part of a more extensive system, working in harmony with other components to create a rich, multifaceted learning experience.

Proposed Model: Eco-Generative EFL (EG-EFL)

Building on our ecological framework and the potential of Generative AI, we propose the Eco-Generative EFL (EG-EFL) model. This model represents a novel approach to EFL teaching that is responsive to the needs of learners in Society 5.0 while leveraging the power of advanced AI technologies.

The following key features characterize the EG-EFL model:

1. Learner-Centricity: The learner is at the model's core, with all other components designed to support and enhance individual learning journeys. This aligns with constructivist approaches to language learning (Lantolf & Thorne, 2006).
2. AI-Enhanced Personalization: Generative AI is integrated throughout the system to provide personalised learning experiences, from content creation to feedback and assessment.
3. Dynamic Content Ecosystem: Rather than a fixed curriculum, the model proposes a flexible content ecosystem that adapts to learner needs and societal changes, similar to the dynamic systems approach in SLA (De Bot et al., 2007).
4. Multimodal Interaction: The model encourages interaction through various modes - human-to-human, human-to-AI, and human-to-content - to provide a rich, multilayered learning experience.
5. Continuous Assessment and Adaptation: Leveraging AI capabilities, the model includes ongoing assessment that informs real-time adaptations to the learning process.
6. Metacognitive Development: The model emphasises the development of metacognitive skills, helping learners understand their learning processes and interact effectively with AI tools.
7. Ethical Considerations: The model incorporates ethical guidelines for AI use in education, addressing data privacy and algorithmic bias (Zawacki-Richter et al., 2019).

Potential Outcomes

The implementation of the EG-EFL model has the potential to yield significant improvements in language acquisition processes and outcomes. By leveraging the power of Generative AI within an ecological framework, we anticipate several vital benefits:

1. Accelerated Language Acquisition: The personalised nature of AI-generated content and feedback could lead to more efficient and effective language learning. Learners may achieve

higher proficiency levels in shorter time frames, as suggested by preliminary studies on AI in language learning (Crossley, 2020).

2. **Enhanced Learner Engagement:** The interactive and adaptive nature of AI-powered learning experiences is likely to increase learner motivation and engagement. This aligns with research on the positive impact of technology-enhanced learning on student motivation (Golonka et al., 2014).
3. **Improved Learner Autonomy:** With AI-powered tools, learners may take greater control of their learning process, developing crucial self-directed learning skills. This development of learner autonomy is a critical goal in contemporary language education (Benson, 2013).
4. **Development of AI Literacy:** As learners interact with AI systems, they will develop essential skills in effectively using and critically evaluating AI-generated content, preparing them for the AI-integrated workplaces of Society 5.0.
5. **More Inclusive Learning Environments:** The adaptive nature of the EG-EFL model could better accommodate diverse learning needs, potentially making EFL education more accessible and effective for a broader range of learners.

While these outcomes are promising, we must note that they are theoretical projections based on our model. Empirical research will be necessary to validate these potential benefits in real-world EFL contexts.

4. DISCUSSION

Implications of the EG-EFL Model

The proposed Eco-Generative EFL (EG-EFL) model has far-reaching implications for English language teaching, particularly in Society 5.0. These implications span pedagogical, technological, and ethical domains, necessitating a comprehensive examination of how this model might reshape EFL education.

Pedagogically, the EG-EFL model challenges traditional notions of curriculum design and classroom dynamics. Placing the learner at the centre of a complex, adaptive system calls for a fundamental shift in how we conceptualise language teaching and learning. This aligns with sociocultural language acquisition theories (Lantolf & Thorne, 2006) and extends them into the digital age. In this model, teachers become facilitators of personalised learning journeys rather than transmitters of fixed knowledge. This shift echoes Kumaravadivelu's (2001) concept of postmethod pedagogy, where teachers are seen as autonomous agents capable of theorising from their practice and practising what they theorise.

The integration of Generative AI into the learning ecosystem necessitates a reimagining of task design and assessment practices. Traditional exercises may give way to more dynamic, AI-generated tasks that adapt in real time to learner performance. This aligns with dynamic assessment principles (Poehner & Lantolf, 2005) but extends them through AI, potentially allowing for continuous, personalised assessment at a previously unattainable scale.

Technologically, the EG-EFL model presents both exciting possibilities and significant challenges. The reliance on Generative AI requires robust, scalable systems capable of processing natural language inputs and generating appropriate, contextualised responses. This necessitates advanced AI models, significant computational resources, and sophisticated user interfaces. As Warschauer (2004) notes, integrating technology in language learning is not merely a matter of adding a new tool but of fundamentally reshaping the classroom ecology.

The model's emphasis on personalisation and adaptive learning aligns with emerging trends in educational technology (Zawacki-Richter et al., 2019). However, it pushes these trends further by proposing a more holistic, ecologically grounded approach to personalisation. This raises questions about data management, interoperability of different AI systems, and the need for standards in AI-enhanced educational technologies.

Ethically, the EG-EFL model opens up a Pandora's box of considerations. AI in education brings data privacy issues, algorithmic bias, and the potential for over-reliance on technology. As

Slade and Prinsloo (2013) argue, the collection and use of learner data in adaptive learning systems raise significant ethical questions about ownership, control, and the purposes for which this data is used.

Moreover, the model's potential to create highly personalised learning experiences raises questions about equity and access. While it may offer unprecedented opportunities for tailored instruction, it could also exacerbate existing digital divides if not implemented thoughtfully. This echoes concerns researchers like Selwyn (2010) raised about the potential for educational technologies to reinforce rather than mitigate social inequalities.

The EG-EFL model also questions the nature of language and communication in an AI-mediated world. As learners increasingly interact with AI systems, we must consider how this shapes their understanding of language use and interpersonal communication. This relates to ongoing debates about the role of technology in shaping cognitive processes and social interactions (Kern, 2014).

In summary, while the EG-EFL model offers exciting possibilities for enhancing EFL education in Society 5.0, it also necessitates careful consideration of its pedagogical, technological, and ethical implications. As we move forward with this model, engaging in ongoing dialogue with educators, learners, technologists, and ethicists will be crucial to ensure its responsible and effective implementation.

Challenges and Limitations

While the EG-EFL model presents numerous opportunities for enhancing EFL education, it also faces significant challenges and limitations that must be addressed for successful implementation.

One of the primary barriers to implementation is the current state of technological infrastructure in many educational settings. The model's reliance on advanced AI systems and continuous internet connectivity may be prohibitive for schools and institutions with limited resources. As highlighted by Warschauer (2003), this digital divide could potentially exacerbate existing educational inequalities if not carefully managed.

Moreover, integrating such a technologically advanced system into existing educational frameworks poses significant logistical challenges. Educational institutions often have deeply entrenched systems and practices that may resist such radical change. This institutional inertia, as described by Cuban (2001) in his analysis of technology adoption in schools, could significantly slow the adoption of the EG-EFL model.

Another potential barrier is teacher readiness and training. The shift from traditional teaching methods to facilitating AI-enhanced learning environments requires a significant change in teacher roles and competencies. Hubbard and Levy (2006) note that teacher training in computer-assisted language learning (CALL) has often lagged behind technological advancements. The complex nature of the EG-EFL model may exacerbate this challenge, requiring extensive professional development programs.

From a technological perspective, while Generative AI has made remarkable strides, it still faces limitations. Despite their sophistication, current AI models can produce errors or inappropriate content, which could be particularly problematic in a language-learning context. The "black box" nature of many AI systems makes it challenging to understand and correct these errors (Castelvecchi, 2016).

Furthermore, the adaptive and personalised nature of the model requires processing and storing vast amounts of learner data. This raises significant concerns about data privacy and security. Ethical concerns also pose significant challenges. The use of AI in education raises questions about algorithmic bias and fairness. AI systems, if not carefully designed and monitored, can perpetuate or even amplify existing biases related to language, culture, or socioeconomic status (O'neil, 2016). This is particularly pertinent in EFL contexts, where diverse learners' backgrounds must be respected and accommodated.

There is also the risk of over-reliance on AI, potentially diminishing the role of human interaction in language learning. While the EG-EFL model emphasises the integration of AI within

a broader ecological system, there is a danger that, in practice, AI could be seen as a replacement for rather than a complement to human teaching. This echoes concerns raised by critics of technology in education, who warn against the "technocentrism" that can occur when technological solutions are prioritised over pedagogical ones (Papert, 1987).

To mitigate these challenges, several strategies could be employed. Firstly, a phased implementation approach could help address infrastructure and training issues, gradually allowing institutions to build capacity. Secondly, robust data governance frameworks must be established to ensure privacy and security. Thirdly, ongoing monitoring and adjustment of AI systems will be crucial to identify and correct biases or errors.

Moreover, it will be essential to maintain a balance between AI-enhanced and traditional teaching methods, ensuring that human interaction remains a core component of language learning. As Kern (2014) argues, technology should be seen as a mediating tool in language learning, not as an end in itself.

Lastly, addressing ethical concerns will require ongoing dialogue between educators, technologists, policymakers, and ethicists. Developing ethical guidelines for AI use in education, similar to those proposed by Miao et al. (2021), will be crucial for the responsible implementation of the EG-EFL model.

In conclusion, while the challenges and limitations of the EG-EFL model are significant, they are not insurmountable. With careful planning, ongoing research, and a commitment to ethical implementation, these challenges can be addressed, paving the way for a more adaptive and personalised approach to EFL education in Society 5.0.

Future Research Directions

The proposed EG-EFL model opens up numerous avenues for future research, each critical to validating and refining the model for practical implementation. These research directions span empirical validation, long-term impact assessment, and cross-cultural applicability studies.

Empirical validation of the model is a crucial next step. While the EG-EFL model is grounded in established theories and emerging technologies, its efficacy in real-world EFL contexts must be rigorously tested. This could involve controlled studies comparing learning outcomes between traditional EFL approaches and the EG-EFL model. Such studies should consider various factors, including language proficiency gains, learner engagement, and development of metacognitive skills.

Methodologically, these studies could employ mixed-method approaches, combining quantitative language proficiency assessments with qualitative analyses of learners' and teachers' experiences. Longitudinal studies would be precious, allowing researchers to track the model's impact over extended periods. This aligns with calls for more long-term studies in computer-assisted language learning (CALL) research (Chapelle, 2007).

Another critical area for future research is the long-term impact of AI-enhanced language learning on cognitive development and language acquisition processes. As learners interact more with AI systems, how does this shape their language-learning strategies and their conceptualisation of language? This research could draw on cognitive linguistics and neurolinguistic approaches to examine how AI-mediated language learning might affect neural pathways associated with language acquisition (Li, 2013).

The cross-cultural applicability of the EG-EFL model also warrants extensive investigation. Given the global nature of EFL teaching, it is crucial to understand how the model performs across different cultural contexts. This research could explore how cultural factors influence the acceptance and effectiveness of AI-enhanced learning, building on existing work on the cultural dimensions of technology acceptance (Nistor et al., 2013).

Furthermore, the ethical implications of the model require ongoing study. Future research should examine issues such as data privacy, algorithmic fairness, and the potential social impacts of AI in language education. This could involve collaborations between linguists, education researchers, ethicists, and AI specialists to develop frameworks for ethical AI use in language learning contexts.

The potential of the EG-EFL model to support learners with diverse needs is another rich area for future research. Studies could explore how the model's adaptive capabilities can be leveraged to support learners with learning difficulties or those from disadvantaged backgrounds. This aligns with the growing focus on inclusive education in CALL research (Chun et al., 2016).

Additionally, research into teacher experiences and professional development in the context of the EG-EFL model will be crucial. How do teachers adapt to their new roles as facilitators in AI-enhanced learning environments? What kinds of training and support are most effective in helping teachers implement the model? These questions could be explored through action research and professional learning community approaches (Burns, 2009).

Finally, as the model proposes a new ecosystem for language learning, research into the interactions between different ecosystem components would be valuable. This could involve complex systems research methodologies to map and analyse the dynamic relationships between learners, teachers, AI systems, and the broader sociocultural context (Cameron & Larsen-Freeman, 2007).

In conclusion, the EG-EFL model opens up a rich landscape for future research. By pursuing these research directions, we can refine and validate the model, ensuring its effectiveness and ethical implementation in diverse EFL contexts. This research agenda has the potential to advance our understanding of AI-enhanced language learning and contribute to broader discussions about the role of AI in education in Society 5.0.

Comparison with Existing Models

The EG-EFL model represents a significant departure from existing approaches to EFL teaching, offering several advantages through its ecological approach and unique features. To fully appreciate the model's contributions, it is instructive to compare it with current language teaching and learning paradigms.

Traditional EFL approaches, such as Communicative Language Teaching (CLT) and Task-Based Language Teaching (TBLT), have dominated the field for decades. These approaches emphasise authentic communication and meaningful tasks (Ellis, 2003). While effective in many contexts, they often struggle to provide truly personalised learning experiences at scale. The EG-EFL model, in contrast, leverages AI to offer unprecedented levels of personalisation, adapting content and learning strategies to individual learners' needs and preferences.

Moreover, while CLT and TBLT acknowledge the importance of context in language learning, they typically operate within a more linear understanding of the learning process. The ecological approach of the EG-EFL model, drawing on complexity theory (Cameron & Larsen-Freeman, 2007), views language learning as a complex adaptive system. This perspective allows for a more nuanced understanding of how learner characteristics, teaching strategies, technological tools, and sociocultural context interact dynamically to shape the learning process.

Existing technology-enhanced language learning models, such as Mobile Assisted Language Learning (MALL) or Computer Assisted Language Learning (CALL), have made significant strides in integrating technology into language education. However, these approaches often treat technology as an add-on to existing pedagogical frameworks rather than an integral part of the learning ecosystem. The EG-EFL model, by contrast, fully integrates AI into the fabric of the learning environment, creating a more seamless and adaptive learning experience.

One of the unique features of the EG-EFL model is its emphasis on developing AI literacy alongside language skills. As Chapelle and Sauro (2017) argue, digital literacy is increasingly intertwined with language proficiency in the 21st century. The EG-EFL model takes this a step further, recognising that in Society 5.0, the ability to interact effectively with AI systems will be a crucial skill. By incorporating this into the language learning process, the model prepares learners for future societies' linguistic and technological demands.

Another distinctive aspect of the EG-EFL model is its approach to assessment. While many current models rely heavily on discrete-point testing or standardised assessments, the EG-EFL model proposes a continuous, AI-enhanced assessment process. This aligns with calls for

more dynamic assessment approaches (Poehner & Lantolf, 2005) but extends them through AI, allowing for more fine-grained and responsive evaluation of learner progress.

The model's ecological perspective offers a more comprehensive view of the language learning environment than many existing approaches. By explicitly considering the sociocultural context and the complex interactions between different components of the learning ecosystem, the EG-EFL model provides a framework for understanding and leveraging these interactions to enhance learning outcomes.

Furthermore, the EG-EFL model's integration of Generative AI opens up possibilities for language exposure and practice beyond what is possible in traditional or current technology-enhanced models. The ability of AI to generate contextually appropriate, personalised language content on demand represents a significant advance over pre-prepared materials or limited interactive exercises.

However, it is essential to note that the EG-EFL model is not intended to replace existing approaches entirely but to build upon their strengths while addressing their limitations. For instance, CLT and TBLT elements can be incorporated into the AI-generated tasks and interactions within the EG-EFL framework.

In conclusion, while the EG-EFL model shares some common goals with existing approaches - such as developing communicative competence and providing meaningful language practice - it offers a more comprehensive, adaptive, and future-oriented approach to EFL teaching. Its ecological perspective, full integration of AI, emphasis on AI literacy, and dynamic approach to assessment represent significant advances in our conceptualisation of language teaching and learning in the digital age.

Broader Implications for Education in Society 5.0

The EG-EFL model, while specifically designed for English as a Foreign Language context, has broader implications for education in Society 5.0. Its innovative approach to integrating AI within an ecological framework offers insights that could transform various aspects of education beyond language learning.

One of the most significant potential applications is in the field of personalised learning. The EG-EFL model's use of AI to create adaptive, responsive learning environments could be extended to other subject areas. Imagine, for instance, a mathematics curriculum that adapts in real-time to a student's problem-solving approaches or a history course that generates personalised narratives based on a learner's interests and prior knowledge. This level of personalisation, as envisioned by researchers like Bray and McClaskey (2014), could dramatically enhance learner engagement and outcomes across the curriculum.

The model's ecological approach also has implications for conceptualising the learning environment in Society 5.0. By emphasising the interconnectedness of various elements - learners, teachers, content, technology, and sociocultural context - the EG-EFL model provides a framework for understanding education as a complex adaptive system. This perspective could inform the design of learning spaces, both physical and virtual, that are more responsive to the dynamic needs of learners and the rapidly changing demands of society (Ellis & Goodyear, 2016).

Furthermore, the EG-EFL model's integration of AI literacy into the learning process points to a broader need in education. As AI becomes increasingly prevalent in society, the ability to interact effectively with AI systems - understanding their capabilities, limitations, and ethical implications - will become a crucial skill across disciplines. The EG-EFL model offers a template for how this AI literacy can be woven into learning experiences rather than treated as a separate subject (Holmes et al., 2019).

The model's approach to assessment, leveraging AI for continuous, personalised evaluation, could also have far-reaching implications. Traditional assessment methods, focusing on standardised testing, have long been criticised for their limitations in measuring authentic learning and ability (Stiggins, 2002). If applied more broadly, the EG-EFL model's dynamic assessment approach could lead to a more nuanced, comprehensive, and fair evaluation of student learning across various fields.

Moreover, the EG-EFL model's emphasis on learner autonomy and self-directed learning, supported by AI tools, aligns with broader trends towards lifelong learning in Society 5.0. As societal and technological change accelerates, the ability to continuously adapt and acquire new skills becomes increasingly crucial. The model's approach could inform the development of AI-enhanced platforms for lifelong learning, enabling individuals to upskill or reskill throughout their careers.

The model also has implications for teacher education and professional development. As AI takes on more routine tasks in the EG-EFL model, it redefines the role of the teacher as a facilitator, curator, and guide. This shift is likely to occur across educational contexts in Society 5.0, necessitating new approaches to teacher training that focus on skills such as AI literacy, data interpretation, and the design of AI-enhanced learning experiences (Selwyn et al., 2020).

Furthermore, the EG-EFL model's ecological perspective could contribute to a more holistic approach to educational policy and planning. By highlighting the interconnectedness of various elements in the learning ecosystem, it encourages policymakers to consider the broader impacts of educational interventions. This systems-thinking approach could lead to more effective and sustainable educational reforms (Senge et al., 2012).

The model's integration of ethical considerations in AI use has broader relevance. As AI becomes more prevalent in education, data privacy, algorithmic bias, and the ethical use of learner data will become increasingly important across all disciplines. The EG-EFL model's approach to addressing these issues could inform the development of ethical guidelines for AI use in education more generally (Zawacki-Richter et al., 2019).

The EG-EFL model's potential to create more inclusive learning environments through personalisation and adaptive support could have significant implications for special education and efforts to address educational inequalities. The model could inspire similar approaches in other educational contexts by demonstrating how AI can meet diverse learner needs, potentially contributing to more equitable educational outcomes.

The model's emphasis on developing domain-specific knowledge (language skills) and meta-skills (such as AI literacy and self-directed learning) reflects a growing recognition of the importance of transversal skills in Society 5.0. This dual focus could inform curriculum design across disciplines, encouraging a balance between subject-specific content and developing adaptable, future-oriented skills.

Lastly, the EG-EFL model's integration of AI into the learning process could contribute to our understanding of human-AI collaboration in educational contexts. As AI systems become more sophisticated, questions about optimising the partnership between human teachers and AI tools will become increasingly relevant across all areas of education. The insights gained from implementing and refining the EG-EFL model could inform this broader discussion about the future of human-AI collaboration in teaching and learning (Luckin et al., 2016).

In conclusion, while the EG-EFL model was developed for language learning contexts, its innovative approach to integrating AI within an ecological framework has far-reaching implications for education in Society 5.0. From personalised learning and assessment to teacher education and educational policy, the EG-EFL model principles could contribute to a broader reimagining of education for the AI age. As we navigate the complexities of Society 5.0, models like EG-EFL offer valuable insights into how we can harness the power of AI to create more adaptive, inclusive, and compelling learning experiences across all areas of education.

5. CONCLUSION

This study has proposed the Eco-Generative English as a Foreign Language (EG-EFL) model, a novel approach to language education that integrates Generative AI within an ecological framework. The model reconceptualises EFL teaching for the context of Society 5.0, addressing the evolving needs of learners in an increasingly digital and AI-driven world. The EG-EFL model

offers a more holistic and dynamic approach to language education by viewing language learning as a complex adaptive system.

The main contributions of this research to the field are threefold. First, considering the broader learning ecosystem, it provides a theoretical framework for integrating AI into language learning that goes beyond mere technological integration. Second, it proposes practical applications of Generative AI in EFL contexts, offering new possibilities for personalised, adaptive learning experiences. Finally, it addresses the ethical implications of AI in education, proposing strategies for responsible implementation.

The EG-EFL model represents a significant step towards reimagining language education for the 21st century. Its ecological approach offers a more nuanced understanding of the language learning process, acknowledging the complex interplay of various factors in the learning environment. This perspective has transformative potential, not just for EFL but for education more broadly.

The integration of Generative AI in this model points to a future where technology and human expertise work symbiosis to create more effective and engaging learning experiences. As AI advances, its role in shaping language education will undoubtedly grow. However, the EG-EFL model reminds us that technology should enhance, not replace, the human elements of language learning.

To educators and policymakers, we urge a reconsideration of current language education approaches in light of AI's opportunities and challenges. We call for increased investment in research and development of AI-enhanced language learning systems, focusing on ethical implementation. Let us collaborate across disciplines to realise the full potential of ecological, AI-integrated approaches to language education in Society 5.0.

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