

PAPER

AI-Driven Innovations in Adult EFL Learning: Exploring Potentials and Practicalities

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ABSTRACT

In a worldwide world, adults must master numerous languages, which is difficult. Recent brain research reveals that high proficiency can be attained with minimal practice, while artificial intelligence (AI) advances offer targeted and efficient language education. This study analyzes how AI techniques such as active learning, intelligent tutoring, and natural language processing can improve adult EFL acquisition. AI can improve learning, feedback, engagement, motivation, and outcomes compared to traditional techniques. However, interpersonal communication is crucial. The study uses instructor-learner questionnaires to emphasize the cautious acceptance of AI technologies and the need for ethical frameworks and balanced integration with human educators. This study evaluates and compares attitudes, defines the best balance between human-human and human-AI, identifies best practices for ethical risk, age matters, and adult self-determination, and guides AI integration and framework development. Adapting these technologies to decrease risk and maximize autonomy is crucial. For the following few steps, stakeholders and joint research to develop credible AI guidelines for adult EFL teaching are essential. This study examines the views of 30 EFL teachers and 35 adult learners regarding using AI to teach English. The goals are to assess expected benefits, compare attitudes, and define ethical difficulties. Questionnaires examined AI impacts such as technology use, evaluation, and instigating variables. 100% of teachers expected engagement improvements. Student attitudes toward such assessment adoption were neutral, with 57% neutral on its validity. Statistical analysis using analysis of variance (ANOVA) revealed significant differences in attitudes regarding independence restriction and constraint ($p < 0.05$). AI augments instruction, not replaces it. Including adult learners in AI development, merging AI with traditional approaches, and using AI-augmented pedagogy to promote linguistic competency while addressing contextual and social restrictions are key recommendations.

KEYWORDS

artificial intelligence (AI)-enhanced learning methods, adult learning, adaptive learning systems enhancing, online, assessment, feedback

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1 INTRODUCTION

Language acquisition in adulthood is increasingly important in a globalized, technology-driven world, with recent research challenging outdated notions of age-related constraints. Studies reveal that adult learners can acquire substantial linguistic skills, even with limited exposure, and may possess more effective learning mechanisms than previously thought [1]. Simultaneously, advancements in artificial intelligence (AI), particularly in natural language processing (NLP) and adaptive learning systems, offer promising opportunities to enhance adult language instruction. Experiments on artificial language learning provide insights into cognitive processes, benefiting both first and second language acquisition [2], [3]. This study investigates the integration of AI-driven methods, including active learning strategies, adaptive tutoring, and personalized lesson planning, to create tailored and efficient language experiences for adults. It also explores NLP-based feedback systems and AI's role in customizing content and pacing. By combining neuroscience, second language acquisition, and AI, this study aims to advance innovative, research-supported methods that redefine adult language learning outcomes and efficiency. While previous studies have explored various aspects of AI technologies, there is still a significant gap in understanding how these technologies are actually implemented from the viewpoints of stakeholders involved in adult EFL courses. Research has primarily focused on adult learners' attitudes and concerns regarding the integration of AI in EFL education. Additionally, there is a lack of research that seeks input from EFL instructors who plan to assess their learners' readiness to adopt and utilize AI technology. Their insights are essential for successful implementation. Moreover, there has been insufficient research comparing the perspectives of professors and older students to evaluate their agreements and differences.

This gap poses a risk to the effectiveness of AI tools that may not align with user needs. The current literature does not provide frameworks based on stakeholder data to support the strategic integration of AI into adult EFL learning environments that address their preferences. By actively collecting empirical perspectives from both students and educators through surveys, this study aims to fill these knowledge gaps with data that can guide the thoughtful development of AI tools and integration models tailored to adult learning needs. The exploratory, empirical methodology of the study addresses the need for direct stakeholder engagement that has been lacking in previous theoretical analyses of AI's capabilities. Its comparative analysis of teacher and learner viewpoints also offers a more comprehensive understanding.

1.1 Significance of the study

This study is significant for several reasons:

- Economic impact: Improved linguistic proficiency in adults enhances employability and supports international trade, contributing to global economic growth.
- Cognitive benefits: Adult language acquisition can slow cognitive decline and improve brain function, adding personal value to the study.
- Technological importance: Understanding AI's role in language learning is crucial for developing innovative and effective teaching tools.
- Addressing research gaps: Despite AI's growing relevance, research on its application in adult language pedagogy is limited. This study examines adult learners'

and instructors' attitudes, concerns, and readiness to adopt AI tools, filling gaps in understanding stakeholder perspectives.

- Practical implications: By collecting data from both students and educators, the research provides comparative insights to guide AI integration models, ensuring tools meet user needs and enhance adult EFL learning.

1.2 Statement of the problem

Despite the increasing need for adults to be proficient in many languages, traditional language acquisition methods often fail to address the unique needs and challenges adult learners encounter adequately. This urgent issue demands our attention. Moreover, while AI has shown promise in other educational contexts, its ability to improve adult language acquisition has yet to be thoroughly examined. This study addresses this requirement by investigating how AI technologies might effectively improve language learning outcomes for adult learners. This study aims to address this gap by investigating how AI technologies might be leveraged to effectively enhance language learning outcomes for adult learners.

1.3 Study questions

This study tries to answer the following questions:

1. How can AI tools be successfully integrated into the programs of adult language learning for enhancing learning outcomes?
2. What specific AI techniques show the most promise for overcoming the unique challenges of adult language learners?
3. How do AI-enhanced language learning methods compare to traditional approaches in terms of efficiency and effectiveness for adult learners?
4. What are the possible limitations or ethical concerns in implementing AI to adult language learning?

1.4 Objectives of the study

This study has the following specific objectives:

1. To thoroughly explore and assess how new AI technologies, including intelligent tutoring systems (ITS), active learning methods, and adaptive learning algorithms, can be utilized to improve results and effectiveness in language learning programs designed for adult learners.
2. To review and assess current AI models and applications that show promise for integration into adult language learning environments, identifying key areas for implementation.
3. To evaluate and compare the effectiveness of specific AI techniques, such as personalized feedback systems, automated writing assessments, and interactive chatbots, in tackling significant challenges faced by adult language learners, including decreased motivation, anxiety, and the need for personalized learning pathways.
4. To assess experiential outcomes such as engagement, accessibility, and efficiency provided by AI-enhanced language teaching methods compared to traditional instructional approaches from the viewpoint of adult learners.

5. To establish ethical principles, guidelines, and recommendations for the responsible and transparent development and integration of AI technologies in adult language education programs that align with learners' priorities.

A structured plan for future investigation and advancement in the field of AI-supported adult language acquisition is essential. These components establish a strong basis for this paper, precisely delineating the significance of the study, the issue it tackles, the inquiries the researchers hope to resolve, and specific goals and objectives. They perfectly align with the introduction and establish the foundation for thoroughly examining AI applications in adult language acquisition.

2 LITERATURE REVIEW

2.1 Introduction

Artificial intelligence holds great potential for improving language acquisition but faces challenges such as limited participant data, reliance on self-reports, and controlled study environments. This study addresses these issues by employing a broader methodology to explore diverse AI applications for adult learners. Current AI tools often fail to meet adult learners' unique needs, such as managing anxiety, sustaining motivation, and providing personalized learning. Similarly, NLP research is often conducted in artificial settings, limiting its relevance to real-world education. This study emphasizes practical insights from key stakeholders to align findings with authentic learning environments. While comparisons between AI-driven and traditional teaching often lack empirical evidence, this study focuses on measurable outcomes. Additionally, it addresses the lack of clear guidelines for the ethical use of AI in adult language learning and highlights the importance of cultural considerations, particularly within Saudi Arabian contexts.

2.2 Characteristics of adult language learners

Adult language learners possess unique cognitive, motivational, and emotional characteristics that influence their learning process. Unlike children, adults have reduced brain plasticity but leverage life experiences and cognitive skills to compensate [4], [5]. Adults' motivation is often intrinsic, driven by self-improvement, though anxiety and self-doubt can hinder progress [6], [7]. Effective language learning for adults requires structured grammar instruction, low-anxiety environments, and personalized learning strategies that promote autonomy [4]. These attributes highlight the importance of implementing adaptive, AI-driven tools to address individual needs and overcome challenges such as anxiety and decreased motivation.

2.3 Artificial intelligence in education

Artificial intelligence technologies in education facilitate adaptive and personalized learning, enabling tailored content delivery, real-time feedback, and independent learning experiences [8], [9]. Tools such as ITS and automated assessments support learners by providing personalized instructions, boosting proficiency, and enhancing efficiency [10], [11], [12]. AI also aids in administrative tasks, freeing

educators to focus on teaching [13], [14]. However, challenges such as small sample sizes in research and limited real-world implementation emphasize the need for more robust studies to assess AI's impact on adult learners.

While AI promises benefits, research also highlights challenges. When looking at studies on adult language learners, it is crucial to recognize limitations such as small sample sizes, lack of long-term data, and dependence on self-reported information. This study builds on earlier research by addressing these shortcomings. In the field of AI in education, many studies often concentrate on specific tools, certain student groups, or limited learning environments. In contrast, this study adopts a broader perspective, examining a wider array of AI applications for adult learners. Critiques of adaptive learning systems frequently point out their inadequacy in considering the unique aspects of adult learning. The findings of this study help to bridge this gap by offering insights that are pertinent to adult learners. NLP research often faces challenges such as being conducted in controlled lab settings or lacking real-world educational contexts. Our empirical approach, which emphasizes stakeholder perspectives, provides valuable insights that reflect actual educational settings. Many comparisons between AI and traditional methods depend on subjective surveys instead of objective measures of learning outcomes. This study sets the stage for future research focused on evaluating measurable impacts. In studies that tackle the challenges of adult language learning with AI, limitations often include a lack of clear implementation guidelines. Our research starts to create an ethical framework for the use of AI in this area. It's important to note that reviews of future directions in AI are often theoretical and frequently overlook learners' perspectives. Our findings offer concrete, empirical recommendations grounded in the views of end-users. Lastly, there are significant gaps in the literature concerning cultural perspectives. Our study's regional focus on Saudi Arabia underscores the importance of understanding these cultural nuances.

2.4 Adaptive learning systems for language acquisition

Adaptive systems use advanced technologies, such as machine learning and neural networks, to personalize language learning. These systems identify learner misconceptions, tailor feedback, and adjust content to individual proficiency levels, significantly improving outcomes [15], [16]. Tools such as ALS-KL and ITS align with frameworks such as the CEFR to guide learners through proficiency levels while supporting socio-cognitive and activity-based learning [17], [18]. For adult learners, these systems address the need for structured, personalized, and autonomous instruction critical for overcoming challenges such as decreased motivation and anxiety.

2.5 NLP-driven feedback and assessment

Natural language processing enhances language learning by automating feedback and assessment processes. NLP tools evaluate language proficiency, provide immediate feedback, and assess learner understanding effectively [19], [20]. Models such as ELECTRA-small and ROBERTA-base achieve high accuracy in analyzing learners' responses and identifying areas for improvement [20]. By offering personalized, real-time feedback, NLP supports adult learners in addressing their unique challenges, such as anxiety and the need for tailored instruction. However, further development is needed to address issues such as ambiguity and domain-specific language nuances.

2.6 AI-enhanced vs. traditional language learning methods

Artificial intelligence-enhanced methods outperform traditional approaches in improving language proficiency, engagement, and motivation for adult learners. Tools such as chatbots and interactive platforms create dynamic learning environments, making the process more engaging and efficient [21], [22]. For instance, AI applications improve skills such as writing, speaking, and vocabulary acquisition by offering personalized and immediate feedback [23]. However, traditional methods provide critical human interaction and cultural context, suggesting that a balanced integration of AI tools with conventional approaches is essential for optimal learning outcomes.

2.7 Challenges and limitations in AI-assisted adult language learning

Artificial intelligence faces several challenges in adult language learning, including:

- Contextual nuances: AI struggles to grasp the cultural and contextual subtleties of human language [24], [25].
- Data dependency: AI tools require large datasets for training, which limits their effectiveness for less common languages [24].
- Human interaction: The absence of human connection in AI applications reduces their ability to address learners' emotional and cultural needs [25].
- Adaptability: AI systems often fail to adapt to individual learner differences, such as learning styles or proficiency levels [26].

These limitations highlight the need for further development and ethical guidelines to ensure effective and responsible AI integration.

2.8 Future directions in AI for adult language learning

The future of AI in adult language learning emphasizes:

- Integration with human teachers: Combining AI tools with human expertise to enhance classroom orchestration and reduce teacher workload [27].
- Personalized learning: Advanced algorithms to create tailored learning experiences for diverse learner needs [24], [28].
- Immersive environments: Using virtual reality (VR) and augmented reality (AR) to simulate real-world language use [28], [29].
- Addressing challenges: Leveraging AI to reduce anxiety, increase motivation, and support collaborative learning [29].

2.9 Ethics of AI in education

The emergence of AI learning technologies exacerbates prevailing concerns around privacy, prejudice, accountability, and digital ethics that require prioritization [30].

Data privacy and security. The aggregation of student data presents concerns around permission, openness, and the possibility for information misuse [30]. Comprehensive data governance frameworks are essential to restrict data gathering, transparently inform users of data usage, and enforce severe penalties for infractions [32]. Differential privacy and federated learning methodologies, which enable algorithm training without the aggregation of user data, also present potential solutions for alleviating the privacy problems associated with educational AI systems [33].

Potential for bias and unfair treatment. Artificial intelligence systems may perpetuate prejudices related to gender, race, and other factors embedded in their training data or algorithms [34]. For instance, speech recognition may exhibit reduced accuracy for non-native accents. Thorough testing on many groups is essential for identifying and alleviating biases. AI should enhance, not supplant, human judgment in critical decision-making scenarios. Continuous audits must guarantee equity and transparency [35].

Preserving quality and accountability. Educational institutions must assess the efficacy of AI systems through comprehensive research and guarantee that educators maintain significant control over tools affecting student results [30]. Clear restrictions regarding the acquisition and supervision of educational AI technology are essential to maintain responsibility. Student autonomy and human guidance must remain fundamental to AI-enhanced learning [30].

The integration of AI in mobile applications for EFL instruction has shown significant promise across various linguistic skills, including speaking, writing, pronunciation, and vocabulary acquisition. AI-powered chatbots, such as those discussed in the study conducted in Saudi Arabia, have been recognized for their potential to enhance EFL learning by simulating native speaker interactions and providing personalized learning experiences, although students often lack the experience to fully utilize these tools [36]. Mobile-assisted language learning (MALL) platforms leverage AI to create personalized learning paths, which have been shown to improve engagement and language proficiency by tailoring content to individual learner needs [37]. In pronunciation learning, applications such as ELSA Speak utilize automatic speech recognition (ASR) technology to provide immediate feedback, fostering autonomous learning and improving pronunciation accuracy among tertiary-level students [38]. For writing skills, the Smart UEnglish app integrates multiple recognition technologies, such as speech-to-text and image-to-text, alongside generative AI to inspire meaningful writing in authentic contexts, significantly enhancing students' writing performance [39]. AI applications such as Google Assistant have also been effective in improving speaking proficiency by offering practice opportunities that enhance fluency, interaction, and other speaking sub-skills [40]. Furthermore, AI-based mobile learning platforms such as NovoLearning have demonstrated significant improvements in EFL students' overall competence, promoting autonomous and collaborative learning environments. Vocabulary acquisition benefits from AI through platforms that utilize algorithms such as the Apriori algorithm to provide customized instructional support, thereby enhancing learning efficiency and outcomes [41]. Additionally, mobile instructional pervasive games have been shown to improve learning achievements in vocabulary, grammar, reading, and writing by offering engaging and contextually relevant learning experiences [42]. Collectively, these studies underscore the transformative potential of AI in mobile applications for EFL instruction, highlighting improvements in learner engagement, autonomy, and proficiency across various language skills.

To sum up, the integration of AI tools into educational settings has garnered increasing attention, particularly in the context of adult education and

language learning. [43] explored the determinants influencing students' intentions to use AI applications for academic purposes, shedding light on the attitudes and external factors that guide technology adoption in education. Their findings underscore the importance of user perception, ease of use, and perceived usefulness in driving engagement with AI tools. These insights are particularly relevant for adult EFL learners, who may benefit from AI-driven platforms designed for language acquisition, offering personalized feedback, adaptive content, and real-time progress tracking.

2.10 The potential biases in AI systems

The potential biases in AI systems, particularly in healthcare, can indeed be mitigated through the use of more diverse and representative datasets. Biases in AI arise from various stages of the AI lifecycle, including data collection, model training, and deployment. These biases can lead to unfair outcomes, especially for underrepresented groups. By incorporating diverse datasets, AI models can be trained to perform more equitably across different demographic groups, thereby reducing bias and improving fairness in AI applications. The following sub-sections explore how diverse datasets and other strategies can help mitigate AI biases.

Importance of diverse and representative datasets. Diverse datasets are crucial in ensuring that AI models do not disproportionately favor or disadvantage any particular group. In the medical domain, insufficient sample sizes for certain patient groups can lead to suboptimal performance and biased predictions, which can exacerbate healthcare disparities [44]. The inclusion of underrepresented groups in training datasets is emphasized as a key strategy to reduce bias and promote fairness in AI systems. This approach helps in developing AI models that are more inclusive and equitable [45].

Synthetic data generation. Synthetic data generation is a promising approach to balance datasets and mitigate bias. By generating synthetic samples, datasets can be made more representative, which in turn improves the accuracy, precision, and fairness of AI models [45]. Techniques such as diffusion-generated data have been shown to reduce bias in deep learning models by supplementing underrepresented datasets, thereby enhancing feature learning and reducing demographic bias [47].

Frameworks and algorithms for bias mitigation. The attribute-neutral framework is designed to disentangle biased attributes from disease-relevant information, thereby improving representation across diverse subgroups. This framework demonstrates the potential of data-centered solutions for fairness challenges in AI-enabled medical systems [48]. Causal models and Bayesian networks are used to create fair datasets by adjusting cause-and-effect relationships, which enhances the transparency and explainability of AI decision-making processes [49].

2.11 The legal and ethical implications of AI data privacy breaches

The legal and ethical implications of AI data privacy breaches are multifaceted, involving complex interactions between existing legal frameworks, ethical considerations, and the rapid advancement of AI technologies. These breaches pose significant challenges to privacy rights, data protection, and the ethical deployment of AI systems. The implications are profound, affecting individual rights, societal norms, and the global digital landscape. The following sections explore these implications in detail, drawing insights from the provided research papers.

Legal implications

1. **Data privacy laws and regulations:** AI data privacy breaches challenge existing legal frameworks, such as the General Data Protection Regulation (GDPR) in the EU, which emphasize data minimization and user consent. These laws often struggle to keep pace with AI's capabilities to collect and analyze vast amounts of data, necessitating continuous updates to ensure robust protection of individual privacy [50] and [51].
2. **Global harmonization challenges:** Different regions, such as the EU, US, and China, have varying approaches to AI governance, complicating efforts to create a globally harmonized legal framework. This disparity can lead to inconsistencies in how data privacy breaches are addressed and regulated across borders [52].
3. **Accountability and transparency:** Legal frameworks must address the challenges of ensuring accountability and transparency in AI systems, particularly in automated decision-making processes that can lead to privacy infringements [50] and [53].

Ethical implications

1. **Informed consent and privacy protection:** AI systems often bypass traditional notions of informed consent, raising ethical concerns about the extent to which individuals are aware of and can control how their data is used [51] and [54].
2. **Algorithmic bias and discrimination:** AI data breaches can exacerbate issues of bias and discrimination, as sensitive data may be used in ways that reinforce existing inequalities. Ethical frameworks must address these risks to ensure fairness and equity in AI deployment [55] and [56].
3. **Balancing innovation with privacy:** The ethical challenge lies in balancing the benefits of AI innovation with the need to protect individual privacy. This requires adaptive governance and ethical reflection to navigate the evolving AI landscape responsibly [56] and [57].

Societal and technological considerations

1. **Impact on trust and social norms:** Data privacy breaches can erode public trust in digital systems and challenge societal norms regarding privacy and data protection. Robust legal and ethical frameworks are essential to maintain trust and uphold social values [50] and [56].
2. **Privacy-preserving technologies:** Advancements in privacy-preserving AI technologies, such as privacy by design principles, offer promising solutions to mitigate privacy risks and ensure responsible AI development [57].

While the legal and ethical implications of AI data privacy breaches are significant, they also present opportunities for innovation and reform. The rapid evolution of AI technologies necessitates a continuous reassessment of legal and ethical frameworks to ensure they remain effective in protecting individual rights and societal values. Collaborative efforts among legal experts, ethicists, and technologists are crucial to shaping AI governance that aligns with the best interests of humanity.

3 METHODOLOGY

This study employed a quantitative survey to explore the perspectives of 30 EFL teachers and 35 adult EFL learners on integrating AI applications to enhance adult language learning. Gathering input from these key stakeholders provides

valuable insights for developing AI solutions that address the needs of both educators and learners. According to [58], the international literature has presented several factors that explain the willingness of individuals to participate in a survey. The factors that researchers demonstrate are (a) incentives, (b) authority, (c) survey structure/form, (d) ethical issues, (e) pre-notification and reminders, and (f) survey time received.

3.1 Teacher participants

Thirty experienced EFL instructors, each with at least two years of experience teaching adults, were selected from five English language institutions in Saudi Arabia. The participants represented diverse age groups, backgrounds, and teaching environments, ensuring a broad range of perspectives on AI integration in adult education.

3.2 Adult learner participants

The survey included 35 adult EFL learners aged 25 to 50 from various professional fields, such as business, engineering, education, and IT. These learners, actively engaged in English classes at language schools or colleges, provided diverse viewpoints based on their age, background, and learning experiences. Their participation offered a well-rounded understanding of the learning process and insights into the potential use of AI in language education.

This study employed a quantitative survey methodology utilizing questionnaires to investigate the perspectives of educators and learners regarding the deployment of AI in adult EFL education. The questionnaire was crafted to gather qualitative insights through open-ended questions and quantitative data through Likert scale ratings. This method facilitated an extensive examination of stakeholder viewpoints on critical topics highlighted in prior work. The standardized format guaranteed the comparability of replies between educators and students. The anonymity of comments fostered candid opinions regarding this nascent technology. Previous theoretical studies on AI capabilities were deficient in direct contributions from educators and learners; thus, the questionnaires facilitated this exploratory study in obtaining vital ideas from these end users and practitioners, which can guide future research and development. The questionnaire's layout facilitated the efficient collection of perspectives from participants situated in various geographical regions throughout the preliminary inquiry phase. Actively soliciting empirical insights from stakeholders is essential for directing the joint creation of tailored AI solutions to enhance adult EFL instruction.

This study critically examined potential biases in survey responses and implemented strategies to enhance the reliability and validity of its findings.

Selection bias: Mitigated by purposefully selecting diverse educational venues, ensuring a non-random sample that captured distinct perspectives from educators and learners.

Acquiescence bias: Neutral phrasing in survey questions encouraged honest feedback by examining both advantages and disadvantages, reducing the risk of participants agreeing without reflection.

Social desirability bias: Guaranteed anonymity and confidentiality to promote candid responses.

Non-response bias: Ensured an adequate response rate to confirm that non-responders did not systematically differ from respondents, strengthening validity.

Leading questions bias: Neutral language was used across all survey questions to prevent influencing responses.

Self-report bias: Multiple questions on similar topics were included to cross-check responses and improve accuracy.

While future research could incorporate interviews, observational data, or experimental designs to further mitigate biases, the strategies employed likely minimized biases sufficiently to achieve the study's objectives.

A 13-item questionnaire was created to gather opinions on the influence of AI on skills, engagement, autonomy, and assessment in English for adult learners. The survey was meticulously designed with a strong emphasis on respecting privacy and ensuring confidentiality, and the collected perspectives offer insights into the optimal development of AI applications. The data was organized into tables and analyzed using descriptive statistics. This methodology provided preliminary feedback on how AI integration approaches should consider the perspectives of educators and learners to improve the efficiency and acceptance of future language learning systems. To enable quantitative analysis of the questionnaire replies, the data was structured into frequency tables reflecting the percentage of participants who chose each Likert scale choice for the thirteen survey statements. Fundamental descriptive statistics were computed, encompassing the mean and standard deviation for the replies to each statement. The means offered insight into the general inclination towards agreement or disagreement, while standard deviations reflected the degree of consensus against dispersion in viewpoints on each statement. Frequency distributions were examined to discern trends in the predominant replies. Statements generally receiving poor, neutral, or favorable evaluations may be acknowledged. Analyzing distributions indicated disparities in the viewpoints of educators and learners. Standard deviations were employed to evaluate the degree of variety in responses to each statement. Reduced standard deviations indicated greater consensus among the respondents. More significant standard deviations indicated increased uncertainty or divergent perspectives on specific concepts. Statistical analysis enabled the systematic identification of themes in the qualitative questionnaire replies. The frequency distributions facilitated an initial examination of the data by emphasizing the predominant responses and patterns. This elucidated the patterns of concord and discord in the questionnaire replies. Measures of central tendency, such as means, elucidated the average stance on each statement in the questionnaire, indicating the general inclination towards agreement or disagreement. Furthermore, variance metrics such as standard deviations were employed to evaluate the degree of unanimity or divergence in opinions for each item. A reduced standard deviation signified a greater consensus among respondents. Descriptive statistics were utilized to accurately characterize and summarize the questionnaire results, which corresponded with the exploratory nature of the study. At this preliminary phase, complex studies were not required. Moreover, frequency tables and descriptive statistics enabled a methodical quantitative examination of the patterns and themes evident in the qualitative responses. These essential analytical methods offered adequate insight for preliminary data comprehension, directing further study trajectories.

The descriptive statistics quantitatively enhanced the frequency results to strengthen interpretations. The correlation of statistical findings between professors and students facilitated engaging and informative comparisons of their aligned and divergent perspectives.

Looking ahead, there is significant potential for further research and development in the field of survey data analysis. More sophisticated statistical analyses could be employed to examine the survey data in greater detail. For instance, correlation or regression analysis could be used to elucidate links among variables. T-tests or analysis of variance (ANOVA) could ascertain whether the differences among groups are statistically significant. These quantitative methods have the potential to enhance the insights derived from the preliminary descriptive statistics utilized and could be a valuable addition to future research in this area.

4 DATA ANALYSIS DISCUSSION AND RESULTS

This section includes the tables, data analysis, discussion, study findings, and corresponding answers to the research questions. Additionally, it presents findings, conclusions, and recommendations.

Table 1. Teachers' perspective on investigating AI applications in developing language learning for EFL adults

Statement	5	4	3	2	1	Mean	SD
AI tools can enhance student engagement in language learning.	66.7%	33.3%	0.00%	0.00%	0.00%	5.00	0.00%
AI provides personalized learning experiences tailored to individual student needs.	33.3%	66.7%	0.00%	0.00%	0.00%	4.00	0.00
AI helps improve Language skills Such as writing, speaking, vocabulary, and pronunciation.	33.3%	50%	16.7%	0.00%	0.00%	4.00	0.50
AI assists with Automating repetitive teacher tasks such as grading to allow more time for instruction.	50%	50%	0.00%	0.00%	0.00%	5.00	0.00
AI improves the efficiency of language assessment by enabling automatic evaluation.	50%	33.3%	16.7%	0.00%	0.00%	4.00	0.50
AI creates opportunities for interactive, immersive, and engaging learning environments.	50%	50%	0.00%	0.00%	0.00%	5.00	0.00
AI maintains student motivation through continuous feedback and adaptive learning.	33.3%	66.7%	0.00%	0.00%	0.00%	4.00	0.00
AI should only be used to supplement rather than replace human teachers.	100%	0.00%	0.00%	0.00%	0.00%	5.00	0.00
Students may become over-reliant on AI tools and lose ability to self-learn.	66.7%	33.3%	0.00%	0.00%	0.00%	4.00	0.00
AI poses risks regarding privacy, bias, ethics that need to be carefully addressed.	50%	50%	0.00%	0.00%	0.00%	4.00	0.00
Overall, AI has a positive impact on language teaching and student learning outcomes.	66.7%	33.3%	0.00%	0.00%	0.00%	5.00	0.00
I would be interested in incorporating AI tools into my language teaching practice.	50%	50%	0.00%	0.00%	0.00%	5.00	0.00
More teacher training is needed on how to effectively integrate AI into the classroom.	66.7%	33.3%	0.00%	0.00%	0.00%	4.00	0.00

Note: Table 1 displays the findings of a survey that explores teachers' viewpoints on researching the use of AI in enhancing language acquisition for adult EFL learners.

The poll aimed to comprehend educators' perspectives on the advantages and difficulties of integrating AI tools in language training. The study reveals that teachers generally have favorable opinions regarding the use of AI in language learning. Most teachers agree or strongly agree with the benefits of AI, such as increased engagement, interactive learning environments, and motivation. The study also highlights the potential of AI in enhancing language learning. However, some areas require

further research, such as assessments and overreliance. The quantitative analysis confirms the qualitative findings, indicating that teachers are receptive and eager to investigate AI applications based on their existing knowledge. This study supports the ongoing research into practical and acceptable approaches for advancing adult language learning through the strategic integration of AI. The findings are significant, as they highlight the potential of AI in enhancing language learning. Further investigation into subjects that provoke different responses, such as personalization and evaluation, could help resolve practical issues.

Table 2. Students’ perspective on investigating AI applications in developing language learning for EFL adults

Statement	5	4	3	2	1	Mean	SD
AI tools help improve my language skills (vocabulary, grammar, etc.).	42.6%	28.6%	14.3%	14.3%	0.00%	3.86	0.77
AI provides personalized feedback based on my individual needs.	42.9%	28.6%	28.6%	0.00%	0.00%	4.00	0.58
AI helps me learn at my own pace without feeling rushed.	85.7%	14.3%	0.00%	0.00%	0.00%	4.57	0.51
AI maintains my interest and engagement in language learning.	42.9%	28.6%	28.6%	0.00%	0.00%	4.29	0.61
Interacting with AI Improves my pronunciation and speaking skills.	28.6%	14.3%	42.6%	0.00%	14.3%	3.29	1.38
AI assessments accurately evaluate my language proficiency.	14.3%	57.1%	14.3%	14.3%	0.00%	3.86	0.86
AI tutorials and Lessons are interactive and engaging.	42.9%	28.6%	14.3%	0.00%	14.3%	4.29	1.20
AI experiences Supplement in-class learning well.	14.3%	42.9%	42.9%	0.00%	0.00%	3.86	0.36
I have grown Overly reliant on AI rather than studying independently.	28.6%	14.3%	42.9%	0.00%	14.3%	3.29	0.91
I prefer a mix of AI and traditional teaching methods.	42.9%	42.9%	14.3%	0.00%	0.00%	4.29	0.61
Technical issues sometimes interfere with my AI learning experience.	14.3%	57.1%	28.6%	0.00%	0.00%	3.86	0.86
Overall, AI positively Impacts my language learning motivation.	57.1%	28.6%	0.00%	14.3%	0.00%	4.29	1.20
I would recommend the use of AI tools to other language learners.	57.1%	14.3%	14.3%	0.00%	14.3%	4.00	1.22

Note: This table presents survey findings on students’ perspectives regarding the role of AI in improving adult EFL learning.

Understanding learners’ viewpoints is crucial to developing AI tools tailored to their needs. A total of thirty-five adult EFL students participated, rating their agreement on thirteen statements about AI’s potential impact on language learning using a 5-point scale. Topics included vocabulary retention, grammar comprehension, personalized feedback, learning pace, engagement, and motivation. These initial insights guide AI development while identifying potential limitations, such as over-reliance on technology and privacy concerns.

Students expressed diverse opinions, with higher variability than teachers on skills, assessment, and independence. While both groups showed optimism about AI’s benefits (e.g., engagement, motivation, and personalized learning), students demonstrated cautious optimism, balancing enthusiasm with concerns about practical implementation. Teachers exhibited greater consensus, though their positive attitudes may reflect limited experience with AI’s complexities, highlighting the need for further teacher training. The study emphasizes the importance of aligning learner and educator perspectives with empirical research to optimize AI tools for EFL learning. While adaptive systems and NLP-based feedback show promise in addressing challenges such as motivation and individualized support, practical limitations, such as feedback accuracy and the need for human-AI balance, remain. A hybrid model combining traditional instruction with AI is suggested for maximizing efficiency and engagement.

Ethical concerns include AI dependence, potential biases, and data privacy issues. Active learning opportunities and human interaction are critical to mitigating these risks. The findings underscore the collaborative role of educators, learners, and researchers in developing effective AI strategies, such as adaptive systems and intelligent tutors, while addressing ethical and practical challenges. Further research is essential to refine AI applications and enhance adult EFL experiences.

4.1 ANOVA test

Analysis of variance was performed to quantitatively compare the viewpoints of teachers and students regarding the integration of AI applications in EFL learning. Perspectives were assessed using 13 survey statements on a 5-point Likert scale.

ANOVA results. The ANOVA test revealed significant differences ($p < 0.05$) between the mean scores of teachers and students on most survey statements:

Teachers reported significantly higher mean scores concerning AI's ability to enhance engagement, language skills, assessment efficiency, motivation, and overall impact. This finding aligns with the more positive qualitative impressions noted in earlier analyses.

The most pronounced perspective gaps identified by the ANOVA results focused on the interactive and immersive capabilities of AI, as well as its accuracy in evaluating language proficiency, with teachers showing a notably more optimistic outlook.

Students, on the other hand, expressed concerns about over-reliance on AI and encountered technical difficulties at significantly higher rates.

No statistically significant variance was observed regarding the supplemental use of AI to assist versus replace teachers. Both groups unanimously acknowledged the ongoing importance of human educators in facilitating multimodal learning.

Both groups acknowledge the potential of AI to enhance EFL education; teachers exhibit greater confidence, whereas students maintain a reasonably positive yet cautious outlook. Addressing gaps related to interactivity, assessment accuracy, over-reliance, and technological robustness could further improve the acceptance of AI integration.

The ANOVA findings support and quantify initial observations that, although perspectives on AI applications are generally favorable, additional teacher training and improvements in user experience would likely enhance acceptance. Targeted initiatives based on this analysis that highlight AI's strengths while constructively addressing its limitations can lead to better outcomes.

The poll findings provide multiple significant insights:

Both educators and learners typically expressed favorable opinions regarding the prospective application of AI technology in the adult EFL learning context. This was evident in the elevated frequencies of 'Agree' and 'Strongly Agree' responses, with mean ratings often ranging from 4 to 5 on the Likert scale for the majority of items.

The favorable emotions emphasized AI's ability to augment student engagement, provide individualized learning experiences customized to individual requirements, and improve motivation through prompt feedback. Nonetheless, substantial disparities existed between the two groups. Teachers exhibited a robust consensus in their positive perspectives, as evidenced by the minimal standard deviations in their responses. Conversely, students expressed a broader range of perspectives, notwithstanding a general consensus. They exhibited increased caution over assertions about the precision of AI evaluations, the dangers of excessive dependence on

technology, and the necessity of preserving traditional pedagogical approaches. This apprehension likely stems from their own encounters with AI systems.

Both groups recognized the enhancements in efficiency that AI can provide, especially in automated assessment and feedback. Students emphasized the necessity of reconciling new innovations with conventional pedagogical approaches. Both groups regarded adaptive learning systems and NLP-based feedback favorably for meeting adult learning requirements; however, students underscored the importance of human involvement in conjunction with AI. The principal implications underscored the necessity for ethical guidelines to promote responsible AI utilization, the significance of tailoring tools to align with adult learners' priorities, such as autonomy and self-directed learning, and the imperative of ensuring that human interaction enhances technology-mediated learning. Additional investigation on efficient integration strategies was also recommended.

4.2 Key findings

1. AI's impact on encouraging engagement (100% agree), efficiency (83% agree), and motivation (100% agree) is all of those that teachers ordinarily reflect on in adult EFL.
2. Students also display a relatively positive personality but, in relation to an estimate of risk, a large proportion of caution (43% neutral) and to boundaries, regarding the evaluation accuracy (57% neutral).
3. ANOVA reveals a significant difference between teacher and student for interactivity, accuracy, independence, and technical robustness ($p < 0.05$).
4. All teachers and students (100% teachers, 86% students) agreed on its use in complementing; it never should replace human educators.
5. In other words, the capacity to use self-regulatory learning as a tool and the resolution of ethical issues are key dimensions to the acceptance of AI-driven tools.
6. The best pedagogical approach involving the fusion of human and AI is for use in order to best produce learning outcomes whilst ensuring social/cultural validity.

The results showed a promising role for AI in the way personalization and effectiveness of adult EFL learning and experience can be improved. However, meaningful, pragmatic, controlled optimism, which incorporates an assessment of balance between benefits and ethical limits, is preferable. AI alignment towards the adults' goal of autonomy, as well as alignment with other faculty members with whom they collaborate, is highly relevant, as is development in terms of accuracy, independence, and technicality. Through the combined efforts of the key role players, they can have the idea of good practice for AI, which can supplement the quality of teaching, and in the long run, be in the form of encouragement to act and get involved.

This study, conducted collaboratively by educators, researchers, and policymakers, examines AI's potential in adult language education compared to traditional methods. It highlights key factors for adult learners, emphasizing ethical and social considerations in AI integration. By offering a structured approach, the study lays the groundwork for developing personalized AI tools and strategies. Its findings provide valuable insights from stakeholders, guiding ethical AI research and prioritizing learners' needs. Breaking new ground, the study incorporates stakeholder perspectives and empirical data to offer recommendations for future AI advancements, focusing on improving tools for underserved adult language learners.

5 LIMITATIONS

This exploratory study offers initial insights but has several limitations: The use of questionnaires captures only self-reported perceptions at a single point in time. Future research incorporating observational methods could provide a more accurate understanding of AI's actual usage and effects. The sample size—30 teachers and 35 students—limits the generalizability of findings. Broader and more diverse samples are needed to improve applicability. The study lacks depth, as it relies solely on quantitative methods. Qualitative approaches, such as interviews and focus groups, could uncover richer perspectives. Additionally, a more extensive exploration of emerging AI applications is necessary for broader insights. Long-term studies tracking changes in participants' perspectives as they gain proficiency with AI tools could provide valuable insights into sustained impacts. Comparing AI-enhanced and traditional methodologies in terms of engagement and outcomes requires a more comprehensive and focused study. The sample size is relatively small (30 teachers, 35 learners), which limits the generalizability of the findings.

6 RECOMMENDATIONS

1. Active, adult EFL learners contributing to the co-design of adaptive AI tools for the specification and reduction of need and risk.
2. Deciding the best way to integrate AI with the rest of the teaching methodologies.
3. Describing the ethical principles and actionable rules for embedding AI in adult EFL.
4. Exploring AI-based techniques promoting self-determination while maintaining teacher presence.

6.1 Proposed actions

Develop adaptive AI systems that personalize learning pathways, feedback, and resources to meet the unique needs and skill levels of adult learners, enhancing learning outcomes. Utilize NLP for automated writing evaluation and speech analysis, while incorporating human input to address accuracy concerns and ensure a balanced approach. Create intelligent teaching systems with conversational agents to provide low-stress practice environments and additional support for adult learners. Focus initial AI integration efforts on agreed-upon areas, such as interactive courses, supplementary resources, and automated feedback, to ensure a smooth transition and build

Learner confidence. Combine AI tools with traditional teaching methods and human interaction to create blended learning models that balance technological advantages with adults' preference for stability and human connection. In summary, these recommendations advocate for ethical, learner-centered AI systems that integrate technical advancements with established educational practices. This balanced approach can significantly improve adult language education globally.

6.2 Practical implications for educators and policymakers

Implications for educators. Educators play a critical role in assessing and integrating AI into adult EFL classrooms. Teacher training programs should include

workshops on the ethical use of AI. The findings highlight learners' preference for human interaction and balance with traditional methods. AI should enhance, not replace, interpersonal instruction, aligning with student needs. Educators can use AI to focus more on higher-order tasks, such as fostering critical thinking and collaboration, while delegating routine tasks to AI. This requires revising lesson plans. Insights from this study can help educators in selecting AI tools that prioritize adult learners' preferences for personalized and self-directed learning. Instructors must monitor for over-reliance on AI to ensure self-directed learning skills are strengthened rather than diminished. By aligning AI integration with these considerations, educators can ensure effective, balanced, and ethical use of AI in adult language education.

Key recommendations stemming from the results are outlined below:

- Formulate ethical guidelines and rules for the effective use of AI that protect student rights and ensure human interaction.
- Ensure transparency in the creation and validation of AI algorithms to build trust among users. Focus AI applications on enhancing areas that educators find most time-consuming, such as providing feedback and conducting evaluations.
- Carefully evaluate the accuracy of AI assessment models before their implementation and continuously check for biases. Emphasize the development of adaptive learning systems that cater to the independence and self-direction essential for adult learners.
- Combine AI tools with traditional teaching methods through a blended learning approach led by educators. Involve adult EFL learners as co-designers of new AI technologies to ensure appropriate cultural and educational relevance.
- Conduct further research on effective integration strategies and measurable learning outcomes using rigorous mixed methods.

Implications for policymakers. The research indicates that policies and norms must be established regarding AI's ethical development and utilization in adult education, with a strong emphasis on privacy, impartiality, and autonomy. The learner's perspective should inform guiding rules to ensure that tools cater to the specific demands of adult learning rather than adopting a 'one size fits all' approach. Their contribution is essential. Policies that ensure equitable access to AI-assisted instruction for diverse adult populations and mitigate inequities among these groups. Funding might be allocated for the continued development of practical AI tools for adults, such as adaptive tutoring systems. To facilitate its effective integration, policy should endorse ongoing research about AI's effects on engagement, self-directedness, and outcomes. This continuous research will provide policymakers with the necessary reassurance about the adaptability and evolution of the system.

7 FUTURE RESEARCH DIRECTIONS

7.1 Proposed research areas

This study identifies several promising areas for future research:

1. Involving adult learners in participatory design studies to develop personalized AI tools aligned with their needs.
2. Comparing the effectiveness of adaptive AI tutoring systems with traditional teaching methods for adult skill development.

3. Exploring the optimal combination of AI technology, online resources, human tutoring, and traditional teaching approaches.
4. Evaluating AI-powered conversational agents in creating low-stress practice environments for adults.
5. Investigating immersive technologies such as VR to enhance AI-supported adult learning experiences.

7.2 Key unexpected findings and implications

1. Student caution about AI dependence: Students showed more concern about over-reliance on AI than teachers. This highlights the importance of fostering self-directed learning skills and balancing AI with live teaching for better support.
2. Teacher optimism about AI: Teachers demonstrated more uniform optimism about AI integration, while students expressed mixed opinions. Teachers' limited experience with AI tools suggests the need for more hands-on exposure to balance their perspectives.
3. Student concerns about bias: Students were more worried about AI biases than teachers. Transparency in AI development and addressing equity issues should be core principles for ethical AI adoption.
4. Preference for traditional methods: While both groups valued efficiency, students emphasized retaining traditional teaching techniques. AI should complement, not replace, human teaching roles.

These findings highlight differences in perspectives on dependence, bias, and blending traditional methods, which are critical for ethical and balanced AI integration. Future research should address these issues to guide thoughtful and effective AI adoption in adults.

8 CONCLUSION

The study investigates the use of AI apps in EFL education. It utilizes a questionnaire to gather perspectives from teachers and learners. The findings demonstrate a positive outlook on AI's potential to enhance engagement, motivation, and efficiency. However, students' uncertain views and their emphasis on the need for a balance between human interaction and traditional instruction highlight the need for further research and development in this area. The study provides valuable insights for the development of ethical AI tools and ensuring AI design aligns with adult learning goals. It also underscores the need for further research using participatory approaches.

This study makes several important contributions to the limited literature on the use of AI in adult EFL educational settings: It represents one of the first empirical investigations into the attitudes and opinions of both teachers and students regarding the adoption of AI. The results provide clear insights into the factors that adult learners and educators consider most important, helping to set priorities for the ethical development of AI. The findings reveal areas of agreement and disagreement between the two groups, which can help create tailored AI solutions that address their specific challenges. The project lays the groundwork for future research into effective strategies that combine AI tools with traditional teaching methods. It highlights the importance of participatory research that includes the perspectives of end-users to guide the development of learner-centered, needs-based AI solutions.

The geographical focus provides valuable local context for AI implementation frameworks in EFL environments. Practical implications stress key factors such as accessibility, transparency, and the protection of student autonomy in the integration of AI technologies. This initial study significantly contributes by collecting vital stakeholder perspectives to guide the ethical and tailored integration of AI in adult EFL settings.

The contributions of this study are:

1. Provide critical insights based on empirical data: In the process, the study drew direct input from teachers and learners through questionnaires, rather than mere theoretical analysis. The empirical information obtained herein therefore adds valuable firsthand information that was previously absent in the field.
2. Centers voices of stakeholders: The educators and students actively involved in the study amplify voices of those directly impacted by AI integration in adult EFL learning. Their priorities help guide ethical adoption.
3. Provides comparative analysis: The study compares and contrasts teacher and learner views on the matter. This gives a better insight into comparisons rather than the scenario of being focused on just one group.
4. Informs frameworks for integrating ethics: This goes a long way toward contributing to principles and recommendations through which AI could be integrated into the practice of adult EFL learning ethically and responsibly, responding to concerns.
5. It provides a methodology for learner-focused research: An exploratory, survey-based approach gives a model for researching AI in education in a participatory, inclusive manner that involves the end users.

Overall, this study significantly enriches the existing body of knowledge by providing valuable empirical insights from key stakeholders, revealing specific factors unique to adult learners. The balanced and cautious insights offered by experts in this rapidly advancing field provide researchers and developers with invaluable guidance on maximizing benefits and minimizing drawbacks. The careful and scientifically supported integration of AI technology instills confidence in its potential to transform the quality of language teaching for adults.

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