

## ARTICLE

# Acquisition of Language, Linguistics Via Computer (AI) in Higher Education Institutions and Its Effects

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## ABSTRACT

The ever-evolving realm of higher education offers revolutionary prospects for educators and learners through the merging of language studies, linguistics, and artificial intelligence (AI). This paper examines the interdisciplinary integration of these fields, highlighting their combined capacity to improve teaching methods, research innovation, and educational results in higher education institutions. The study initiates by analyzing conventional methods of language and linguistics instruction, pinpointing enduring pedagogical issues like student engagement, assessment precision, and

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linguistic diversity. It subsequently examines the transformative influence of AI technologies—such as natural language processing (NLP), machine learning, speech recognition, and automated evaluation—in tackling these issues. The paper illustrates how AI-powered technologies may customize learning, support multilingual education, and enhance linguistic research through a comprehensive examination of existing literature, theoretical frameworks, and case studies.

**Keywords:** Linguistics; Language; Artificial Intelligence; ELT; HEI; Education; Multilingual Communication

## 1. Introduction

The amalgamation of language, linguistics, and computer technology—particularly artificial intelligence (AI)—has gained significant prominence in higher education as educators, policymakers, and academics acknowledge the substantial potential of interdisciplinary innovation. The current digital revolution has altered nearly every facet of human interaction, encompassing the acquisition, processing, and communication of language. Language, being the essential medium of human cognition and expression, uniquely intersects with AI, a technology designed to emulate facets of human intelligence, including natural language comprehension and production. In higher education, where language and linguistics instruction often prioritize theoretical understanding, critical analysis, and humanistic exploration, the emergence of AI tools introduces both remarkable potential and significant obstacles. These tools can automate evaluations, deliver immediate feedback, customize learning experiences, and enable multilingual communication in international classrooms. Simultaneously, they pose significant pedagogical, ethical, and epistemological inquiries concerning the use of technology in education, the safeguarding of cultural and linguistic variety, and the future of language studies. Language and linguistics consistently embody the intricacy and flexibility of human cultures. Linguistics, the scientific examination of language, explores structure, meaning, and context, providing profound insights into cognition, culture, and communication. Language education is an essential medium for imparting communication skills, intercultural competency, and critical thinking to pupils. The integration of AI into these domains facilitates a novel epoch of education and inquiry that merges empirical precision with computational efficacy. This study aims to investigate how higher education may leverage the intersection of language studies, linguistics, and artificial intelligence to address the changing requirements of students, teachers, and society

as a whole. The paper aims to address various critical research concerns through a comprehensive literature review, theoretical analysis, and case study examination.

- In what ways is AI transforming the instruction of language and linguistics in higher education?
- Which pedagogical paradigms most effectively facilitate the incorporation of AI in these fields?
- What problems and ethical dilemmas arise from the increasing integration of AI in language education?
- How can educators reconcile technological advancement with the maintenance of humanistic principles fundamental to language and linguistic studies?

This paper seeks to enhance scholarly discourse on the future of higher education by providing actionable insights for educators, curriculum designers, institutional leaders, and policy-makers who must navigate the intricate intersection of language, linguistics, and artificial intelligence. This paper presents a thorough literature survey, followed by a discussion of the theoretical frameworks that underpin the analysis. The text analyzes current pedagogical practices in language and linguistics education, investigates the specific applications of AI within these domains, evaluates the opportunities and challenges arising from this technological convergence, and concludes with recommendations for fostering inclusive, innovative, and ethically responsible educational practices.

## 2. Literature Review

The literature on the integration of language, linguistics, and artificial intelligence (AI) in higher education is expanding rapidly, reflecting both the growing interest in interdisciplinary teaching models and the accelerating development of AI technologies applicable to language learning. This section presents a comprehensive review of existing scholarship, organized around several key areas: (1) language pedagogy and traditional approaches,

(2) linguistics education in higher education, (3) emerging AI applications in language learning, (4) AI in linguistics research and instruction, and (5) theoretical and ethical considerations associated with AI adoption in language education. Additionally, numerous searches were conducted using a combination of several keywords in the source database and using Boolean values. These included “AI” or “artificial intelligence” or “artificial intelligence” or “education” or “higher education”, “research” or “opportunities” or “opportunities” or “benefits” or “benefits” or “ethical issues” or “affect” or “affect” or “integrity” or “academic credibility”. Electronic database search engine such as Google Scholar, Scopus, Elsevier, Sage, Emerald Insights, Springer, Web of Science, Willey, JSTOR, Directory of Open Access Journals (DOAJ) data were used for access and retrieval.

## 2.1. Traditional Approaches to Language Pedagogy

Language teaching in higher education has long been shaped by a range of pedagogical theories, including behaviorisms, structuralism, communicative language teaching (CLT), and sociocultural approaches. Early methods such as the grammar-translation method and audiolingual approaches emphasized rote memorization, structural repetition, and accuracy, but often failed to develop communicative competence<sup>[1]</sup>. The communicative turn in the 1970s and 1980s, led by scholars such as [2,3,4], shifted focus to meaningful interaction, fluency, and the social functions of language<sup>[5]</sup>. The rise of task-based language teaching (TBLT) and content-based instruction (CBI) further emphasized authentic language use in real-world contexts<sup>[6-8]</sup>.

Despite these advances, traditional approaches face ongoing challenges. Learner motivation, linguistic diversity, individualized feedback, assessment validity, and scalability remain persistent concerns in language classrooms. The growing diversity of student populations, particularly in multilingual and multicultural societies, places additional demands on instructors to address varied linguistic backgrounds and learning styles<sup>[9]</sup>. These challenges provide fertile ground for technological interventions that can offer scalable, personalized, and data-driven solutions.

The teaching of linguistics in higher education has historically emphasized theoretical knowledge of phonology,

morphology, syntax, semantics, pragmatics, and sociolinguistics<sup>[10,11]</sup>. Linguistics programs aim to equip students with analytical tools to understand language structure and use, but often struggle to balance theoretical rigor with practical application<sup>[12]</sup>. Students may find abstract linguistic concepts challenging without sufficient real-world data or empirical analysis<sup>[13]</sup>. Additionally, traditional linguistics curricula have been slow to incorporate computational methods, which are increasingly relevant in the age of big data and AI. Calls for a more interdisciplinary and applied approach to linguistics education have grown in recent years. The emergence of fields such as computational linguistics, corpus linguistics, psycholinguistics, and sociolinguistics highlights the need for linguistics curricula to integrate technology, data analysis, and cross-disciplinary perspectives<sup>[14]</sup>. As AI reshapes the study of language through natural language processing (NLP), automated text analysis, and speech recognition, higher education institutions are increasingly urged to update linguistics programs accordingly

## 2.2. Emerging AI Applications in Language Learning

Artificial intelligence has introduced a wide range of tools that directly support language learning in higher education. Intelligent tutoring systems (ITS), adaptive learning platforms, automated essay scoring, speech recognition software, and virtual language assistants exemplify how AI can personalize instruction, enhance engagement, and streamline assessment<sup>[15]</sup>. Natural language processing (NLP) plays a central role in many AI language applications, enabling automated feedback on grammar, pronunciation, and vocabulary usage<sup>[16]</sup>. Recent advancements in large language models, such as OpenAI’s GPT and Google’s BERT, have revolutionized machine translation, conversational AI, and text generation, opening new possibilities for language education<sup>[17]</sup>. These tools offer potential to supplement instructor feedback, facilitate peer learning, and support learners in multilingual classrooms. Research also highlights the potential of AI-driven chatbots and virtual reality (VR) environments for immersive language learning experiences. AI-supported collaborative learning platforms enable students to practice real-time dialogue, receive instant corrections, and engage in context-rich lan-

guage tasks.

Beyond language learning, AI is transforming the field of linguistics itself. Computational linguistics and corpus linguistics have benefited significantly from AI tools capable of processing massive language datasets, conducting automated discourse analysis, and identifying linguistic patterns across diverse languages and registers<sup>[18]</sup>. AI facilitates empirical linguistic research by enabling high-speed analysis of phonetic data, syntactic structures, lexical variation, and semantic relationships. In linguistic instruction, AI-powered data visualization tools, automated transcription systems, and interactive syntax parsers offer students hands-on experience with real linguistic data<sup>[19]</sup>. AI allows learners to explore language patterns across dialects, registers, and corpora in ways that were previously impractical in traditional classrooms<sup>[20]</sup>. As AI research advances, applications in endangered language documentation, dialect analysis, and multilingual corpora development are expanding rapidly.

### **2.3. Ethical, Pedagogical, and Theoretical Considerations**

The integration of AI into language and linguistics education raises important ethical and pedagogical concerns. Issues of data privacy, algorithmic bias, linguistic imperialism, and unequal access to AI resources pose significant challenges for educators and institutions<sup>[21]</sup>. The potential for AI tools to replicate or amplify cultural biases embedded in training data highlights the importance of critical digital literacy among both educators and students<sup>[22]</sup>. Pedagogically, there is ongoing debate about the appropriate balance between AI assistance and human instruction in language education. While AI can automate certain aspects of feedback and assessment, critics caution against over-reliance on automated systems that may overlook the nuances of human communication, cultural context, and affective dimensions of language learning<sup>[23]</sup>. Theoretically, scholars have called for new models that integrate sociocultural theories of language acquisition with AI-mediated learning environments. Vygotskian approaches, for example, emphasize the role of social interaction and mediation in language learning, which challenges purely individualized, machine-driven models of AI instruction.

### **2.4. AI and Second Language Acquisition (SLA) Theories**

Another rapidly emerging field within the literature is the integration of AI with second language acquisition (SLA) theories. Researchers are exploring how AI-based systems align with or challenge prominent SLA models such as Krashen's Input Hypothesis (1985), Swain's Output Hypothesis (1985), and Long's Interaction Hypothesis (1996)<sup>[24,25]</sup>. AI-powered conversational agents, for example, provide meaningful interaction opportunities that support the interaction hypothesis by facilitating comprehensible input, negotiated meaning, and corrective feedback. Machine translation tools and AI-driven speech recognition programs offer scaffolding for learners, allowing them to access comprehensible input that gradually advances their proficiency. Furthermore, adaptive AI systems that personalize learning pathways may help operationalize Krashen's concept of "i+1," presenting learners with materials that are just slightly beyond their current proficiency level. This adaptivity supports individualized pacing and reduces the affective filter, a critical component of learner motivation and confidence. At the same time, critics caution that over-reliance on AI for comprehensible input may diminish the social dimensions of interaction emphasized by sociocultural SLA frameworks.

### **2.5. AI, Multilingualism, and Global Language Education**

Another important dimension of the literature focuses on how AI influences multilingual education in global higher education contexts. Globalization has increased the demand for multilingual competence, prompting universities to expand their language offerings and embrace diverse linguistic landscapes. AI-powered machine translation, speech synthesis, and automatic transcription technologies support multilingual communication in classrooms, administrative functions, and international collaborations. AI tools enable real-time translation of lectures and course materials, allowing international students to access content in their preferred language and reducing linguistic barriers<sup>[26]</sup>. However, concerns persist regarding the accuracy and cultural appropriateness of AI-generated translations, particularly in specialized academic disciplines where preci-

sion and nuance are critical<sup>[27]</sup>.

Scholars emphasize the need for critical language awareness when integrating machine translation tools, as they may inadvertently promote linguistic imperialism or marginalize local languages.

Assessment practices in language and linguistics education have also received extensive scholarly attention concerning AI technologies. Automated essay scoring (AES), automated speech evaluation, and AI-driven formative assessments offer scalable solutions for evaluating large cohorts of students while reducing grading burdens for instructors. These systems provide immediate feedback on pronunciation, grammar, and lexical accuracy, enabling learners to engage in self-directed learning<sup>[28]</sup>. While AI-enhanced assessment offers many benefits, concerns about validity, reliability, and fairness remain central in the literature. Automated scoring systems may struggle to accurately assess complex discourse features such as coherence, rhetorical structure, and cultural appropriateness<sup>[29]</sup>. Moreover, algorithmic bias may disadvantage certain learner groups, particularly non-native speakers with non-standard accents or dialects. Scholars call for human-AI hybrid models of assessment that combine the efficiency of automation with the nuanced judgment of human evaluators.

Another important strand of literature focuses on the professional development of language and linguistics faculty in adapting to AI-enhanced teaching environments. The successful integration of AI tools requires educators to develop new digital competencies, critical AI literacy, and pedagogical flexibility (Zawacki-Richter et al., 2019). Faculty often express mixed attitudes toward AI, with some embracing its potential for innovation while others voice concerns about job displacement, depersonalization of instruction, and loss of academic freedom<sup>[30]</sup>.

Effective faculty training should address ethical considerations, data privacy, cultural biases, and the preservation of humanistic values central to language and linguistics education<sup>[31]</sup>. Collaborative approaches to AI integration—where faculty, instructional designers, data scientists, and ethicists work together—are increasingly recommended<sup>[32]</sup>.

The expanding literature also identifies several emerging research gaps that warrant further investigation. While

much attention has focused on AI applications for major world languages (e.g., English, Mandarin, Spanish), there is limited research on AI's role in supporting endangered languages, indigenous language revitalization, and less commonly taught languages. AI-driven language documentation, corpus development, and automatic transcription hold promise for preserving linguistic diversity, but require culturally sensitive, community-centered approaches<sup>[33]</sup>. Additionally, there is a growing need for longitudinal studies that examine the long-term impacts of AI-enhanced language learning on learner autonomy, intercultural competence, identity development, and critical thinking. Scholars also call for more research on ethical AI design, particularly concerning algorithmic transparency, data ownership, and student privacy in educational contexts<sup>[34]</sup>.

### 3. Theoretical Backdrop

This study aims to conduct a comprehensive analysis of the intersection between artificial intelligence, language learning, and linguistics education. It is grounded in multiple theoretical frameworks that collectively explore the cognitive, social, technological, and ethical dimensions associated with AI-enhanced education.

The frameworks presented herein serve as vital analytical tools for comprehending the pedagogical possibilities and significant challenges that emerge with the integration of AI technologies into the human-centered domains of language and linguistics education.

#### 3.1. The Sociocultural Theory of Language Acquisition as posited by Vygotsky in 1978

The Sociocultural Theory of Learning, as articulated by Lev Vygotsky, serves as a foundational framework for understanding language acquisition<sup>[35]</sup>. This theory asserts that the genesis of knowledge is fundamentally rooted in social interactions, cultural contexts, and the collaborative processes of meaning-making. Vygotsky posits that the process of language acquisition is fundamentally facilitated through dialogue, structured guidance, and engagement in activities that are situated within a cultural context. The application of AI in language learning, through the lens of sociocultural theory, highlights the imperative for AI systems to replicate significant social interactions. The capac-



ity of virtual language tutors, AI chatbots, and intelligent tutoring systems to emulate certain aspects of guided interaction is evident; however, their proficiency in reproducing the depth and richness of human dialogic experiences is constrained. The integration of AI applications in educational contexts has the potential to support the developmental trajectories of learners. However, it is imperative to recognize that without a deliberate focus on cultural nuances, emotional engagement, and authentic sociolinguistic negotiation, systems driven solely by algorithms may inadequately emulate the richness of authentic sociocultural learning experiences. This theory emphasizes the necessity for educators to recognize that AI tools ought to serve as enhancements rather than substitutes for human-mediated social learning environments. The theories of constructivist learning, as articulated by Bruner (1996), underscore the premise that knowledge is actively constructed through processes of exploration, inquiry, and reflection, rather than being merely absorbed in a passive manner<sup>[36]</sup>. In the realm of language acquisition, the constructivist approach emphasizes the importance of engaging learners in problem-based activities, undertaking authentic tasks, and promoting student autonomy. Platforms that leverage artificial intelligence to adapt to the performance of learners, offer prompt feedback, and introduce authentic linguistic tasks are in strong alignment with constructivist educational theories as articulated. In conjunction with constructivism, George Siemens' Connectivism (2005), elucidates the dynamics of knowledge dissemination across digital networks comprising individuals, information, and artificial systems<sup>[37]</sup>. The contemporary landscape of higher education is defined by intricate and interrelated ecosystems, comprising AI-powered learning tools, data-driven adaptive platforms, and online peer networks. Within interconnected frameworks, artificial intelligence systems function as pivotal knowledge nodes that perpetually gather, scrutinize, and disseminate information, thereby facilitating collaborative knowledge creation on a worldwide level. The integration of AI technologies is supported by these theories, which emphasize the promotion of active, learner-centered inquiry. Additionally, they underscore the significance of preserving human presence, mentorship, and critical reflection within digitally mediated environments.

The extensive framework of second language acquisi-

tion theories provides significant perspectives for assessing the impact of artificial intelligence in the realm of language education. Krashen's Input Hypothesis, articulated in 1985, underscores the necessity for learners to encounter comprehensible input that is marginally above their existing level of proficiency, denoted as "i+1." Language systems powered by artificial intelligence demonstrate exceptional capabilities in delivering personalized and adaptive input, aligning the complexity of content with the proficiency levels of learners (Derwing & Munro, 2015). Swain's Output Hypothesis, articulated in 1985, underscores the significance of engaging in meaningful language production as a crucial factor in the advancement of fluency<sup>[38]</sup>. The utilization of AI chatbots and virtual tutors facilitates simulated conversational practice, enabling learners to generate language output within contextual frameworks, receive corrective feedback, and subsequently refine their responses. In a comparable manner, Long's Interaction Hypothesis (1996) underscores the significance of negotiated meaning within interactive communication, a concept that AI-mediated dialogic agents strive to emulate via adaptive conversational modelling. Although artificial intelligence has the potential to enhance various principles of second language acquisition, scholars have expressed concerns regarding the limitations of machine-mediated interactions. These interactions frequently fall short of capturing the intricate nuances, spontaneity, and cultural context inherent in authentic communication, which may hinder the development of socio-pragmatic competence<sup>[39]</sup>. The exploration of intelligent learning systems is further substantiated by the application of educational theories specifically tailored to artificial intelligence. The theory of Intelligent Tutoring Systems (ITS) elucidates the mechanisms through which artificial intelligence emulates personalized tutoring. This is achieved by modeling the knowledge states of learners, pinpointing misconceptions, and providing adaptive scaffolding. These systems demonstrate significant efficacy in the realms of grammar correction, vocabulary enhancement, and pronunciation training within the context of language education. Furthermore, the theory of Self-Regulated Learning, as articulated by Zimmerman in 2002, demonstrates a significant intersection with adaptive systems powered by artificial intelligence, which promote learner autonomy, facilitate goal setting, encourage meta-

cognitive reflection, and enhance self-monitoring capabilities. The implementation of AI platforms designed to monitor learner performance and encourage strategic behaviors has the potential to significantly improve metacognitive awareness and the competence of self-directed learning<sup>[40]</sup>. The frameworks for AI education underscore the necessity for intelligent systems to prioritize transparency, interpretability, and the incorporation of human-centered learning objectives, as opposed to solely focusing on the optimization of algorithmic efficiency.

The exploration of emerging theoretical paradigms, including Posthumanism and Postdigital Theory, critically examines the complex relationships that develop between humans and intelligent machines within educational settings. The concept of posthumanism, interrogates traditional anthropocentric frameworks of learning by acknowledging the role of AI systems, algorithms, and non-human agents as integral contributors to the process of knowledge production<sup>[41]</sup>. The framework of Postdigital Theory, challenges the conventional binary separation of “digital” and “non-digital.” It underscores the notion that AI technologies are intricately woven into the fabric of modern academic environments. In the realm of language education, it is essential to recognize that learners are progressively acquiring knowledge not solely through traditional human educators, but also through the integration of AI-driven platforms, diverse multimodal resources, and interconnected digital frameworks. The exploration of these theories compels educators to reconceptualize their pedagogical roles, the identities of learners, and the dynamics of power within AI-mediated learning contexts. This inquiry elicits significant considerations regarding agency, embodiment, and the evolving demarcations between technology and the human experience. The integration of artificial intelligence within the realm of higher education necessitates a thorough examination of ethical considerations. Critical Pedagogy, as articulated by Freire (1970) and Giroux (2011), underscores the necessity of enabling learners to engage in a critical analysis of the technologies that influence their educational experiences. The growing impact of AI algorithms on students’ reading, writing, and learning necessitates that educators cultivate a form of critical digital literacy. This literacy should empower learners to critically examine algorithmic biases, the implications of data-

driven decision-making, and the influence of corporate entities on educational technologies<sup>[42]</sup>. The implementation of global frameworks, including the IEEE’s Ethically Aligned Design (2019), UNESCO’s AI Ethics Guidelines (2021), and the EU’s Ethical AI principles, underscores the necessity for transparency, fairness, accountability, and human oversight in the deployment of artificial intelligence. The examination of ethical frameworks reveals significant concerns regarding data privacy, surveillance, linguistic imperialism, and the risk of cultural homogenization within the context of AI-powered language education<sup>[43]</sup>. The integration of AI technologies in language and linguistics education necessitates a meticulous consideration of the interplay between the efficiencies and personalized experiences afforded by such technologies and the imperative to safeguard student privacy. Additionally, it is crucial to uphold principles of algorithmic equity while maintaining the humanistic values that characterize language learning as an inherently social, cultural, and ethical pursuit.

## 4. Application Of AI In Linguistics And Language Education

The integration of artificial intelligence within the realms of language and linguistics education is significantly transforming established pedagogical approaches and research frameworks. This section examines various significant areas in which AI technologies are currently reshaping the pedagogical and research landscapes of language and linguistics within the realm of higher education.

The advancement of personalized and adaptive learning platforms represents a crucial contribution of artificial intelligence to the field of language education. In contrast to conventional uniform models, systems powered by artificial intelligence engage in the real-time analysis of individual learner performance, thereby adaptively delivering content that is specifically tailored to the current proficiency level, learning style, and pace of each learner. The systems in question utilize advanced algorithms designed to monitor learner errors, pinpoint knowledge deficiencies, and suggest specific exercises, thereby establishing a tailored educational trajectory for each student. Platforms such as Duolingo, LingQ, and Babbel serve as prime examples of contemporary educational trends, incorporating

advanced feedback systems powered by artificial intelligence, elements of gamification, and algorithms based on spaced repetition to enhance both learner engagement and retention. Evidence indicates that adaptive systems have the potential to enhance motivation and yield superior learning outcomes when contrasted with traditional static curriculum models. Furthermore, these adaptive platforms present advantages across various educational settings, encompassing online distance education, flipped classrooms, and blended learning models. Higher education institutions that cater to linguistically diverse student populations can leverage AI-driven personalization to create inclusive learning environments. This approach enables students from various language backgrounds to advance at their optimal pace. The advent of AI technologies has led to the development of automated assessment tools that exhibit a high degree of scalability, enabling the evaluation of language skills through various modalities. Automated essay scoring systems, including e-rater, Criterion, and IntelliMetric, conduct a comprehensive analysis of student writing, focusing on aspects such as grammar, vocabulary, coherence, and organization. In a comparable manner, technologies that utilize artificial intelligence for speech recognition evaluate aspects such as pronunciation accuracy, fluency, and intonation<sup>[44]</sup>. Despite the efficiency and immediacy provided by such systems, it is crucial to underscore the necessity of human oversight, especially in the context of high-stakes assessments, as highlighted by researchers. The limitations of automated scoring systems are evident, as they may not adequately encompass the complexities inherent in argumentation, the subtleties of creativity, and the contextual relevance of language use. There is a growing recommendation for hybrid assessment models that integrate AI-generated feedback alongside instructor evaluation, as this approach seeks to achieve a balance between scalability and pedagogical validity.

In the realm of linguistics education, the implementation of AI assessment tools facilitates the real-time analysis of authentic linguistic data by students. The utilization of tools such as Sketch Engine and AntConc facilitates automated corpus analysis, frequency analysis, and collocation detection, thereby affording students practical engagement with empirical linguistic research.

#### **4.1. The Role of Natural Language Processing in the Domain of Linguistic Research**

Natural language processing exemplifies a significant convergence of artificial intelligence and linguistic studies. The utilization of NLP tools facilitates the extensive examination of linguistic structures, discourse patterns, and semantic relationships within vast corpora. The integration of AI-driven NLP technologies within the field of applied linguistics facilitates automatic parsing, sentiment analysis, semantic role labeling, and machine translation, thereby significantly broadening the parameters and depth of linguistic research. Higher education institutions are progressively integrating natural language processing into their linguistics curricula, thereby equipping students with skills in corpus linguistics, computational linguistics, and the development of language technologies<sup>[45]</sup>. The capacity to analyze extensive multilingual datasets equips students with the necessary skills for professional pursuits in language technology, translation studies, sociolinguistics, and artificial intelligence research. Furthermore, the application of NLP tools is demonstrating significant value in the documentation and revitalization of endangered languages. The utilization of advanced speech-to-text technologies, automated glossing mechanisms, and semantic tagging systems plays a crucial role in aiding linguists in the development of digital corpora for languages that are under-documented, thereby significantly contributing to the preservation of global linguistic diversity. The integration of AI-driven virtual tutors and chatbots presents innovative methodologies for language practice, effectively emulating human conversational dynamics. The systems in question, frequently driven by advanced language models, exemplify the capacity to facilitate interactive dialogue practice for learners, deliver immediate error correction, and impart cultural insights, as evidenced by the research.

The efficacy of virtual tutors in fostering conversational fluency, pragmatic competence, and sociocultural awareness is noteworthy, particularly in domains that have historically necessitated human interaction. The findings of the research suggest that individuals who interact with AI-driven chatbots demonstrate a reduction in anxiety levels and an enhanced propensity to communicate, especially during the initial phases of language acquisition. Notwithstanding their potential, apprehensions remain about the



constraints of AI agents in comprehending intricate social subtleties, humor, irony, and context-specific significance. The continuous advancements in conversational AI seek to mitigate these challenges; however, the indispensable contribution of human instructors remains crucial in delivering comprehensive and contextually relevant language learning experiences. The recent advancements in artificial intelligence have facilitated the development of multimodal methodologies in language education, which integrate speech, text, image, and video processing to create cohesive learning experiences. The utilization of artificial intelligence tools that analyze visual cues, facial expressions, and body language significantly contributes to the instruction of non-verbal communication elements, which are essential for developing intercultural competence <sup>[46]</sup>. The integration of immersive technologies, including virtual reality, augmented reality, and mixed reality environments, significantly enhances the role of artificial intelligence in the domain of multimodal language instruction. Engagement in simulated real-world scenarios, including virtual travel and intercultural business meetings, provides learners with opportunities to practice language skills within authentic sociocultural contexts <sup>[47,48]</sup>. The integration of AI-driven avatars, sophisticated virtual agents, and affective computing technologies plays a pivotal role in creating emotionally responsive educational settings, thereby enhancing both engagement and retention among learners. The integration of multimodal platforms is consistent with theoretical frameworks surrounding embodied cognition, which underscore the significance of sensory-motor experiences in the process of language acquisition. The exploration of AI-enhanced virtual and augmented reality within higher education programs is becoming increasingly prevalent, particularly in the context of professional language training across various fields such as aviation, medicine, and diplomacy.

#### **4.2. The Role of Artificial Intelligence in Enhancing Academic Writing**

The integration of AI-driven tools within higher education has become increasingly prevalent, serving to enhance the development of academic writing across various disciplines. The utilization of grammar checkers, plagiarism detection systems, paraphrasing tools, citation generators,

and style editors serves as a foundational support mechanism for non-native speakers and novice academic writers. The emergence of advanced AI writing assistants, including Grammarly, ProWritingAid, and applications based on ChatGPT, has significantly enhanced the writing process by offering sophisticated real-time feedback. Nonetheless, researchers must exercise caution regarding an uncritical dependence on AI writing instruments. The excessive reliance on certain tools can obstruct the cultivation of critical thinking, rhetorical awareness, and autonomous writing skills unless these elements are thoughtfully incorporated into educational structures that prioritize metacognitive reflection and the agency of the writer.

### **5. Challenges, Ethical Issues, and Limitations of AI in Language and Linguistics Education**

The incorporation of artificial intelligence within the domains of language, linguistics, and higher education presents significant opportunities; however, it concurrently gives rise to a multifaceted set of challenges, constraints, and ethical dilemmas. The complexities of these issues necessitate a comprehensive examination that spans pedagogical, technological, cultural, and philosophical realms, thereby demanding careful deliberation from educators, institutions, policymakers, and technologists alike. The unregulated proliferation of AI technologies has the potential to undermine fundamental humanistic, democratic, and ethical principles that are essential to the process of language learning. The issue of algorithmic bias represents a significant challenge in the context of AI applications within language education. The inherent biases found within large datasets are inevitably mirrored in AI systems that are trained on such data sources. Within the realm of language education, this phenomenon frequently leads to the prioritization of dominant global languages, particularly English, alongside standard dialects and culturally accepted language usage. Consequently, this dynamic tends to marginalize minority languages, regional dialects, and a variety of sociocultural language practices. The training of numerous AI-powered language models primarily on Western-centric corpora results in skewed portrayals of the world's linguistic diversity. Speech recognition sys-

tems often encounter significant challenges in accurately processing non-native accents, regional variations, and instances of code-switching, thereby placing learners from non-dominant linguistic communities at a disadvantage<sup>[49]</sup>. This situation prompts a critical examination of the ethical implications surrounding linguistic dominance and the potential exacerbation of the marginalization faced by languages that are already vulnerable within the context of the global AI economy. It is imperative for language educators to engage in the advocacy of training datasets that are more inclusive and representative, thereby encompassing a wide array of linguistic ecologies, sociolinguistic variations, and global language varieties. Efforts that encompass the development of indigenous language corpora, the documentation of endangered languages, and the creation of multilingual datasets serve to address these biases and foster linguistic equity. While the integration of artificial intelligence in language instruction presents notable efficiencies, an excessive dependence on automated systems could unintentionally undermine critical human elements inherent in the educational process of language acquisition. The capabilities of AI algorithms extend to the identification of syntactic errors and lexical patterns; however, they remain limited in their ability to evaluate aspects such as creativity, the quality of argumentation, humor, irony, and the application of nuanced rhetorical strategies in both student writing and conversational contexts<sup>[50]</sup>. The role of instructors is fundamentally significant in demonstrating genuine communication, fostering intercultural dialogue, and supporting the emotional well-being and confidence of learners—elements that continue to pose challenges for AI systems to emulate. The apprehension surrounding the deskilling of educators, characterized by their transition into roles as mere facilitators of automated systems, has been extensively articulated in the literature. Institutions must guarantee that artificial intelligence functions as a tool for augmentation, enhancing the professional judgment, pedagogical creativity, and relational expertise of educators, rather than displacing these essential qualities. AI-driven learning platforms consistently gather extensive personal data to tailor educational experiences, monitor advancement, and enhance learning algorithms. Nevertheless, the practices surrounding data collection and usage present significant issues related to privacy, surveillance, and the

ownership of data. Numerous AI-driven language platforms maintain sensitive learner data, which encompasses speech patterns, writing samples, cognitive profiles, and engagement metrics, within corporate-controlled servers. The implications of this situation encompass significant risks, including the potential for data breaches, commercial exploitation, and state surveillance, all of which serve to undermine the autonomy of students and their capacity for informed consent. The implementation of transparent data governance frameworks, the establishment of stringent institutional data protection policies, and the promotion of digital literacy education are imperative to guarantee that learners maintain control over their data. Institutions must prioritize the acquisition of student consent, impose restrictions on the sharing of data with third parties, and advocate for transparency in algorithmic processes to sustain trust and adhere to ethical standards in data management. The worldwide proliferation of AI-augmented educational systems poses a significant threat of intensifying pre-existing disparities in access and opportunity, delineated by geographic, economic, and sociopolitical factors. In the context of higher education, it is evident that institutions in affluent nations are increasingly integrating advanced artificial intelligence technologies. Conversely, numerous universities situated in developing regions face significant challenges, including inadequate technological infrastructure, limited financial resources, and a deficiency in faculty expertise, which hinder their ability to adopt these innovative systems. The existing disparities in broadband access, computing power, technical support, and digital literacy serve to perpetuate inequalities in the opportunities available to students for benefiting from AI-mediated language learning. Moreover, languages that lack sufficient resources and marginalized communities frequently find themselves overlooked in the prioritization of AI research, thereby constraining their engagement with the transformative possibilities that AI presents. It is imperative that the integration of artificial intelligence on a global scale emphasizes the importance of equitable access, the development of capacities in underrepresented regions, and the necessity of public investment in open-source AI tools. Such measures are essential to ensure that innovation is democratized and not confined to elite educational institutions.

### 5.1. The Commercialization of Language Acquisition and the Influence of Corporate Governance

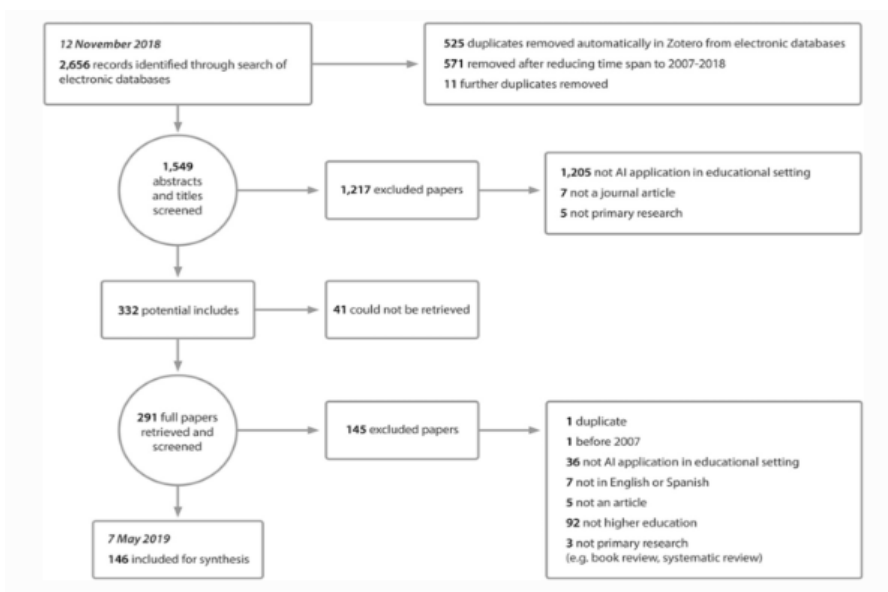
The emergence of commercial AI-driven language learning platforms raises significant inquiries regarding the corporatization of educational practices. The current landscape of higher education is increasingly characterized by the predominance of private enterprises in the creation and dissemination of artificial intelligence tools. This trend prompts significant apprehensions regarding the implications of proprietary algorithms, profit-oriented frameworks, and the consequent diminishment of academic independence. It is evident that corporate interests often place a higher value on cost-efficiency, scalability, and profitability, potentially at the expense of pedagogical quality, humanistic learning objectives, and cultural sensitivity. This situation poses a significant threat to the integrity of language education, potentially reducing it to a mere commodity driven by consumer demands, rather than fostering a critical, liberating, and interactive human experience as advocated by prominent educational theorists.

It is imperative for educators and institutions to engage in a thorough assessment of corporate AI partner-

ships, promote the adoption of open-source alternatives, and withstand the influences that prioritize market-driven imperatives over educational principles. The increasing advocacy for open educational resources and non-commercial artificial intelligence research offers a distinct perspective on the integration of AI, emphasizing the importance of public benefit over private gain.

### 5.2. The Evolution of Educators' Responsibilities and the Transformation of Teaching Methodologies

The growing influence of artificial intelligence in language education is poised to fundamentally alter the responsibilities and functions of educators within this domain. In contemporary educational paradigms, the role of instructors has evolved beyond mere knowledge transmission to encompass a multifaceted approach that includes facilitation, data interpretation, technology integration, and ethical mentorship<sup>[40,49,51]</sup>. This transformation in educational methodology necessitates comprehensive faculty development, ongoing professional learning, and collaborative efforts across disciplines. See **Figure 1**.



**Figure 1.** Prisma Digram.

**Source:** slightly modified after Brunton & Thoms, 2012, pp. 86; Moher, Liberati, Tetzlaff, & Altman, 2009, pp. 8<sup>[51,52]</sup>.

Educators must cultivate new competencies encompassing AI literacy, algorithmic ethics, digital pedagogy, and critical evaluation of technology. Institutions must

allocate resources towards comprehensive professional development initiatives that enable educators to effectively utilize AI technologies, all the while preserving their peda-

gological authority, fostering creativity, and adhering to student-centered learning principles .

## 6. Future Directions and Recommendations

The effective incorporation of artificial intelligence within the realms of language and linguistics education necessitates a multifaceted approach that encompasses technological advancements, strategic planning, inclusive design principles, and a steadfast dedication to pedagogical ideals. This concluding section delineates essential future trajectories and strategic recommendations for the integration of AI in higher education, informed by the opportunities, challenges, and ethical considerations discussed in preceding sections.

### 6.1. The Advancement of Inclusive and Culturally Responsive Artificial Intelligence Systems

In order to effectively tackle the issues of algorithmic bias and linguistic imperialism, it is imperative that future advancements in artificial intelligence place a strong emphasis on the importance of linguistic diversity and the necessity of sociocultural sensitivity. It is imperative that researchers, policymakers, and educational institutions engage in collaborative efforts to construct extensive, ethically curated multilingual corpora that accurately reflect regional dialects, indigenous languages, and the linguistic diversity of marginalized communities. The development of AI language tools necessitates the involvement of interdisciplinary teams that include linguists, AI developers, sociolinguists, and community stakeholders. Such collaboration is essential to ensure that these tools respect cultural specificity, pragmatic variation, and pluralistic language ideologies, as highlighted in the works of Phillipson (1992) and Kumaravadivelu (2012)<sup>[53,54]</sup>. Open-source initiatives, exemplified by Mozilla's Common Voice and language documentation projects facilitated by academic institutions, serve as paradigms for inclusive data collection and the democratization of AI development.

AI should be viewed not as a substitute for human instructors, but rather as an adjunct that enhances educational methodologies. Language educators must maintain their

role as primary facilitators in the domains of intercultural competence, critical thinking, and ethical reflection—domains that remain beyond the complete reach of automation by artificial intelligence. Future curricula must prioritize the development of critical digital literacy, equipping students with the skills to analyze not only the structures of language but also the underlying social, political, and economic influences that shape AI technologies within the realm of language education. As artificial intelligence systems increasingly integrate into academic frameworks, it is imperative that professional development initiatives for faculty adapt in response to these advancements. Educators must engage in continuous professional development focused on the domains of artificial intelligence literacy, data ethics, algorithmic transparency, as well as the pedagogical advantages and constraints associated with AI-enhanced learning. Faculty development initiatives must adopt an interdisciplinary approach, necessitating collaboration among computer scientists, ethicists, instructional designers, and policy experts. Institutions must establish environments that foster experimentation with emerging technologies, all the while safeguarding faculty autonomy and preserving academic freedom. Ensuring ethical oversight of data management while promoting the independence of students is paramount. Comprehensive ethical frameworks must be established to regulate the processes of data collection, storage, and utilization within AI-driven educational systems. Institutions must implement transparent policies that emphasize the importance of informed consent, curtail the exploitation of commercial data, and uphold the autonomy of students. AI developers must emphasize the importance of algorithmic explainability, thereby enabling both educators and learners to comprehend the decision-making processes of AI systems. Institutions must implement independent ethical oversight boards tasked with the evaluation of AI partnerships, procurement processes, and the structures governing algorithmic accountability<sup>[55]</sup>. In order to achieve global equity, it is imperative that the integration of artificial intelligence within higher education be accompanied by ongoing public investment in technological infrastructure, the enhancement of faculty capabilities, and the development of resources specifically aimed at under-resourced regions. The role of international funding agencies, global consortia, and open-source col-

laborative networks is pivotal in the democratization of access to AI-enhanced language learning tools on a global scale <sup>[56,57]</sup>. Collaborative alliances among institutions that facilitate the exchange of artificial intelligence tools, training materials, and linguistic datasets across international boundaries are crucial for preventing the perpetuation of educational hierarchies in global AI advancements. Such partnerships are instrumental in fostering equitable opportunities for all learners. <sup>[58]</sup>

## 6.2. Advancing the Scope of Interdisciplinary Inquiry into Artificial Intelligence and Language Education

Ultimately, the progression of the field necessitates comprehensive and ongoing research that integrates the domains of artificial intelligence, linguistics, education, ethics, and cognitive science. It is essential to conduct longitudinal studies to explore the enduring impacts of AI-enhanced learning on various dimensions, including language proficiency, critical thinking, intercultural competence, and learner identity <sup>[59]</sup>. The application of ethnographic research, mixed-methods studies, and action research frameworks serves to elucidate the intricate experiences of both students and instructors as they engage with AI-mediated learning environments <sup>[60]</sup>. The establishment of interdisciplinary academic centers dedicated to the intersection of artificial intelligence and education is imperative for fostering collaborative innovation, facilitating ethical reflection, and ensuring the socially responsible design of AI within the realm of language and linguistics education.

## 7. Conclusions

The incorporation of artificial intelligence within the realms of language, linguistics, and higher education signifies a significant pedagogical shift characteristic of the 21st century. The growing impact of AI systems on the domains of language instruction, acquisition, investigation, and evaluation positions higher education institutions at a critical juncture. This study has examined the significant opportunities as well as the intricate difficulties that arise from this convergence. The integration of advanced technological tools, including adaptive learning platforms, natural language processing systems, virtual tutors, automatic

evaluation technologies, and multimodal learning environments, presents significant potential for the personalization of educational instruction, the democratization of access to language education, and the enhancement of linguistic research methodologies. The innovations presented herein demonstrate significant potential for tackling enduring issues within the realm of language pedagogy, notably those pertaining to learner diversity, the scalability of assessments, and the limitations imposed by resource availability. The integration of artificial intelligence within the domains of language and linguistics education prompts significant ethical, cultural, and philosophical inquiries that warrant thorough examination. The challenges posed by algorithmic bias, data privacy concerns, linguistic capitalism, technological inequities, and the potential depersonalization of humanistic learning necessitate thorough examination and a commitment to institutional accountability. The increasing dominance of corporate entities in the realm of AI tools introduces significant complexities regarding the preservation of academic independence, the fairness of access, and the commercialization of language acquisition. The examination of the theoretical frameworks, which encompass sociocultural theory, constructivism, second language acquisition theories, AI education models, post-humanist viewpoints, and critical pedagogy, reveals that the trajectory of AI-enhanced education extends beyond mere technical optimization. Rather, it necessitates approaches that are profoundly ethical, culturally attuned, and pedagogically sound, placing the learner at the forefront as a complete individual situated within social, cultural, and cognitive frameworks. In the pursuit of educational advancement, institutions must implement hybrid pedagogical frameworks that maintain the essential contributions of human educators while simultaneously harnessing the capabilities of artificial intelligence for enhanced personalization, feedback mechanisms, and resource efficiency. The transformation necessitates a comprehensive approach that encompasses faculty development in artificial intelligence literacy, the establishment of transparent data governance policies, the implementation of culturally welcoming design practices, and the fostering of global collaborations aimed at achieving digital equity. In conclusion, the incorporation of artificial intelligence into the realms of language and linguistics education presents a significant opportunity to redefine



the paradigms of teaching, learning, and communication within the context of the digital era. When implemented with care, artificial intelligence has the potential to enhance rather than supplant the essential humanistic values that render language education a crucial arena for critical examination, cultural interaction, and individual development. The imperative for higher education is to confront this challenge by positioning AI not merely as an inevitable technological outcome, but rather as a meticulously developed instrument that serves the principles of democracy, equity, and ethical education for everyone.

## Author Contributions

Conceptualization, B.G.A. and L.İ.A.; methodology, M.M. and S.J.A.; software, V.S.K.N.; validation, Z.M.B., L.Z.A., E.M.; resources, G.V.B.M., T.R.A.; data curation, V.S.K.N.; writing—original draft preparation, L.İ.A.; writing—review and editing, R.M.A., B.G.A.; visualization, M.M., S.J.A. and Z.M.B.; supervision, B.G.A. and B.G.M.; project administration, L.İ.A.; funding acquisition, T.R.A. All authors have read and agreed to the published version of the manuscript.

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Not applicable.

## Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this paper. This research was conducted independently, with no financial or commercial influences affecting the outcomes.

## Data Availability Statement

The data used for the study are available from the correspondence author upon reasonable request.

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## Conflicts of Interest

The authors declare no conflict of interest.

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