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Redefining Language Education in the AI Era: Challenges, Opportunities and Perspectives

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Abstract
Recent years have seen a substantial evolution in the nascent field of artificial intelligence (AI), influencing a wide range of disciplines. The domain of language teaching and learning is similarly undergoing a transformation driven by this technological upheaval, that of Industry 4.0. However, the integration of AI in this field is often undertaken without sufficient reflection, despite the profound social and personal implications it entails, including ethical concerns and data protection issues. The objective of this chapter is, essentially, threefold: 1) it contextualises language teaching within the burgeoning technological milieu, underscoring the interplay between AI and language education; 2) it explores the challenges and opportunities in language teaching arising from AI integration; and 3) it explores the potential of AI to enhance the efficiency and effectiveness of language education, while also critically examining the possible adverse effects that its application might bring about.

Keywords: artificial intelligence, second language acquisition, language education, language learning.

9.1. Introductory Remarks

The emergence of artificial intelligence (henceforth AI) within contemporary society has brought with it significant transformations, revolutionising the approach not only to mundane tasks but also to those of a more specialised nature (see, e.g., Russell et al., 2022, for an overview of the field). In this context, numerous scholars acknowledge the advent of what is often referred to as the Fourth Industrial Revolution (or Industry 4.0), a period characterised by the integration of advanced technologies such as AI into sectors like healthcare, finance, transportation, entertainment and the media, human resources and education. Within language education, AI is poised to assume diverse roles in all these fields, serving as a tutor, a learning facilitator, and even an advisor, according to Dakakni & Safa (2023). The potential of AI to mimic human thought processes – such as learning, reasoning, memory, planning and problem-solving – is significant. Combined with its capabilities in voice and image recognition, natural language processing (NLP), and multidimensional factor analysis (Abdullah Sharadgah & Abdulatif Sa'di, 2022), AI is providing substantial (and obvious) benefits in the field of language education. Furthermore, the previous decade has been characterised by unprecedented developments in deep learning technologies (Surdeanu & Valenzuela-Escárcega, 2024; see also Goodfellow et al., 2016, for a more general review) departing from symbolic approaches to NLP and, by extension, to AI (see Gómez-Pérez, 2023, pp. 57 and ff., for further information). In fact, language-centric AI is "undergoing a paradigm shift with the rise of neural language models that are trained on broad data at scale and are adaptable to a wide range of monolingual and multilingual downstream tasks" (Agerri et al., 2023, p. 16).

Nonetheless, for the purpose of proposing the responsible use of these technological advancements, it is crucial to acknowledge that a number of ethical dilemmas are subject to debate. These challenges extend beyond the general implications associated with the use of AI to encompass issues related to language, linguistic policy and the phenomenon of linguistic cybercolonialism. Moreover, the rapid pace of technological advances here scarcely affords adequate time for the execution of comprehensive studies aimed at assessing the benefits and potential risk fac-

tors involved. Consequently, this acceleration brings with it the risk of insufficient understanding of the manner in which these technologies alter various facets of life and human behaviour (Jenks, 2023).

9.2. The Interplay between Language Teaching and AI

The domain of language teaching is one sphere of activity in which AI exerts a considerable influence. As shown in subsequent sections of this chapter, AI facilitates the adoption of innovative methodologies that significantly bolster the learning process, such as gamification (i.e., the application of elements of game design in educational contexts to increase motivation and learning outcomes). Such an enhancement is attributable to four factors in particular (Akgun & Greenhow, 2022; Caldarini et al., 2022; Chen et al., 2020; Dakakni & Safa, 2023; Roll & Wylie, 2016; Wei, 2023; Zhang et al., 2020): 1) the scope for personalised learning,[1] fundamentally through the adaptation of content and pace of learning to accommodate individual requirements, this facilitated by the capacity of AI to identify specific learning difficulties; 2) the adoption of hybrid instructional models, which integrate traditional face-to-face teaching with technologically mediated education; 3) the provision of augmented support for learners engaged in the development of collaborative projects; and 4) real-time interaction with intelligent systems that can simulate real-life linguistic interaction in natural, realistic contexts, although with difficulties in replicating cultural and contextual nuances (e.g., idioms, colloquialisms, etc.) characteristic of natural languages (Rebolledo-Font-de-la-Vall & González-Araya, 2023).

1. Although findings are not consistent, some studies have shown that AI can sustain the quality of student feedback and intrinsic motivation, and can enhance the efficacy of self-monitoring in preserving student performance, thus promoting a sense of empowerment in their self-regulated learning practices. Also reported is the possibility that groups trained using AI make additional effort in their peer reviews, resulting in more extended comments; such lengthier comments have been linked to improved learning and self-regulation, and to a reduction in student anxiety (Darvishi et al., 2024; Lai et al., 2023; Wei, 2023). It is crucial, then, to acknowledge the significance of affective states and motivation in the success of language learning performance (Dewaele, 2022).

This is pertinent to the framework of a constructivist approach in the realm of language pedagogy, underpinned as it is by sociocultural theory (Lantolf & Pavlenko, 1995). As argued by Kannan & Munday (2018, 14), "language learning is fundamentally a socio-cultural experience". Concurrently, Blake (2017) observes that collaboration between two or more learners is likely to yield more sophisticated and precise expressions in a foreign language. Furthermore, applying Situated Learning Theory to language acquisition underscores the crucial role of a community, where experienced speakers facilitate the learning process for newcomers. This approach emphasises "the relationship between learning and the social situation in which it occurs" (Lave & Wenger, 2009, p. 14), making clear the importance of contextual and social dimensions in learning processes. At the same time, and as noted by Anderson et al. (1996), we should acknowledge that the situated nature of learning is not a universal requisite for all learning experiences, although it is greatly beneficial in the case of language learning. In this context, it appears that AI could, to a certain extent, fulfill the role of an interlocutor in this form of learning, especially if the process becomes wholly immersive. This, in turn, would have profound effects on the conceptualisation of interaction within language teaching and learning. Moreover, it potentially entails shifts in linguistic behaviour on a global scale (Jenks, 2023).

The ability of AI to simulate real-life situations through multimodal teaching learning is of particular import. To date, achievements have remained elusive, despite efforts to this end within communicative (or interactive-based) and sociocultural methodologies. Yet there is the potential for the great success of AI here, moving beyond the era of Computer Assisted Language Learning (CALL) that has been dominant over the past 30 years. It also has the potential to influence and enhance more recent advancements like Mobile Assisted Language Learning (MALL), evolving towards Intelligent CALL and Networked Learning (NL) (Kannan & Munday, 2018). These developments represent a shift towards "learning in which ICT [Information and Communication Technology] is used to promote connections between one learner and other learners, between learners and tutors, and between a learning community and its learning resources" (Jones, 2015, p. 5).

In a similar vein, the integration of virtual reality (VR) alongside AI in language learning should be emphasised. Some studies highlight the benefits that VR can offer in language learning in a variety of ways: the creation of real-life contexts, a reduction in anxiety, etc. (Ma, 2021; Tai & Chen, 2021; Melchor-Couto & Herrera, 2022; Gruber et al., 2023; Kaplan-Rakowski & Gruber, 2023; Ironsi, 2023). In this respect, multimodality (Bateman, 2021; Kress & Van Leeuwen, 2001) currently constitutes the framework within which any language learning should take place, alongside the sociocultural approach (Dressman, 2019; Guo, 2023). Whereas technology applied to language teaching has thus far incorporated this multimodal dimension gradually and to a certain extent (Herrero, 2023), AI could facilitate substantial improvements here, including the ability to conceptualise communication within the realms of language education and acquisition as transcending mere aggregations of utterances. AI possesses the capacity to analyse and generate messages that incorporate a multiplicity of communicative modalities, engendering a variety of meanings through the use of heterogeneous semiotic resources (including, of course, those of a social nature). This is exemplified by the recent development of Google's multimodal AI model Gemini (Durante et al., 2024), particularly as further progress is made in the transition from multimodal understanding models to multimodal generation models, and with the application of compositional AI. The latter is understood as the use of AI modules with diverse functions that combine to address complex problems, from the amalgamation of which new capabilities emerge, ones which are unattainable for a single module (Du & Kaelbling, 2024; Martie et al., 2023; see also Wei et al., 2022, for emergent abilities of large language models). In addition, the capacity of AI to furnish instantaneous feedback on the progression of linguistic competencies must be underscored, an issue that is of key importance in language learning, given that feedback can propel the learning process (see Chen et al., 2024).

It is thus likely that the use of AI in the years ahead will enable not only the establishment of personalised language-learning programmes, but also the reduction of the linguistic gap between what is taught in classrooms and the reality of languages in use. This approach brings students closer to a sociolinguisti-

cally immersive reality, by allowing for the consideration and adjustment of content based on the linguistic distance between the macro and micro levels of language use, as well as the cultural, linguistic, and social diversities of linguistic practices.

Within this discourse, several scholarly contributions recommend eclectic methodologies that integrate conventional paradigms with innovative, technology-based methodologies, including AI. Consequently, the synthesis of pedagogical strategies that accentuate the communicative and contextual dimensions of language usage and acquisition – the communicative approach, whole language approach, etc. – seems to facilitate an appropriate means of embedding AI into language education. This integration does not invariably sideline the teacher, and it has been argued convincingly that both blended and situated learning methodologies tend to produce favourable outcomes (Valledor et al., 2023).

As will be discussed below, tools such as intelligent chatbots facilitate language practice in real-world contexts, while adaptive systems tailor content to the user's level, thereby optimising the learning process. AI also contributes to the analysis of linguistic outputs, enabling precise feedback on pronunciation and grammar, and provides learning recommendations based on the user's progress and preferences. This significantly enhances the educational experience and could even alleviate the anxiety associated with foreign language production tasks (Abdullah Sharadgah & Abdulatif Sa'di, 2022).

9.3. AI-Based Technology for Language Learning

AI technologies as applied to language learning scenarios encompass a multi-faceted range of integrations, as described in Pokrivcakova (2019; see also Abdullah Sharadgah & Abdulatif Sa'di, 2022, for the use of AI in English teaching and learning). These range from intelligent tutoring systems (ITS) and chatbots (also conversational agents, virtual assistants or pedagogical agents) (Hwang & Chang, 2023; Zhai & Wibowo, 2022) to speech recognition prototypes. Son et al. (2023), for their part, review AI's role in foreign language learning, highlighting a future where AI-supported tools become integral to language edu-

cation, covering seven areas of application: NLP, data-driven learning, automated writing evaluation (AWE), computerised dynamic assessment, intelligent tutoring systems, automatic speech recognition and chatbots.

Gkountara & Prasad (2022), for instance, present an overview of variegated AI implementations within the domain of (foreign) language learning. They outline how AI-based technology can enhance diverse aspects of learning here, such as automated speech recognition (ASR) for pronunciation and oral proficiency training (see Agarwal & Chakraborty, 2019; Liu et al., 2022); the development of tailored syllabuses that adapt to learners' progress; and the use of virtual and augmented reality to gamify learning and promote collaborative learning (see Hung et al., 2018). They also highlight the optimisation of learning applications to accommodate different learning styles (e.g., Duolingo); the evaluation of text readability (e.g., ReaderBench; see Dascalu et al., 2013); the use of AI-powered translation tools (e.g., Google Glass Enterprise Edition or Google Pixel Buds); and AWE to improve writing skills, support learner autonomy, and reduce teachers' workload by providing immediate, detailed feedback (see Zhang, 2021, for a review of AWE systems and the importance of navigating challenges such as the effective comprehension of AWE feedback among both educators and learners). Additionally, Gkountara & Prasad (2022) showcase robot-assisted language learning (RALL), as a subfield of human-robot interaction (HRI), for interactive engagement, potentially offering unique advantages over computer-assisted language learning (CALL) (albeit more research is needed to establish robust design and implementation guidelines) (see Randall, 2020), including: the use of AI to mitigate language learning anxiety; personalised feedback through formative assessment with AI and machine learning techniques; and the facilitation of computer mediated communication (CMC) and storytelling (e.g., Mentira, Holden & Sykes, 2012).

9.4. Ethical Considerations

As we know, a substantial number of ethical considerations envelop AI, particularly within its educational applications (Bod-

dington, 2023; Nguyen et al., 2023; Satpute, 2023; UNESCO, 2019, 2021). This chapter focuses exclusively on those aspects which, in relation to language teaching, have specific, significant importance.

Firstly, during the development of individualised learning trajectories, AI constructs models of both learners and educators, incorporating data on their emotional, social, motivational and linguistic states, alongside their preferences within these domains. As indicated in numerous studies, this raises the potential for infringing or compromising privacy (Akgun & Greenhow, 2022) and, among other concerns, it also intersects with issues pertaining to linguistic rights, such as the choice of language and its dialects, for instance.

On the other hand, the challenge of distinguishing between oral/written texts produced by humans or by AI (Farhi et al., 2023; Renzella et al., 2022; Susnjak, 2022; Tlili et al., 2023) represents a recurrent issue in contemporary language teaching in formal contexts. Students often use this technology not to learn languages, but simply to help them pass their courses, possibly because AI is not integrated into classrooms as a supportive tool, but rather is seen as a form of plagiarism (for the time being, largely an undetectable one). Therefore, it is crucial to encourage both educators and students to reflect on the ethical dimensions of using these tools in academic settings, and on the importance of individual linguistic creativity in language learning, without demonising the use of AI-based technologies.

A critical issue to consider in the relationship between AI and language teaching is the status of minority languages in this Fourth Industrial Revolution. A "Digital Language Extinction" would affect not only minority languages but also those which, although of majority use in a specific area, are minority ones in other countries (see Kornai, 2013). This situation has been especially apparent in the field of automatic translation, as noted by Jenks (2023). However, there is also the risk that, within the context of language education, the increased prominence of majority languages, particularly those serving as a lingua franca (i.e., English in the contemporary global context, see Crystal, 2003) and perceived (erroneously) as inherently more valuable, might lead to further marginalisation, if not the effective extinction, of languages with fewer speakers.

This is not a trivial matter, and has led European institutions (Council of Europe Secretariat of the European Charter for Regional or Minority Languages, 2022; European Parliament, 2018) to issue a series of reports aimed at mitigating the precarious situation of numerous languages at risk of digital extinction, in order to fulfill the obligations of the *European Charter for Regional or Minority Languages*.[2] UNESCO has also voiced its concern through various resolutions that seek to promote multilingualism and protect minority languages in the digital domain. In this context, AI can be seen as offering dichotomous potentialities: on the one hand, it offers positive ones, in that it can serve as an invaluable means of collaboration in the development of educational applications targeting the preservation and expansion of those languages in danger, provided that it is aptly designed and trained for such endeavours. On the other hand, there exists a plausible risk that the capabilities of generative AI for these languages might be severely limited due to their underrepresentation in available datasets.

Not all languages enjoy the same levels of technological, social, political and economic supports to ensure their continuance in the AI era, leading to an additional degree of digital colonisation by predominant languages. In their examination of thirty European nations, Rehm & Way (2023, p. 38) point out that "with the exceptions of English, German, French and Spanish, all languages we investigated exist in socio-political and economic ecosystems that do not incentivize, encourage or foster the development of technologies for these languages. While all 30 European countries we surveyed have put in place national AI strategies, almost all of these national strategies seem to have either ignored or left out the topic of languages and language-centric AI".

This consideration is linked to the observation that algorithms are inherently non-neutral, reflecting the values and biases of their creators (Akgun & Greenhow, 2022; Alegria & Yeh, 2023; Karan & Angadi, 2023). Consequently, algorithms may, one way or another, incorporate ideological profiles and biases towards languages, fostering inequality, social stratification and

2. See also the "Report on the state of Language Technology in 2030" (Way et al., 2022) from European Language Equality (2022).

discrimination based on linguistic variables, as well as conforming to specific linguistic policies rooted in social, economic, or strategic interests.[3]

Therefore, it is necessary to incorporate a framework of social justice that also extends to languages and their pedagogy. Such a framework must address and ameliorate inequalities towards ensuring equitable access to technological advances, irrespective of an individual's socioeconomic status. This approach seeks to prevent the exacerbation of the digital divide and the subsequent marginalisation of particular communities, regardless of whether these concerns arise from the status of minority languages or from socioeconomic and political circumstances.

9.5. Conclusion

In the current chapter, we have described both the benefits and the ethical considerations associated with the deployment of AI in the domain of language learning. Clearly, AI has the potential to facilitate the development of tailored learning curricula that not only align with the aspirations of learners but also meticulously track their progression across all linguistic dimensions, ranging from phonetic to pragmatic aspects, and spanning productive, receptive, mediating, and interactive communicative competences, as well as strategic skills. It is crucial to underscore the great capacity of generative AI in developing multimodal environments which, through the integration of VR, will situate learning within a thoroughly immersive experience. However, given the apparent variations in effectiveness across disciplines, a thorough exploration of this issue within the context of language teaching and learning has become essential (Pumptow & Brahm, 2023). The broad benefits of AI may entail certain drawbacks, particularly if there is a lack of awareness regarding the potential consequences that its implementation might have on the use and learning of minority languages. In this context, the need for social justice becomes evident, demanding the elimina-

3. Particularly noteworthy here is the VirtuSign project in terms of its innovative integration of AI, facilitating a gamified environment that enables interactive learning and practice of the American Sign Language (ASL) alphabet (Tukpah et al., 2023).

tion of biases in AI. Such biases can arise from the limited data available for minority languages, as well as from the disparities in access to technology due to socioeconomic factors.

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