

Generative Artificial Intelligence and the Digital Transformation of Foreign Language Education: Opportunities, Challenges, and Strategies

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Abstract: Generative artificial intelligence (GenAI) has emerged as a transformative technology that is reshaping teaching, learning, and educational ecosystems and accelerating the digital transformation of foreign language education. Beyond serving as a technological tool, GenAI offers significant opportunities for personalized and adaptive learning, generative and interactive pedagogy, transformed teacher and learner roles, and AI-mediated feedback and assessment. At the same time, its widespread adoption raises critical challenges concerning teacher readiness, unequal student capacity, assessment validity, ethical and integrity concerns, and institutional governance gaps. This review synthesizes recent research on the application of GenAI in foreign language education and examines its implications for the ongoing digital transformation of language teaching and learning. Specifically, it reviews emerging opportunities, analyzes key challenges encountered by educational institutions, teachers, and learners, and proposes strategies across three interrelated dimensions. Rather than viewing GenAI merely as an instructional technology, this review argues that it should be understood as a catalyst for the systemic transformation of foreign language education. It provides a comprehensive overview of current developments and offers practical insights for educators, researchers, and policy-makers seeking to promote sustainable and responsible digital transformation in language education.

Keywords: Pedagogical innovation; Language learning; Teacher roles; Learner agency; Educational technology; Institutional governance

Online publication: September 30, 2026

1. Introduction

Digital transformation is one of the defining trends of higher education reform, which is accelerated by the rise of generative artificial intelligence (GenAI). Miao and Holmes ^[1] position GenAI as a transformative force for educational transformation. Its capabilities, such as generating multimodal content, providing

intelligent feedback, enabling personalized learning, and adaptive instructional design ^[2], map directly onto the core processes of foreign language learning, where communication, feedback, and language production are central. These capabilities make it possible to transform foreign language learning and teaching systematically.

A growing body of research has examined GenAI's applications in foreign language education, documenting both the opportunities it creates across language learning domains and the challenges it raises ^[3]. However, most of the studies focus on particular applications, pedagogical practices, or learning outcomes ^[4]. Such an application-oriented perspective has yielded valuable insights, but it does not fully explain the broader educational changes that may emerge. Moreover, the application of GenAI in foreign language education does not in itself produce digital transformation ^[5]. Digital transformation involves more fundamental changes in educational practices, relationships, processes, and so on. Therefore, it is a more fundamental question how the generative, interactive, and adaptive capabilities of GenAI may reshape the ways learners learn, teachers teach, and educational processes are organized.

The present review takes GenAI as a catalyst for the digital transformation of foreign language education. In this review, we first clarify the evolving relationship between digital transformation and GenAI, then synthesize the major opportunities and challenges associated with digital transformation enabled by GenAI in foreign language education, and finally discuss possible strategies for digital transformation. By moving the focus from what GenAI can do to what GenAI is changing, this review seeks to provide a broader understanding of how GenAI is influencing the digital transformation of foreign language education.

2. GenAI and the digital transformation of foreign language education

2.1. Digital transformation in foreign language education

Digital transformation is not merely the adoption of new technologies. Vial ^[5] defined it as a process in which an organization reshapes how it creates value by using digital technologies, and stressed that this depends on changes in structures, processes, and practices rather than the technology alone. Verhoef *et al.* ^[6] offered a related three-stage model: digitization, digitalization, and digital transformation, and argued that only the final stage brings changes in organizational structure, digital resources, strategy, and value creation. In foreign language education, this understanding has also evolved considerably over time. Early efforts primarily focused on the adoption of digital technologies to supplement traditional language instruction, such as computer-assisted language learning (CALL), multimedia learning environments, and network-based language teaching ^[7,8]. Such steps reflect the digitization and digitalization stages identified by Verhoef *et al.* ^[6]. As digital technologies became more sophisticated, researchers increasingly shifted their attention from technological adoption to pedagogical innovation, exploring how digital tools could reshape foreign language learning and teaching.

More recently, digital transformation is regarded as a comprehensive process of educational change. Miao and Holmes ^[1] emphasize the systematic redesign of teaching, learning, assessment, governance, and institutional development in the digital era, while the OECD ^[9] highlights the integration of digital technologies with educational innovation to enhance learner outcomes and institutional effectiveness. These perspectives suggest that digital transformation is not simply about adopting advanced technologies, but more about reconfiguring educational processes and relationships.

Foreign language education is particularly well suited to this broader understanding of digital transformation, since language learning is inherently interactive ^[10] and learners vary widely in their backgrounds, pace, and needs ^[11]. Digital transformation is therefore not simply the addition of technological tools, but a reorganization of how language learning is designed, delivered, and supported. Digital technologies can expand access to authentic language resources and communication beyond the classroom, while also supporting more flexible and learner-centered forms of language learning ^[12,13]. However, the significance of digital transformation in foreign language education lies not in these affordances themselves but in how they are integrated into broader changes in educational processes ^[5,6].

2.2. GenAI as a catalyst for digital transformation

Among the technologies important to digital transformation, GenAI represents a qualitatively different case. Its distinctiveness lies not only in what it can do but in how it interacts with language learners and teachers. Earlier educational technologies were mainly aimed at providing information, facilitating communication, or automating specific language learning tasks. By contrast, GenAI can generate and adapt outputs according to the needs of language learners and teachers and provide immediate, context-sensitive feedback ^[4,14]. It can also function as a conversational partner, creating additional opportunities for language practice and interaction beyond conventional classroom settings ^[15].

GenAI is generative, interactive, and adaptive. These capabilities allow digital content and instructional support to be dynamically generated and adapted according to the changing needs of teachers and learners. As a result, they participate in the creation and adaptation of digital content, shifting from content consumers to content co-creators. Thus, GenAI introduces a more dynamic form of engagement in which users shape the process, and GenAI responds to their changing needs.

These capabilities, in turn, change the relationship between learner, teacher and technology. In conventional technology-mediated language learning, learners typically use digital systems to access materials, complete activities, or receive predefined feedback. Such use was usually a one-off encounter. By contrast, GenAI becomes an interactive mediator with which language learners and teachers collaborate to develop and refine outputs ^[16]. The exchanges become more dynamic and iterative. Language learners and teachers can ask questions, request clarification, refine prompts, evaluate responses, and redirect the interaction according to their immediate needs. Through the ongoing interaction, they become active participants in shaping their experiences of using GenAI to learn or teach. This introduces a new layer of human-GenAI interaction into language education, and contributes to the broader reconfiguration of learners' and teachers' roles that characterizes digital transformation rather than mere digitization.

More importantly, through the dynamic human-GenAI interaction, educational processes become more responsive, participatory, and adaptable, opening up new possibilities for pedagogical transformation in foreign language education. With GenAI, educational content and support are no longer mostly predetermined. They could evolve dynamically throughout the learning process. Teachers can use GenAI to develop and adapt materials and activities for learners at different proficiency levels. This brings greater flexibility in how learning experiences are designed and experienced, and also encourages more personalized, collaborative, and context-sensitive approaches to teaching and learning ^[4]. In this sense, GenAI does not just add another technological layer to established practices. Rather, it creates conditions under which pedagogical practices can be adapted and reorganized. Potentially, such changes could bring significant

changes in pedagogical practices, roles, and structures rather than the simple digitization of resources ^[17]. These changes can create conditions for movement toward the transformation stage described by Verhoef *et al.* ^[6], provided that they extend beyond the digitization of existing resources and practices.

Therefore, GenAI can be understood as a catalyst for digital transformation rather than simply another digital tool. Its significance lies in its potential to accelerate and deepen changes in how learning, teaching, and other educational processes are organized. However, such transformation is neither automatic nor inherently positive. As Miao and Holmes ^[1] stress, meaningful use of GenAI requires appropriate pedagogical design, human capacity development, institutional support, and human-centered governance. Building that capacity presents an emerging literacy and integration challenge that research is only beginning to map ^[18].

3. Opportunities and challenges of GenAI-driven digital transformation in foreign language education

3.1. Opportunities and transformative potentials of GenAI

In traditional foreign language teaching, principles such as student-centered learning, personalized learning, and formative assessment have long been valued but can be difficult to implement consistently at scale. GenAI creates new possibilities for putting these principles into practice by making learning resources, interaction, feedback, and instructional support more responsive to individual needs. Its potential significance lies not simply in improving the efficiency of existing practices, but in enabling changes in how learning and teaching are organized. From this perspective, the opportunities offered by GenAI can be understood in terms of their potential to support broader digital transformation in foreign language education.

3.1.1. From standardized instruction to personalized adaptive and learner-directed learning

GenAI has particular potential to shift foreign language learning from relatively standardized forms of instruction toward more personalized, adaptive, and learner-directed processes. Such a shift is consistent with the broader logic of digital transformation, in which technology is integrated into educational processes in ways that alter how learning is organized rather than simply digitizing existing resources.

Technology-mediated language learning has extended language learning beyond formal classroom settings by giving learners greater access to authentic resources and opportunities for self-directed and informal learning ^[19]. GenAI can further extend these possibilities by functioning as an accessible conversational partner and learning support tool. Unlike many earlier computer-assisted language learning systems that relied on predefined pathways and responses, GenAI can generate and adapt its responses as interactions develop, allowing learners to receive support that is more closely aligned with their interests, proficiency levels, and immediate learning needs ^[20]. This flexibility enables learners to access individualized language input and feedback beyond the constraints of classroom time and teacher availability. In addition, learners can exert more influence on what they learn, how they interact with learning resources, and how deeply they pursue particular questions. In this sense, GenAI can support a shift from learners as recipients of pre-packaged instruction toward more active participants in shaping their own learning experiences ^[21,22].

GenAI can also expand the range of learning environments available to language learners by providing opportunities for simulated, low-stakes interaction. Through role-play and conversational interaction, learners can practice using the target language in situations that may be difficult to reproduce consistently in conventional classrooms ^[4,23]. The relatively low-pressure nature of AI-mediated interaction may also

encourage learners to experiment with language and learn through repeated attempts without immediate social evaluation. Recent research suggests that GenAI-supported language learning can be associated with learners' psychological needs, motivation, and emotional experiences, although these effects depend on how the technology is integrated into learning activities ^[24,25]. These possibilities are relevant to digital transformation because they expand not only where language learning can occur, but also the forms of interaction through which learning can take place.

The instant and iterative feedback from GenAI further supports the change to personalized and learner-directed learning. Learners can receive immediate responses to their language output, identify problems quickly, and reflect on and adjust their performance accordingly. This feedback is not a final judgment on completed work but an iterative dialogue through which learners can seek clarification, explore alternatives, and revise their output. Therefore, the feedback is not just an external evaluative event, but an integral part of the learning process itself. With appropriate guidance, such interaction can also support more cognitively demanding language-learning activities, including critical writing, structured discussion, creative expression, and cross-cultural analysis ^[4,26]. This helps to deepen their language competence and cognitive engagement. In this sense, GenAI not only makes informal autonomous learning convenient, but also reconstructs how language learners relate to knowledge, feedback, and the learning process itself. Therefore, it moves foreign language learning beyond the digitalization of predefined materials toward a transformation of the learning experience ^[6].

3.1.2. From predefined static resources to co-created dynamic content and pedagogical innovation

While the transformation of learning addresses how learners engage with language, the transformation of content and pedagogy addresses what is learned and how instruction is organized. GenAI creates new possibilities for moving from predefined and relatively static learning materials toward dynamically co-created content and more flexible pedagogical innovations.

Recent studies suggest that GenAI can be used to generate various types of learning resources—such as videos, images, exercises, reading materials, and assessments—when guided by appropriate prompts and human oversight, tailored to specific proficiency levels, topics, and learning objectives ^[27,28]. A notable feature of GenAI-supported resource development is that both teachers and learners can act as co-creators ^[29]. Teachers can produce and adapt materials for particular classes, while learners can generate resources that match their individual interests and needs. These resources can be distributed, adapted, and shared through multiple channels, moving toward a more open, distributed, and on-demand resource ecosystem. This may broaden access to learning resources, particularly where access to qualified language teachers or high-quality instructional materials is limited ^[1]. However, whether greater resource accessibility translates into educational equity also depends on learners' access to technology, digital competence, and institutional support.

Building on these dynamically generated resources, GenAI can also support varied and context-sensitive language learning scenarios. Rather than relying on fixed exercises or predetermined sequences, teachers and learners can use GenAI to generate and modify tasks according to particular learning goals, proficiency levels, and interactional needs. Learners can engage in real-time conversation practice, receive immediate feedback on writing, grammar, and vocabulary, and work with reading tasks adapted to their current level

^[30–32]. Such flexibility allows language practice to be embedded in more varied and meaningful contexts, while enabling learners to revise, extend, or redirect activities as their needs change. GenAI-supported practice can therefore move beyond the repeated use of fixed digital exercises toward more dynamic learning environments in which content, tasks, and interaction can be continuously adapted. These capabilities make the learning environment more responsive to changing learner needs and allow learning activities to be adjusted throughout the learning process.

Beyond supporting individual practice, GenAI can also create opportunities for innovation in pedagogical methods and instructional design. As a collaborative partner for instructional design rather than merely a content generator ^[33], GenAI can help teachers develop more flexible learning sequences and pedagogical approaches that would be difficult to implement at scale. For example, language teachers may integrate project-based learning and collaborative learning across pre-class, in-class, and post-class stages, designing learning sequences that target higher-order thinking skills such as critical thinking, problem-solving, and metacognition ^[34]. In such environments, learners are able to exercise greater control over learning activities and create more chances for active meaning-making ^[35]. Therefore, GenAI can support changes in how content is generated, how classroom and learning time are organized, and how activities are sequenced and connected. When these changes extend beyond the digitization of existing materials to involve the reorganization of educational processes, they are consistent with the broader transformation stage described by Verhoef *et al.* ^[6].

3.1.3. From knowledge transmitter to learning designer and pedagogical orchestrator

As key factors in the digital transformation of foreign language education, teachers play a pivotal role in shaping how technology is integrated into language learning ^[36]. GenAI can provide comprehensive support that helps them to move beyond their traditional role as knowledge transmitters toward new roles as learning designers, facilitators, and pedagogical orchestrators.

One of the most immediate forms of support that GenAI provides is assistance with routine and time-consuming work. It can support lesson preparation, resource development, activity design, and the organization of teaching materials ^[37]. By generating and adapting instructional resources for particular teaching contexts, GenAI allows teachers to devote more time to forms of pedagogical work that demand human judgment, such as diagnosing learning difficulties and building relationships with learners. The redirection of professional capacity creates the conditions for deeper changes in teachers' work and roles ^[38]. GenAI can also support professional learning, teaching reflection, and the analysis of learners' learning behaviors and language output ^[39], extending its potential contribution beyond routine instructional preparation.

The redistribution of professional time and effort can also change the nature of teachers' work. With GenAI assisting in routine content production, teachers can devote greater attention to generating, evaluating, selecting, adapting, and integrating GenAI-produced materials into teaching practice, strengthening their roles in content curation and pedagogical orchestration ^[33]. They can also use GenAI to interpret patterns in learners' work, language output, and learning activities, which may support reflection on instructional design, classroom interaction, and assessment ^[4]. These uses position teachers more actively in the processes of evaluating information, making pedagogical decisions, and adapting instruction to learners' needs. Therefore, GenAI creates new possibilities for teachers' professional development.

These changes in teachers' work are accompanied by changes in their roles. As learners gain greater access to knowledge and learning support through GenAI, teachers' responsibilities extend beyond the transmission of knowledge to include facilitating learning, designing activities, evaluating AI-generated content, and guiding learners' use of technology. Their professional value increasingly lies in interpreting learners' needs, designing learning activities, evaluating AI-generated content, and providing pedagogical guidance. Thus, GenAI becomes a complement to teachers' professional expertise, while the distribution of instructional responsibilities across teachers, learners, and AI becomes more flexible. This development reflects an important dimension of digital transformation: changes in technology are accompanied by changes in how teaching responsibilities and pedagogical relationships are organized.

3.1.4. From product-oriented assessment to iterative process-oriented assessment

GenAI can reshape how interaction, feedback, and assessment are integrated into foreign language learning. To be specific, these processes can move from relatively separate and time-bound activities toward more continuous, embedded, and learner-centered cycles of practice, feedback, and revision.

GenAI changes how interaction takes place in foreign language learning. It can function as an accessible conversational partner with whom learners can practice language beyond scheduled classroom activities ^[14].

Through dialogue, role-play, and simulated real-life situations, learners can engage in repeated language use and receive responses that are tailored to the ongoing interaction ^[40]. Such context-sensitive interaction is particularly valuable in foreign language learning, where opportunities for frequent, low-stakes language use may be limited ^[21].

The interactive nature of GenAI changes the timing and function of feedback, too. GenAI is able to provide immediate and iterative feedback, offering a more continuous form of feedback than the delayed responses often associated with conventional assessment practices. Feedback can be generated during the interaction, responded to by the learner, and followed by further revision and response. This creates a feedback cycle in which learners can identify problems, make changes, and test their revised language through continued interaction. Feedback thus becomes closely integrated with learning activities and contributes directly to ongoing practice and revision.

The changes in feedback also bring new opportunities for language assessment. Ongoing information about learners' performance and difficulties can support more formative and process-oriented approaches to assessment. Rather than primarily focusing on the evaluation of a final product, assessment can become closely connected to learners' ongoing practice, revision, and development over time.

Taken together, GenAI-mediated interaction, iterative feedback, and formative assessment can form a more continuous cycle of language learning. Learners interact with GenAI, receive feedback, revise their language, and re-engage in further practice. In this cycle, assessment provides evidence that can inform subsequent learning and instructional decisions. Therefore, GenAI brings these processes into closer alignment within the learning process itself. This represents another dimension of the shift from technology adoption toward the digital transformation of how foreign language learning is organized, monitored, and experienced ^[6,14].

3.2. Challenges in GenAI-driven digital transformation of foreign language education

GenAI offers significant transformative potential for foreign language education, but the transformation is neither automatic nor smooth. The challenges involved are not technical side effects resolvable through better

tools alone, but structural tensions arising when powerful new technologies interact with existing institutions, professional capacities, pedagogical practices, and equity dynamics. If these challenges remain unaddressed, GenAI may become a superficial add-on to conventional teaching or, worse, exacerbate existing inequalities and create new forms of educational risk.

3.2.1. Readiness of teachers and learners

Teachers serve as critical mediators in any educational transformation, and the changes brought by GenAI place substantial new demands on their professional capacities and role identities. Yet many foreign language teachers remain insufficiently prepared for these demands ^[26,41].

As GenAI becomes increasingly involved in lesson preparation, resource development, feedback, assessment, and learning support, teachers need to understand both what the technology can do and where its limitations lie. However, a considerable proportion of teachers still lack sufficient understanding of and willingness to apply GenAI in foreign language education, largely due to limited AI literacy ^[42]. Without teachers' proper understanding of GenAI, meaningful digital transformation in foreign language education is difficult to achieve. This requires teachers to develop the ability to design GenAI-supported learning activities, evaluate generated content, manage human-AI interaction, and make appropriate pedagogical decisions. This places high demands on teachers' abilities and literacy in teaching design, implementation, assessment and feedback, and resource development. However, the development mechanisms for foreign language teachers' digital literacy and teaching abilities remain immature. Systematic, targeted training is often lacking, and awareness of and motivation for interdisciplinary growth remain weak ^[26]. As a result, many teachers' digital literacy and teaching capabilities do not yet meet the demands of digital transformation in foreign language education.

The integration of GenAI also challenges existing teacher-student relationships and role expectations. As learners gain greater access to GenAI-generated explanations, language resources, and personalized assistance, the traditional role of foreign language teachers as knowledge transmitters is being challenged. This requires teachers to adopt an open and inclusive mindset, moving from being mere transmitters and practitioners toward becoming facilitators, guides, supporters, collaborators, designers, and researchers, exploring strategies, models, and methods empowered by GenAI. This shift from a traditional single role to multiple roles necessitates profound mental transformation and continual proactive learning in teachers ^[43]. Moreover, GenAI introduces a tripartite relationship among teachers, students, and AI, in which AI should complement rather than replace human interaction and teachers' pedagogical roles ^[44].

Correspondingly, the traditional, authoritative teacher-student dynamic needs to shift toward a more supportive and equitable relationship. Teachers must support learners not only with technical guidance, learning resources, feedback, and strategies but also with psychological support. When learners experience anxiety and frustration due to technical difficulties, unsuitable learning modes, poor outcomes, or technology dependence, teachers need to offer emotional support to sustain learners' confidence and motivation. This requires truly adopting a student-centered approach and building relationships based on mutual trust, inclusivity, and equality. This might be an even greater challenge than mastering the technology itself, because it requires teachers to renegotiate deeply held assumptions about authority, expertise, and the teacher-student relationship. Without teachers to provide this emotional and pedagogical scaffolding, learners may either disengage from deeper GenAI-supported learning or fall into unreflective dependence ^[45]. GenAI

itself risks being absorbed into existing routines as a mere efficiency tool, leaving the core structures of teaching and learning untransformed.

3.2.2. Unequal student capacity and the second-level digital divide

The ultimate success of GenAI-driven transformation depends on whether learners can use the technology to achieve deeper learning. Yet, learners vary considerably in their capacity to benefit from GenAI. These differences may crystallize into new forms of educational inequality that directly constrain how far transformation can reach.

Although many learners can master the basic operations of GenAI tools relatively easily, completing high-level, innovative, and challenging foreign language tasks with GenAI, and thereby enhancing the depth and effectiveness of language learning, can be difficult, especially for learners with limited learning experience or lower language proficiency^[46]. Without systematic training and guidance, learners often lack strategies for effectively evaluating GenAI-generated content and may hold vague understandings of academic misconduct, leading to unintentional or intentional breaches of academic integrity. Additionally, due to insufficient self-discipline and critical thinking among some learners, over-reliance on GenAI for tasks such as translation and writing may diminish active engagement in language learning, resulting in inadequate language skill development and restricted creative thinking^[47].

This issue extends beyond the traditional digital divide of access. It reflects the second-level digital divide, which concerns disparities in skills and effective use^[48]. In the context of GenAI, the more consequential distinction lies in what learners can do with the technology once access is available. AI literacy involves not only knowing how to operate AI tools but also understanding their capabilities and limitations, formulating appropriate prompts, critically evaluating outputs, and making informed decisions about when and how to use them^[49,50]. Such competencies are particularly important in language learning, where learners may not always possess sufficient linguistic knowledge to identify inaccurate or inappropriate AI-generated language. This means learners need to develop a combination of metacognitive strategies, critical thinking, and digital literacy to use GenAI productively, yet these competencies remain weak points in current foreign language education^[46].

Over-reliance presents a further dimension of this inequality. For some learners, GenAI can provide valuable scaffolding that supports self-directed learning; for others, its convenience may reduce the need to formulate ideas independently, retrieve language autonomously, or persist through difficult tasks, inadvertently weakening the very cognitive and self-regulatory processes that effective language learning requires^[51].

If left unaddressed, these disparities mean that the expansion of AI-supported learning opportunities may coexist with, and even amplify, substantial differences in learners' capacity to benefit from them. The transformational vision of GenAI-empowered learning can only be realized when learners possess the capacity to engage with the technology critically and agentially. When a significant proportion of learners lack this capacity, transformation risks becoming a privilege of the already well-prepared, rather than a systemic shift in how foreign language learning is organized and experienced.

3.2.3. Assessment validity and the reconfiguration of educational goals

One of the most direct disruptive effects of GenAI on foreign language education lies in assessment, where the technology challenges fundamental assumptions about what can be measured and what counts as

evidence of learning. Assessment plays a powerful role in shaping what teachers teach and what learners prioritize in their learning ^[52]. Without aligning assessment with new pedagogical realities, curricular and instructional innovations are unlikely to take root.

GenAI challenges a basic assumption underlying conventional assessment in foreign language education. That is, learners' final language products can be a reasonably direct indication of what they have learned. When learners can use GenAI to generate, translate, revise, and polish their work, the relationship between the final product and the learner's own knowledge and ability becomes less straightforward. Conventional product-based assessment approaches may therefore make it more difficult to draw valid inferences about learners' independent knowledge and ability ^[53,54]. Assessment may need to consider how learners interact with GenAI, evaluate its suggestions, revise AI-generated content, and explain the decisions they make. In other words, how learners arrive at an answer may matter as much as the answer itself ^[55].

This raises a broader question about what should count as valuable competence in foreign language education. Critical thinking, information evaluation, AI literacy, problem-solving, creativity, communication, and the ability to make informed decisions may become increasingly important in GenAI-mediated learning and assessment ^[49,56]. The challenge is not simply to add a few new indicators to existing assessment systems, but to reconsider whether those systems still capture the competencies that learners actually need in an AI-mediated world. Due to the inertia of long-standing evaluation practices and institutional structures, existing assessment practices and many teachers' assessment competencies have not fully adapted to these emerging demands, a challenge not unique to foreign language education but shared across the education sector ^[57].

In short, GenAI may transform assessment from a mechanism primarily used to measure learning outcomes into a more integrated means of understanding and supporting the learning process. If education changes what it measures, it may also need to reconsider what it defines as meaningful learning. For foreign language education, the goal may need to expand beyond producing linguistically accurate products toward developing learners who can communicate effectively, think critically, work productively with AI, and exercise independent judgment. GenAI thus challenges not only how learning is assessed but also what foreign language education considers worth assessing. As long as high-stakes assessments continue to reward polished final products while giving limited recognition to the processes through which learners use and evaluate GenAI, teachers and learners may have fewer incentives to adopt more collaborative, inquiry-based modes of learning that GenAI makes possible ^[55], and transformative potential may remain constrained.

3.2.4. Reliability, ethical, and academic integrity challenges

Beyond questions of pedagogy and assessment, GenAI introduces a set of cross-cutting reliability, ethical, and academic integrity concerns that affect multiple aspects of foreign language teaching and learning. These concerns are not temporary bugs to be fixed through technical updates. They represent structural tensions that the educational community must continuously negotiate as transformation proceeds.

One fundamental issue is the reliability of AI-generated content. GenAI can produce fluent and plausible language, but its outputs may contain factual inaccuracies or fabricated information, a problem commonly discussed in the literature as hallucination ^[58]. This is particularly problematic in foreign language learning, where learners with limited linguistic or digital literacy may find it difficult to identify errors in AI-generated responses ^[4]. Miao and Holmes ^[1] therefore emphasize the need for human oversight and critical evaluation when GenAI is introduced into educational settings.

GenAI also complicates questions of authorship and academic integrity. Its ability to generate essays, translations, summaries, and other forms of language output can make plagiarism, inappropriate assistance, and undisclosed AI use more difficult to identify ^[2,59]. These concerns are among the factors leading to teachers' cautious approaches to integrating GenAI into foreign language teaching ^[4,60]. The issue, however, goes beyond whether learners use AI to complete assignments. When human and GenAI contributions become intertwined, conventional distinctions between original work and external assistance become less straightforward. Identifying and addressing academic misconduct while ensuring fair evaluation of learners using GenAI in foreign language learning remains a significant challenge.

Privacy, bias, and discrimination present additional concerns. GenAI systems may process user data and reproduce biases embedded in their training data, potentially affecting how learners receive information and feedback ^[2]. These risks may be particularly consequential for equity in foreign language education, where differences in infrastructure, digital literacy, and exposure to English-dominant AI systems can widen existing disparities ^[61]. These concerns suggest that responsible GenAI integration requires more than technical safeguards. It demands that learners, teachers, and institutions negotiate new forms of responsibility, verification, and ethical judgment. If these reliability, integrity, and privacy risks are not adequately addressed through updated policies, ethical guidelines, and educational practices, institutions may be more likely to adopt restrictive approaches to GenAI, and teachers may avoid deep engagement with the technology. Such responses could constrain rather than support the transformative potential of GenAI in education.

3.2.5. Institutional and governance gaps

The challenges discussed above cannot be addressed by teachers and learners alone, because many of them are embedded in institutional structures, policies, and support systems. Institutions therefore play a significant role in fostering the responsible integration of GenAI in foreign language education. This responsibility is amplified in the process of digital transformation, where institutions need to build infrastructure, coordinate across departments, develop long-term plans, and formulate coherent policies.

In practice, many universities have begun experimenting with GenAI in teaching and learning, and institutional policies and guidelines are developing rapidly. However, substantial gaps remain in the comprehensiveness, coordination, and adaptability of these institutional responses ^[62-64]. The problem is not simply whether institutions allow or restrict GenAI use, but whether they can provide a coherent framework within which its educational potential can be explored responsibly.

A related challenge is the fragmented nature of institutional adoption. GenAI-supported foreign language education may develop in a relatively spontaneous manner, with individual teachers experimenting with different tools and practices without a shared institutional roadmap. Such bottom-up experimentation can be valuable, but isolated innovation does not automatically lead to digital transformation. Recent analyses of university policies suggest that institutions increasingly provide resources such as sample syllabi, teaching activities, workshops, and guidance for classroom use, yet these efforts do not necessarily constitute a coordinated institutional strategy ^[65,66]. Without coordination across curriculum design, assessment, teacher development, technological infrastructure, and institutional policies, successful practices may remain local and difficult to scale. This requires institutions to move beyond encouraging individual experimentation toward building conditions that support sustained and coordinated innovation.

Institutional governance should not be understood merely as a mechanism for controlling AI use; it

also needs to make meaningful innovation possible. Effective governance therefore involves regulation, infrastructure, professional development, quality assurance, and institutional support. International guidance similarly emphasizes the need for long-term policy development and capacity building rather than short-term responses to emerging technologies ^[1]. Moreover, recent cross-national research highlights the importance of clear communication, stakeholder collaboration, clearly defined responsibilities, and ongoing evaluation in supporting institutional GenAI adoption ^[63]. Without such coordination, GenAI adoption may remain a collection of promising but disconnected practices. The central institutional challenge, then, is to ensure that governance systems can keep pace with technological change and turn scattered AI applications into sustainable educational transformation. Where institutional frameworks lag behind, the challenges examined above are likely to intensify, making genuine digital transformation difficult to achieve.

4. Strategies to foster digital transformation in foreign language education

GenAI brings numerous opportunities for the digital transformation of foreign language education, but it also faces significant challenges. Without effective strategies to address these challenges, leveraging GenAI to advance the digital transformation of foreign language education could remain a mere aspiration.

4.1. Strengthening top-level design and institutional governance

Strengthening top-level design and institutional governance is essential for turning GenAI adoption into systematic digital transformation in foreign language education. Where institutional frameworks lag behind technological and pedagogical developments, the challenges discussed above are likely to intensify. Effective governance can instead create an enabling environment by coordinating resources, clarifying responsibilities, protecting educational values, and supporting responsible innovation. Importantly, institutional governance should not be understood merely as a mechanism for controlling or restricting GenAI use; it should also create the conditions under which meaningful experimentation and sustainable innovation can take place ^[1]. This requires institutions to address three interrelated dimensions: strategic planning, governance, and sustained support.

The first is systematic strategic planning. Institutions should clarify long-term goals and priorities for GenAI-enabled foreign language education, coordinate resources and responsibilities, and integrate GenAI into broader processes of curriculum development, teaching innovation, assessment, and teacher development. Rather than treating GenAI as an isolated technological initiative, strategic planning should connect these efforts within a shared institutional vision. Such top-level planning can provide a clear direction for transformation while allowing sufficient flexibility for context-specific experimentation ^[63].

The second is coherent regulatory and ethical governance. Institutions need clear and adaptable guidelines concerning academic integrity, responsible GenAI use, data privacy, and human agency. These guidelines should provide teachers and learners with shared principles for determining appropriate uses of GenAI, while remaining flexible enough to accommodate rapidly changing technologies and pedagogical practice ^[66].

The third is sustained institutional support. Institutional policies are unlikely to translate into meaningful changes in teaching practice without professional development, appropriate resources, and opportunities for teachers to experiment and learn from practice. Institutions should therefore provide sustained professional development, appropriate resources, and opportunities for experimentation and collaborative learning. Such

support can help transform individual experimentation into more sustainable and coordinated innovation, allowing promising practices to extend beyond isolated classrooms and contribute to broader institutional transformation.

4.2. Advancing resource development and pedagogical innovation

Resource development and pedagogical innovation together constitute the practical vehicle through which GenAI empowers foreign language education. Top-level design provides institutional conditions for transformation, but its goals ultimately depend on concrete teaching scenarios, well-structured resources, and renewed pedagogical approaches to be realized in teaching practice.

First, GenAI-embedded teaching platforms and resource systems should be built. Intelligent teaching platforms can support personalized learning paths and multimodal interaction, while systematic GenAI-enabled resource libraries could cover diverse learning scenarios such as speaking and writing, with materials dynamically updated and adaptable to different proficiency levels and learning objectives. Where feasible, such platforms and resources should adopt open and shareable architectures to facilitate cross-institutional collaboration and reduce redundant development. Shared infrastructure can help GenAI-supported teaching move beyond individual experimentation and become a more routine component of institutional practice, providing a foundation for translating fragmented digital initiatives into more systemic transformation.

Second, pedagogical innovation is needed to translate technological capabilities into teaching practice. GenAI can support the shift from teacher-centered, one-size-fits-all instruction toward personalized, contextualized, and collaborative learning. Teachers should leverage the technology to design situational, project-based, and collaborative teaching activities that promote learner engagement and practical language use. Through such designs, classroom teaching can move from uniform content delivery toward organized, technology-supported interaction. This reorganization of teaching, rather than the technology itself, constitutes a central dimension of digital transformation.

Third, assessment practices should be redesigned to better capture both learners' language development and the processes through which learning takes place. Instead of relying mainly on summative examinations and final products, teachers should make greater use of process-oriented evidence from technology-supported learning, such as interaction patterns and revision histories. This can offer a more comprehensive view of student learning and strengthen the alignment between teaching, learning, and assessment. Assessment, therefore, should not be treated simply as another area in which GenAI can be applied, but as an integral part of the pedagogical reconfiguration required for digital transformation.

4.3. Enhancing teacher and student capacity development

The digital transformation of foreign language education ultimately depends on the people who enact and experience it. Institutional policies, technological infrastructure, and pedagogical innovations can provide conditions for transformation, but their educational value depends on whether teachers and learners possess the knowledge, skills, and dispositions to engage with GenAI effectively and responsibly. Teacher and student capacity development should therefore be treated as a core component of digital transformation. For teachers, this involves developing the competence to integrate GenAI into teaching; for learners, it requires the capacity to use GenAI critically, responsibly, and independently.

For teachers, capacity development should encompass two interrelated areas: GenAI competence

and digital pedagogical competence. GenAI competence provides the foundation for understanding the technology, including its capabilities, limitations, appropriate uses, and potential risks. It should enable teachers to design prompts, interact with GenAI, evaluate its outputs, and make informed decisions about its use. Digital pedagogical competence extends this foundation into teaching practice, enabling teachers to integrate GenAI into lesson and activity design, classroom interaction, formative assessment, and learning management. Therefore, the pedagogical application remains the core of teachers' development, rather than technical operation alone. Together, these competencies can help teachers move beyond using GenAI primarily as an efficiency tool and develop the roles of facilitators, designers, and collaborators required in GenAI-supported foreign language education.

Developing these competencies, however, requires professional development that is differentiated, practice-oriented, and sustained. A one-size-fits-all model is unlikely to address teachers' diverse levels of technological competence and pedagogical needs. Professional development should therefore offer differentiated pathways while connecting training closely with teaching practice, allowing teachers to experiment with GenAI-supported activities, evaluate their effectiveness, and refine their practices through reflection and peer exchange. Rather than relying on isolated sessions, institutions should provide continuing access to relevant resources, collaborative learning opportunities, and professional learning communities.

For learners, the priority is to develop GenAI literacy that goes beyond basic technical operation. Learners need to interact with GenAI effectively while critically evaluating its outputs, verifying information, recognizing limitations and biases, and making informed decisions about its use. Ethical and academic integrity awareness is also essential for understanding the boundaries between legitimate AI assistance and inappropriate use. At the same time, learners need self-regulatory capacities to manage their reliance on GenAI and retain responsibility for their own learning and decision-making. Together, these technical, critical, ethical, and self-regulatory capacities provide a foundation for learner agency in GenAI-supported foreign language learning ^[49,50].

Developing these learner capacities likewise requires learning opportunities that extend beyond one-time training. Foreign language courses can embed GenAI literacy in regular learning activities, enabling students to learn how to prompt, evaluate, verify, revise, and reflect on AI-supported learning through authentic tasks. Institutions can complement such embedded learning with online resources, offline workshops, and interdisciplinary opportunities. This approach can help ensure that the benefits of GenAI-supported learning are not limited to students who already possess strong digital skills, but become more accessible across different learner populations. Thus, developing student capacity becomes not merely a means of teaching learners to use GenAI, but a strategy for enabling responsible and equitable participation in the digital transformation of foreign language education.

The strategies discussed above cannot operate effectively in isolation. GenAI-driven digital transformation also requires collaboration across institutions, sectors, and disciplines. Cross-institutional and regional collaboration can facilitate the sharing of resources, teaching practices, technological expertise, and professional development opportunities, while partnerships between universities and technology enterprises can connect educational needs with technological expertise and support the development of context-specific GenAI applications. At the same time, interdisciplinary collaboration among foreign language studies, educational technology, computer science, psychology, and applied linguistics can bring complementary perspectives to the pedagogical, technical, and ethical challenges of GenAI-supported language education.

Such collaboration can connect the institutional, pedagogical, and human dimensions discussed above, helping move GenAI adoption beyond isolated initiatives toward a more coordinated, inclusive, and sustainable process of digital transformation.

5. Conclusion

GenAI is emerging as a powerful catalyst for the digital transformation of foreign language education. Its generative, interactive, and adaptive capabilities distinguish it from earlier digital technologies and create new possibilities for rethinking how language learning and teaching are organized. Rather than merely improving the efficiency of existing practices, GenAI can reshape personalized learning, pedagogical interaction, teacher and learner roles, feedback and assessment, and the competencies required for effective participation in learning. In this sense, GenAI represents not simply another stage of technology adoption, but a new stage of educational transformation.

At the same time, the transformative potential of GenAI should not be understood uncritically. Its integration into foreign language education creates structural tensions involving human capacity, equity, assessment, reliability, academic integrity, and institutional governance. Technological capability alone cannot produce meaningful digital transformation. GenAI may expand educational possibilities, but whether these possibilities become meaningful changes in practice depends on how technologies are interpreted, integrated, and governed within educational contexts.

The review further suggests that GenAI-driven transformation of foreign language education can be understood as a dynamic process linking technological affordances, pedagogical practices, human agency, and institutional conditions. Generative and adaptive capabilities create new opportunities for interaction and learning, while educational contexts shape how these possibilities are interpreted and enacted. Pedagogical redesign and changing teacher and learner roles, in turn, require corresponding adjustments in assessment, competencies, institutional support, and governance. The strategies discussed in this review reflect this interactive view by addressing these dimensions in a coordinated manner. Digital transformation therefore emerges not from AI alone, but from the interaction between GenAI capabilities and the educational system in which they are embedded.

Funding

This study was supported by Hebei Provincial Social Science Foundation Project (Grant No. HB24JY040).

Disclosure statement

The authors declare no conflict of interest.

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