AI, SEMIOSIS, AND THE FUTURE OF LANGUAGE ACQUISITION: A GLOBAL APPROACH TO EDUCATIONAL SEMIOSPHERE

Ilaria Ingrao
University of Turin
ilaria.ingrao@unito.it

Seyedeh Maede Mirsonbol
University of Turin
seyedehmaede.mirsonbol@unito.it

Abstract

This study explores the role of artificial intelligence in second language (L2) acquisition and the tremendous opportunities that it creates for personalized learning. As the 2030 EU agenda for quality education suggests, the emphasis of research and practice with AI-based approaches should be to foster the learning process. For this reason, the theoretical aspect of this research examines how AI can be situated in the L2 context for promoting personalized learning experiences. The study, specifically, evaluates the effectiveness of the current role of AI in L2, critically reviewing its reflection on the ethical implication of AI in education using a semiotic anal-

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ysis. The objective is to understand how AI adapts to students' cognitive and individual needs to be used as a methodology in learning frameworks. Additionally, the research raises two questions which address the role of AI in Barthes's (1977) *author-reader* approach, proposing a semiosis-based learning model adapted from Eco's *encyclopaedia* (1976, 1984) and Lotman's concept of *semiosphere* (1985). This model aims to ensure deeper personalized learning by reversing traditional pedagogic approaches and analysing the role of each element (student, teacher, text, and AI) inside the educational sphere. In conclusion, the study highlights how AI-driven tools can be integrated into L2 education, facilitating communication, content creation, and engagement with new topics in an inclusive manner.

Keywords: Artificial Intelligence, Second Language Acquisition, Semiotic Analysis, Semiosphere, Quality Education.

1. Introduction

The rapid evolution of artificial intelligence (AI) is not only altering the way we communicate but also redefining the very processes through which language is learned, and meaning is made. In the field of second language (L2) acquisition, AI as a technology-enhanced tool promises to ease teachers' administrative burden, thereby allowing greater focus on the educational relationship between teachers and students. In this context, machine learning models grow increasingly sophisticated, their ability to engage with linguistic patterns, cultural contexts, and semiotic systems challenge traditional theories of language (O'Halloran 2022). Semiosis – the process through which signs convey meaning and create diverse interpretations (Jappy 2020) – is integrated with AI while introducing new possibilities for developing language assessments that are not only responsive, but contextually aware. This intersection marks a critical turning point, inviting a global rethinking of educational space that places AI as a particular multifaceted technology within the learning atmosphere while raising crucial questions regarding its social, political, cultural, and ethical implications (Woo & Choi 2021; Limna et al. 2023; Marcuccio et al. 2025).

However, the adoption of AI-based education is not without challenges that can involve analysis of AI as part of a broader socio-technical system, structured around economic interests, market logics, and political visions of knowledge. From the perspective of education, these technologies do not merely support teaching, they also reflect and simultaneously shape specif-

ic cultural and ideological imaginaries about the future of education and its role in society (Jasanoff 2015). In this sense, AI acts as a true epistemic device that poses new challenges concerning the autonomy of teaching, the protection of students' personal data, equitable access to digital resources, the transparency of decision-making algorithms, and the reproduction of discriminatory biases within educational processes.

According to the human-centred AI lab at the University of Oxford[1], the fusion of educational philosophy and technology-enhanced learning can be seen as an upheaval to build systems that truly contribute to learning by doing. This notion means learning with AI is, in fact, engagement in a more-than-human dialogue, while experimenting with building conscious learning that requires active presence of L2 learners in educational designs. Drawing from research in philosophy of education and semiotics, we take an interdisciplinary approach to explore the ethical and pedagogical implication of personalized learning with AI, while the theoretical section is designed based on Barthes's (1977) view on *author-reader* approach arguing that meaning of a text (in this research the text stands for L2 contents as written, audiovisual, etc.) should emerge from the text itself and the way readers/students interact with it. To navigate this notion deeper, we situate Barthes's theoretical framework within the context of *student-centred learning theory* (Piaget 1964) to critically analyse the incorporation of United Nations' (UN) quality education[2] norms in AI-driven applications for L2 acquisition. This attempt highlights that quality education fosters the integration of sustainable learning into teaching curriculum (UNESCO 2020) while empowering L2 learners to engage with AI effectively.

2. Theoretical framework on educational sphere

2.1. Edusphere

In the context of L2 development, it is valuable to, first, define language *acquisition* and its two primary theoretical orientations. The concept of language acquisition is closely aligned with constructivist theory of learning. This perspective, explored by scholars such as Vygotsky (1978), Krashen (1982), Freeman and Freeman (2004), and more recently Gambino and

[1] Retrieved from: https://hailab.ox.ac.uk/

[2] United Nations' 2030 agenda for sustainable development is consisted of 17 different goals to help developed and developing countries for the future. Quality education is goal number 4 which rises awareness and ask for practical strategies to improve education and growth. For more information read: https://www.un.org/sustainabledevelopment/education/

Share (2023), emphasizes the importance of exposure to comprehensible input and implicit language development through meaningful interactions, be it with human or more-than-human. Rather than focusing on the mastery of rules, acquisition-based approaches prioritize the functional use of language in communicative settings, where the emphasis is placed on understanding and conveying meaning. This orientation reflects a pragmatic view of language, where learners are encouraged to engage with language as a tool for real-world communication.

The teaching methods, learning materials, and digital platforms used for L2 acquisition are all part of a complex system of signs. Therefore, the integration of semiotics fits well with the vision that supports AI-enhanced learning categorizing itself within the educational sphere promoting acts of semiosis for creating interpretations and constructive language use. Additionally, *edusphere* is utilized as a brand name for referring to various educational platforms used inside the learning environment. The term edusphere is a blend of *education* and *sphere*, commonly used to describe the comprehensive realm of education as an adaptive system, encompassing technologies, philosophies, and communities of educators and learners involved in it (Duggan-Haas 2004). Furthermore, it refers to the collective digital environment, and its discussions on signs' interpretation[3]. Edusphere can be conceptually connected to Lotman's *semiosphere* (cfr. 1985), described as a semiotic space outside of which "there can be neither communication nor language" (Lotman 1990: 124). If the edusphere is treated as the total environment of learning where no semiosis can exist outside of it, then it could be seen as a subdomain of the semiosphere. This means that the edusphere is where learning happens, and "learning is a semiotic engagement" (Stables 2005: 375).

In the L2 edusphere, it is important to focus on active participants (teacher, student, text, and AI) and their interactions that lead toward evolving interpretations. Constantinidou (2023) states that "language education is constantly adapting to an ever expanding and transforming digital world" (p: 174) and while the role of AI cannot be avoided, it is essential to take a pragmatic view and acknowledge its presence entangled with semiosis activities inside of the edusphere. In this case, AI becomes part of the meaning-making process as it stands parallel to learning communication to steadily connect the flow of semiosis dialogue while students (the reader of L2 learning context) stand as the main figure in meaning-making.

[3] EduSphere Team. (n.d.). EduSphere: An innovative online learning web app, Devpost, Retrieved from: https://devpost.com/software/edusphere-2d89rx

This view is in contrast with the teacher-centred approach[4] in pedagogy which situates teachers as the main author of L2 learning context , allowing teachersthem to step away from theirbe in control with fixed authority in the class (a fixed author-centred approach)s. This notion is in line with Campbell (2019), who expands on the idea of *semiosis-as-learning*, describing it as a process of meaning-making that bridges the learner with their surrounding environments. These environments, or semiospheres, exist on two levels: internally, within the learner's mind, and externally, within the community they belong to. Understanding semiosis requires active engagement with both dimensions, as learning encompasses not just the classroom setting but also the wider social, digital, and cultural landscape in which it occurs. To avoid obstacles in the semiosis-as-learning process, educators and AI-enhanced content creators for L2 acquisition must develop frameworks that can adapt the complexity of the digital semiosphere in favour of a dynamic and functional atmosphere for today's globalised digital world (Hartley et al. 2020).

The network of minds and semiosis acts that are placed inside the edusphere can be a strong reminder of Eco's theory of the *encyclopaedia* that significantly reconfigures the classic structuralist view of semiotics and textual interpretation. Eco extends the notion of meaning-making by incorporating the reader's interpretive role into the generative process of textual meaning (Eco 1976). Desogus (2012) explains that an aesthetic text serves not to communicate but to challenge and reshape semantic codes for conceptual understandings. Eco's semiotics investigates the production and interpretation of signs within communicative practices. Therefore, meaning arises through a process mediated by shared knowledge, embedded within what he terms the encyclopaedia, "a multidimensional, collective system of information and interpretation" (Desogus 2012: 501). The emphasis is on the interpretative process as a form of cooperative work. Interpreters rely on their individual encyclopaedias to select meanings that render the textual elements coherent, while simultaneously validating these selections within the broader interpretive sphere (Desogus 2012: 517). This cooperative dynamic allows for interaction between individual cognition and shared cultural knowledge, thereby reinforcing Eco's vision of semiosis as a continuous, open-ended system of meaning-making grounded in collective and evolving models. This encyclopaedia exists inside the edusphere and connects teacher to student, student to student, and most importantly

[4] According to British Council for L2 education: https://www.teachingenglish.org.uk/professional-development/teachers/knowing-subject/t-w/teacher-centred

AI as a facilitator that holds the educational venue for learners to build knowledge through experiences, interaction, and reflection.

In (Table 1), there are the theoretical perspectives in semiotic studies to create a roadmap in relation to educational student-centred approaches for this study which highlight the essential role of AI and learner within the L2 acquisition.

Table 1: Theoretical approaches for an AI-enhanced L2 acquisition

Concept	What it means	Connection to Edusphere
Semiosphere	Cultural space where meaning is created	Edusphere exists *within* this larger semiosphere
Semiosis-as-learning	Learning as a process of meaning-making	Core process that drives how people learn in edusphere
Edusphere	Total environment of educational activity	A meaning-rich space shaped by semiosis

2.2. Quality education

Quality education, central to UNESCO's 2030 agenda, transcends disciplinary boundaries and calls for a shift in pedagogy toward globally relevant content and its public awareness. In light of the existing initiatives and technologies, studies attempt to formulate the idea of AI to increase the quality of education (Zygmunt 2016; Al-Jarf 2022; De la Fuente 2022; Williams 2024). As Tonkin (2023) argues, language is central to global discourse, enabling inclusive and persuasive communication. To implement quality effectively, L2 educators must address the persistent knowledge gap and create inclusive, multimodal, and personalized learning paths. To develop learning with AI in a pragmatic framework, it is important to enhance L2 learners' awareness of AI while following the UNESCO's (2019) framework that adapts AI as a facilitator for learning. The framework emphasises the role of digital technologies in knowledge deepening and creation (Pedro et al. 2019: 18) that fosters critical thinking and equips learners to address global challenges.

Integrating quality education into L2 acquisition encourages AI literacy and the use of global topics; however, the main aim is to thoughtfully implement AI, not as a novelty, but as a transformative tool grounded in pedagogy (Argondizzo & Mansfield 2022). AI offers opportunities for personalized learning and enhanced engagement through adaptive content, fostering communication and collaborative learning which all are part of the quality education agenda (Kamalov et al. 2023). These competences

are essential in adapting to rapid societal change and addressing complex global issues. AI-enhanced L2 acquisition should support learning by personalizing content, encouraging critical thinking, meaning-making from students' point of view (Sandhu et al. 2024). AI must adopt learner-centred, interdisciplinary, and flexible frameworks that reflect contemporary educational needs while fostering global mindsets (Leicht et al. 2018). Learner-centred approaches, if designed for L2 apps, help learners to "reflect on their own knowledge and learning processes" (Leicht et al. 2018: 49) which enhances the quality of semiosis practices applied to produce diverse interpretations.

3. Theoretical framework on AI in Education

3.1. Artificial Intelligence: between pedagogical innovation and ethical risks

The use of AI within the educational landscape appears as a controversial and multifaceted phenomenon. Numerous studies highlight the potential benefits offered by using AI devices. From the teachers' perspective, these technologies can lighten activities that are often burdensome in terms of time and resources, such as improving decision-making processes by teachers and administrators or assessing learning tests (Okonkwo & Ade-Ibijola 2021). AI can also support education by automating routine tasks, allowing teachers to focus on personalized student support (Pedro et al. 2019). From the students' side as well, it introduces multiple opportunities. AI makes it possible to personalize learning paths more effectively, fostering greater engagement in study and accelerating the acquisition of skills. It can also help overcome barriers related to disadvantaged contexts by boosting self-confidence, facilitating interaction, promoting learning propensity, and fostering creativity (Smutny & Schreiberova 2020; Kulkami et al. 2022; Handini et al. 2022; Pratama et al. 2023; Khreisat et al. 2024; Marcuccio et al. 2025). In particular, AI has proven effective in language acquisition (Subramanian et al. 2020) thanks to functionalities based on personalization and interactivity, which support the construction of an autonomous and lasting educational experience (Betal 2023). However, despite these advantages, the ethical, political, and social implications associated with the use of AI are rarely critically addressed:

> In the field of education, artificial intelligence can aid in areas such as personalized learning, intelligent tutoring systems, automated grading, and adaptive assessment. The use of AI in education has been shown to improve student outcomes such as retention rates,

> academic performance, and learning process engagement (Ouyang et al. 2022; Chen et al. 2020). In addition, AI can provide educators with data-driven insights for identifying student strengths and weaknesses and customising instruction to meet individual requirements (Bates et al. 2020; Prakash et al. 2021). However, the incorporation of AI into education also raises ethical concerns, such as data privacy, algorithmic bias, and the possibility of human teachers being replaced (Masters 2019). Therefore, it is essential to carefully consider the potential benefits and challenges associated with the incorporation of AI in education and to implement the necessary policies and practices to ensure its responsible and ethical use (Harish et al. 2024: 219).

Many issues highlight the ethical challenges of an AI-oriented approach to teaching (Mamlok 2024) while challenging both technical and pedagogical aspects. The main points are the inadequate training of teachers in the conscious and effective use of these tools (Woo & Choi 2021; Limna et al. 2023; Marcuccio et al. 2025); insufficient protection of privacy and lack of transparency in information management; the need to strengthen data protection policies and adopt more robust practices of informed consent (Woo & Choi 2021); doubts about the reliability of outputs generated by AI applications (Limna et al. 2023); and finally, the risk of superficial learning, as well as the potential weakening of autonomous skills, writing ability, and critical thinking (Sarosa et al. 2021; Marcuccio et al. 2025). Faced with these complexities, it is essential to adopt a critical and balanced perspective: the analysis of the use of AI in education must be neither naively optimistic nor rigidly alarmist. It is necessary to promote a reflective and student-centred approach that, while recognizing the potential of AI, does not overlook its deeper implications. An utopian approach tends to see technology as neutral, ignoring its sociopolitical context, while the dystopian view focuses on structural issues but overlooks its positive social potential (Mamlok 2024).

On one hand, these tools can facilitate learning by democratizing education at multiple levels, both social and cognitive; on the other, they can become an additional tool of alienation, imposing their own worldview and suppressing human creativity (Cooley 1987). The question we must therefore ask ourselves is whether it is possible to create AI capable of enhancing learning and increasing reflection rather than gradually destroying it. Among the major concerns related to the introduction of AI in the educational system is the potential atrophying of social skills. Some devices, in fact, risk functioning as tools that are "anti-relational, anti-dialogical, and rooted in the assumption of education and child development that do not

accord with social and cognitive science" (Means 2018: 117). In this sense, AI can negatively affect contexts where learning – and the strengthening of knowledge – relies on peer-to-peer knowledge sharing, hindering fundamental collaborative and dialogical dynamics (Matsuda 2021). Although it is undeniable that, on an operational level, AI can provide valuable support to learning, it is essential to promote its conscious use. The personalization of learning paths, in addition to easing teachers' workload and improving students' focus, can become a valuable tool for stimulating critical thinking. It can also encourage more exploratory learning methods, open to reflecting on different scenarios and building complex knowledge:

> Artificial intelligence asks learners to think critically, challenge presumptions, and solve challenging problems besides transmitting information. Artificial intelligence assists in preparing people to meet the ever-changing demands of modern society by creating challenges that need critical thinking and imitating real-world scenarios. Al-driven learning personalization is essential for fostering critical thinking. […] Learners are urged to investigate problems, test theories, and critically assess data to cultivate a critical attitude beyond rote learning. (Khreisat et al. 2024: 8524)

3.2. Deeper into ethics approach to AI: privacy, bias, and ethical dilemma

A deeper analysis of the risks associated with the use of AI in education reveals a complex set of issues involving safety, privacy, autonomy, confidentiality, and the use of students' personal data (Khreisat et al. 2024). Often, personalization is considered an undisputed strength in learning, yet the concrete risks it entails are overlooked. One of the main dangers is the possibility that students may become confined within algorithmic logics that create actual *filter bubbles* (Pariser 2011). This process leads to a standardization that affects one of the most vulnerable social groups, risking the suppression of creativity and flattening the diversity of individual cognitive pathways. This phenomenon is fuelled by systems based on inductive approaches that presume a linearity between similar individuals and between past and future behaviours (O'Neil 2017; Sadin 2019; Numerico 2021). AI has the capability to collect, process, and analyse vast amounts of data. However, indiscriminately applying this potential to the educational context may constitute a serious risk factor. Physical, cognitive, and emotional information can be easily acquired through devices that would allow the study and monitoring of students' reactions and their level of attention (Peng & Nagao 2021). This approach tends to transform the

educational environment into a mechanism of control, in which teaching is reduced to performance surveillance, without a real consideration of the ethical implications connected to the collection and management of personal data. Moreover, delegating the monitoring of educational processes to third-party-owned tools entails a high ethical and social risk, raising serious concerns regarding the use of personal data for inadequate surveillance purposes (Kopczynski & Silvia 2024). Appropriate security measures are therefore necessary to prevent the risk of violating the privacy of minors. It is also important that students effectively understand how their information can be used by AI systems (Khreisat et al. 2024). Although AI offers significant opportunities to enhance the educational sector through greater personalization of learning and better implementation of strategies to support students, it is essential to underline that transparency, privacy and security are often the most compromised aspects. The promotion of an ethical, regulated, and responsible use of AI in education cannot therefore disregard a careful consideration of these risks. It is not only a matter of privacy or transparency; the adoption of AI in education also raises serious concerns regarding the proliferation of algorithmic biases, which can lead to inequitable situations by reproducing negative stereotypes – even within educational settings – potentially affecting students directly.

> Another difficulty in automated choice-making is ethical accountability. Reliance on AI advice can absolve people of moral and ethical obligations. It is critical to have a clear accountability system and to specify who is in charge of making important choices. In addition to shielding learners from potentially dangerous choices, this lays a strong basis for trust regarding the application of AI in instruction. (Khreisat et al. 2024: 8524)

The imaginaries we build around technology reflect the kind of future we wish to see, and this also applies to education. The worldviews we adopt are based on shared cultural models (Santangelo 2013), which also materialize through specific technical choices. Devices based on AI are the result of knowledge situated in time, shaped by the interaction between science, technology, and society (Jasanoff 2015). AI can thus be understood as a wheel used for a broader socio technical model, influenced by politics and social dynamics. Education has always been the means through which citizenship is formed, through literacy and qualification (Rahm 2023). When the State assumes responsibility for the education of its citizens, it tends to introduce educational policies aimed at creating a competitive workforce. In this way, education risks becoming a vehicle for a technocratic vision

of knowledge. Therefore, the political and social implications associated with the use of technologies in educational and civic contexts cannot be ignored. Systems like ChatGPT, for instance, can generate enthusiasm but also deep criticism. Their adoption inevitably requires us to question the socio-political contradictions and tensions that accompany the construction and dissemination of such tools (Mamlok 2024). In light of all this, it is essential to consider not only the promised benefits of implementing AI tools in the educational sector, but also the potential risks they entail in ethical, political, and social terms (Figure 1).

Figure 1: An illustration on the use of AI in education (Khreisat et al. 2024)

4. Presentation of the problem and research questions

The role of AI in education has introduced new possibilities for enhancing learning processes, particularly in the domain of L2 acquisition. At the same time, there has been a growing recognition of the value of semiotic approaches in education, emphasizing how meaning-making through signs shape learners' constructive development. Despite these parallel advancements, a significant gap persists in current research concerning the intersection of AI and semiosis within L2 educational methodologies that focuses on student-centred and personalized learning. This study aims to understand what is currently missing in this context by promoting an interdisciplinary approach that is semiotically oriented while raises two fundamental questions:

(1) Can a semiotic-based theory of learning help students in the process of understanding about a sustainable future?

(2) Can AI be trained in this approach for L2 acquisition?

5. Methodology

This study adopts a qualitative and interpretive methodology grounded in the philosophy semiotics and a student-centred perspective, focusing on the pedagogical implications of Barthes' (1977) notion of author-reader approach. This aim is to explore how a theoretical shift from a fixed author-centred interpretation to a fluid reader-centred construction of meaning resonates with modern educational practices, particularly within a student-centred perspective that includes AI. The research unfolds across three interconnected domains: (1) theoretical framework, (2) pedagogical contextualization of AI in a student-centred environment, and (3) quality education: reflective and inquiry-based learning (Figure 2). The theoretical framework is led by Barthes' work to extract key philosophical tenets, especially the rejection of authorial dominance inside the educational semiosphere and the elevation of the learner's interpretive agency in a continuous and open-ended encyclopaedia of meaning-making. These concepts are then mapped into educational paradigms that value learner autonomy, such as constructivist, inquiry-based, and reflective pedagogical approaches. Special attention is given to how Barthes' theory can be reinterpreted to frame the learner as an active meaning-maker in the classroom, rather than a passive recipient of knowledge making.

The recontextualization of the learning environment with AI leads the view towards renewed design of digital spheres for semiosis and global understanding in today's technologically mediated classrooms scaffolded by AI. In this study, AI cannot be eliminated from contemporary pedagogical processes as it is already entangled in activities that occur within the edusphere. AI tools participate in shaping the transmission of meaning in the inner circle of the methodological framework. Therefore, AI will not be just a technological tool, but a semiotic actor – a mediator in the ongoing dialogic exchange between learner and educator. In this model, AI operates within the space between the learner and the teacher, facilitating communication, offering feedback, and personalizing L2 acquisition. The teacher's role thus shifts from authoritative source to co-designer and facilitator of learning experience, while the learner increasingly inhabits the position at the core of the learning sphere and more of a co-author of their educational journey. Meaning is no longer a one-way transmission; it is a distributed, collaborative act across human and non-human agents. And finally, the quality of education is increased by reflective and inquiry-based learning that promotes global awareness in L2 practice. Narrative inquiry by individual learners and their personal learning experiences are pieces of an incorporating edusphere where the learners' own reflective semiosis play an important part in shaping knowledge.

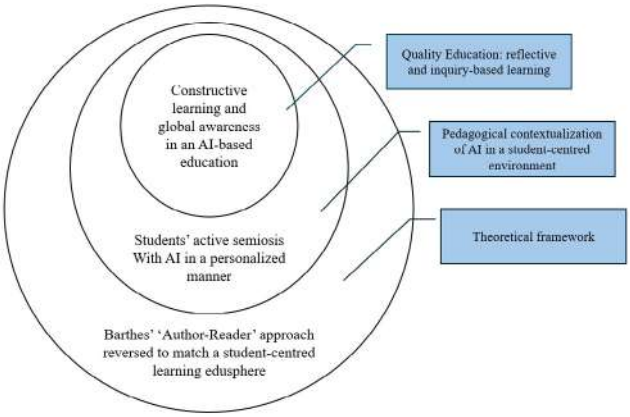

Figure 2: Qualitative and interpretive methodology for a learner-centred edusphere with AI

6. Discussion

The full paradigm in Figure 3 highlights the evolving dynamics when authority and authorship are decentralized. By aligning Barthes' theory with the semiotic complexities of AI-integrated learning environments, this methodology aims to showcase how meaning is constructed, contested, and reimagined in an L2 context when semiosis is used as a communicative facilitator to picture education with AI technology. In doing so, it reaffirms that meaning is never fixed: it is an emergent product of interaction among diverse voices: student, teacher, text, and now AI.

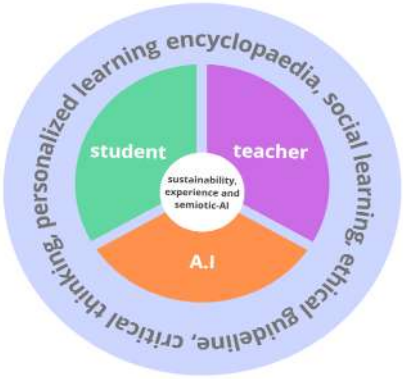

Figure 3: Student-teacher-text-AI model:
A semiotic approach to AI in Education[5]

[5] Figure 3 is a new model developed by both authors in this article to better understand the role of AI in education and how it should be harmonized with other important factors that play critical roles in learning.

6.1. Answer to the first question

Promoting the responsible use of AI requires, on the one hand, a careful consideration of the legal, political, and structural gaps that still characterize the governance of such technologies. On the other hand, it is possible to begin exploring the potential that AI offers in the field of education, where it can be used to enhance students' skills and improve learning processes. While the former scenario calls for interdisciplinary and multimodal interventions aimed at ensuring user safety and privacy, the latter may allow for a more accessible rethinking of pedagogical approaches within a socio-educational framework where AI serves as a tool to expand students' cognitive and critical capacities. Within this perspective, it becomes essential to fully leverage the potential of artificial intelligence in fostering critical thinking among younger generations.

Artificial intelligence asks learners to think critically, challenge presumptions, and solve challenging problems besides transmitting information. Artificial intelligence assists in preparing people to meet the ever-changing demands of modern society by creating challenges that need critical thinking and imitating real-world scenarios. Al-driven learning personalization is essential for fostering critical thinking. AI builds learning environments that encourage problem-solving and active exploration by customizing materials according to every student's interest and skill level (Zapata, Guerrero, and Montilla 2024). Learners are urged to investigate problems, test theories, and critically assess data to cultivate a critical attitude beyond rote learning. Turning this around, another way that artificial intelligence stimulates critical thinking is through modeling difficult situations. [...] Educators and technological innovators must work closely together to successfully include artificial intelligence to promote critical thinking (Fojtik 2024). Teachers are essential to help learners critically analyze the material provided through artificial intelligence and facilitate debates that encourage autonomous reasoning. (Khreisat et al. 2024: 8524).

An interesting proposal in this context is the integration of L2 instruction within an educational pathway focused on reflecting on the future. To this end, we propose the adoption of the *strategic foresight*[6] model, which stimulates students' ability to imagine and design future scenarios (Santan-

[6] The term *strategic foresight* refers to a set of disciplines that investigate, through a multidisciplinary lens (including economics, sociology, anthropology, semiotics, philosophy, and others), the strategies for envisioning future scenarios. It is a methodology designed to shape medium- to long-term visions in order to reflect on possible future configurations and make informed and responsible decisions (Santangelo & Robiati 2024).

gelo & Robiati 2024). Although this method was not originally designed for educational purposes, it offers an innovative approach that views the future not as a fixed destination, but as a tool to better understand the present and make more informed decisions. This perspective led us to explore some key aspects of applying this methodology to second language learning. In *strategic foresight* studies and practices, the future is no longer considered a static goal to reach, but rather a dynamic perspective – a device that guides present-day choices. Traditionally, the future has been perceived as something preordained, to be discovered or predicted. However, it challenges this view by conceiving the future as a hypothetical construction shaped by collective imagination and the ability to design scenarios. In this sense, the future becomes a space for learning and experimentation – a laboratory in which students can develop not only their language skills but also their critical and creative thinking, *aspiring toward desirable futures* (De Leonardis & Deriu 2012; Appadurai 2013; Pellegrino 2019). Nevertheless, such an imaginative process cannot take place without a collective dialogue among diverse actors, so that the future becomes a dynamic field of critical elaboration and creative tension (Santangelo & Robiati 2024). The futures and foresight method is, in fact, a participatory process that guides groups in constructing alternative and plausible future scenarios. It is not about predicting the future but about developing the capacity to conceive it as an open and transformative space. Originally developed for companies and institutions, this methodology can also serve as a powerful pedagogical tool for L2 acquisition. Imagining the future requires students to acquire advanced linguistic skills: they must describe possible worlds, project themselves into future scenarios, and link the present with potential developments. Furthermore, they must engage with diverse cultural perspectives on the future, specific to the linguistic communities they are studying. This approach enriches L2 context by adding a deeper dimension that goes beyond everyday communication.

In this context, semiotics plays a central role. The future is constructed through narratives, and every narrative adheres to specific semiotic rules. From a pedagogical standpoint, this implies that teaching a language is not only about grammar and vocabulary, but also about understanding the *grammar* of future-oriented discourse. We can therefore ask ourselves: What are the key terms in texts about the future? What metaphors and images are most commonly used? What narrative structures dominate future-related stories? We believe that familiarity with these elements enables students to produce meaningful and culturally grounded texts. This approach not only fosters a more in-depth and contextualized study of

the foreign language, but also encourages critical reflection on fundamental issues that shape values and visions of both the present and the future (ibidem). Themes such as responsibility and irresponsibility, single versus multiple perspectives, and limited versus unlimited desires can be analyzed within the discourses that construct specific visions of the societies composing our perception of the world (Figure 4).

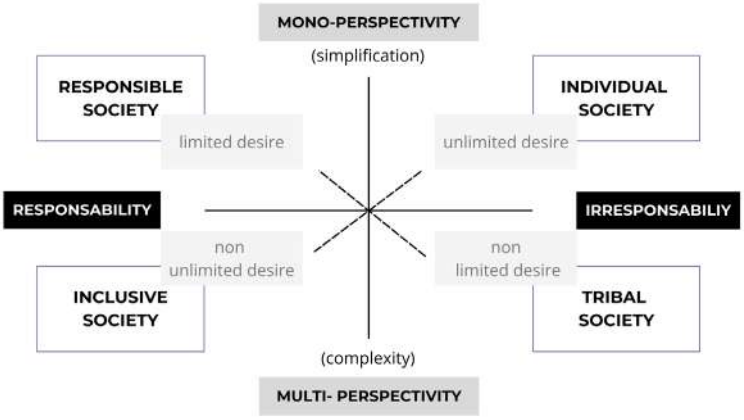

Figure 4: Map of discourses on the societies of the future (Santangelo & Robiati 2024)

6.2. Answer to the second question

The relationship between AI and L2 acquisition must be viewed not simply as a technological enhancement but as a potential paradigm shift in educational theory and practice. In particular, employing a semiotic approach in conjunction with a student-teacher-text-AI model offers a compelling framework for training AI in ways that enhance both the personalization and effectiveness of learning. Recent pedagogical trends signal a shift from teacher-centred instruction toward learner agency and inquiry-based models (Leicht et al. 2018; Li et al. 2021). In this context, AI is no longer positioned as a mere repository of language data or as a mechanical tutor delivering standardized feedback. Rather, it becomes a collaborator in a constructivist learning environment, participating in the learner's meaning-making process (semiosis-as-learning). This reframing invites us to see AI as capable of interpreting signs (linguistic, visual, contextual) in ways that respond to the learner's evolving semiotic environment. By adopting a semiotic lens, AI systems can be trained not merely to recognize correct linguistic forms but to engage with the interpretive process that underlies all language use. In this case, L2 acquisition becomes a dialogic interac-

tion between sign producers (teachers/students) and sign interpreters (students). When AI is embedded in this interaction, it learns to navigate and contribute to this dialogue; to understand intention, context, and variability of meaning. This enhances development in AI that functions as both a sign-producer and a responsive interpreter in educational settings, attuned to the learner's trajectory and the multiple meanings in the target language.

Moreover, designing AI systems through this model means it engages with learners as co-authors of their linguistic development. In this model, learners are not passive recipients of AI-generated input; they are active readers and creators of the signs, co-constructing knowledge in collaboration with AI. Such an approach calls for AI systems capable of interpretative elasticity – responsive to student input, sensitive to multiple meanings, and capable of generating nuanced feedback in L2 that supports the learner's creative use of the target language. It positions learners as intellectual agents in a semiotic journey, rather than operators within a fixed instructional workflow (Pratschke 2024). In addition, adopting a future-oriented framework has implications for digital learning design. If L2 acquisition is to be sustainable and future-oriented, personalized learning experiences must be central to the development of AI-mediated instruction. AI systems designed with semiotic awareness can adapt dynamically to individual learner profiles, interpret learner intent, and respond in ways that reflect not only syntactic accuracy but also pragmatic appropriateness and cultural nuance. This requires training AI not just on corpora of correct language but on diverse, real-world semiotic interactions. Finally, situating AI within a broader pedagogical transformation reinforces its role as a relational tool rather than a technical fix. In this vision, AI operates at the intersection of teacher guidance, learner agency, and contextual meaning-making. This relationship places AI as a mediator in the educational process, not as a replacement for teachers, but as a partner in the co-construction of meaning. Thus, AI can be trained by a semiotic approach to enhance L2 acquisition but only if it is reimagined as a semiotic participant, a co-interpreter, and a co-designer of meaning in the learning process.

7. Conclusion

This article highlights how, within the educational L2 context, AI can serve as an empowering and enhancing tool. The integration of AI into L2 acquisition must be understood not merely as a technological advancement, but as a transformative shift in educational paradigms. The introduction of AI in education raises significant questions regarding student

privacy protection, algorithmic transparency, and the reproduction of biases. Added to these are the tangible risks associated with users' personalities and learning paths. The greatest risk is that AI may not remain a neutral instrument serving education but instead exert pressure toward the realization of a technocratic and performance-driven vision of learning. In such a scenario, education risks losing its critical, reflective, and relational value. For this reason, it is essential to promote a responsible and reflective approach to the use of AI in education. By adopting a semiotic lens and positioning AI within a dynamic *student-teacher-text-AI* model, education moves toward the future where AI becomes a co-participant in the learner's construction of meaning. This model aligns with emerging pedagogical trends that emphasize learner agency, inquiry, and contextualized understanding. Training AI systems to engage semiotically with sensitivity to linguistic, cultural, and contextual nuance redefines them as relational tools embedded in dialogic and personalized learning.Only then can AI effectively support L2 learners as active agents in a co-constructed, meaning-rich educational journey.

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