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DESIGNING LITERACY LEARNING WITH MULTIMODALITY IN THE AGE OF GENERATIVE AI

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Abstract
This paper examines the implications of generative artificial intelligence (GenAI) for literacy learning through the lens of multimodality and pedagogy as design. I argue that the rapid proliferation of digital technologies has fundamentally reshaped the epistemic conditions of literacy, necessitating a reconceptualisation of literacy beyond traditional notions of reading and writing as well as necessitating the role of the teacher to be a designer of learning experiences. While GenAI offers significant potential in supporting literacy learning, it also raises critical concerns related to bias, authorship, and reliability. These tensions underscore the need for critical multimodal literacy, enabling students to engage reflexively with AI-generated content. Building on these insights, I outline key educational implications for curriculum, pedagogy, and assessment. Specifically, I advocate for a shift towards multimodal and process-oriented assessment, the integration of GenAI as a pedagogical aide, and the development of students' semiotic capital.

Keywords: design, educational semiotics, generative AI, multiliteracies, multimodality

Introduction
The rapid proliferation of new technologies in the 21st Century, most recently, generative artificial intelligence (GenAI), presents new literacy demands on our students today (Lim, Cope, & Kalantzis, in press). GenAI tools capable of generating coherent, contextually appropriate, and often sophisticated texts challenge long-standing assumptions about what it means to read, write, and learn (Lim, Gilje, & Djonov, 2025). In such a context, traditional conceptions of literacy which are centred on individual competence in reading and writing are increasingly inadequate (Adami et al., 2022). Literacy must instead be understood beyond the development of language skills to encompass multimodal meaning-making, digital mediation, and critical engagement with algorithmically generated content. This reconceptualisation of literacy is a necessary response to profound epistemological shifts in how knowledge is produced, distributed, and evaluated (Araújo et al., 2024).

This paper aims to examine the implications of GenAI for literacy learning. It reconceptualises literacy learning and reframes the role of the teacher as a

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designer of learning. Building on this framing, the paper reflects on the implications of GenAI for curriculum, pedagogy, and assessment. It argues for the adoption of multimodal and process-oriented approaches to assessment, the integration of GenAI as a pedagogical resource, and the development of students' semiotic capital.

Designing Literacy Learning

Historically, educational paradigms have positioned the teacher as the primary source of knowledge in the classroom, or what has been metaphorised as the 'sage on the stage.' This view of the teacher has been challenged with the advent of the Internet and mobile technologies, which democratised access to information and shifted the teacher's role towards that of a facilitator, that is more as a 'guide by the side' as students direct their own learning. Notwithstanding, recent development of digital technologies necessitates a further reconceptualisation that moves beyond this binary view of learning having to be teacher centric or student centric (Cope & Kalantzis, 2015). The teacher's role can be more appropriately understood as a designer of learning experiences. As Kress and Selander (2012) explain, the teacher takes on the role of the designer, and like all designers, reflects on her use of material resources and the structures of power in a specific environment to best express her meanings. This shift foregrounds the intentional and principled nature of pedagogy, where teaching is about the design of experiences in which meaningful learning can occur. Lim (2021) describes the role of the learning designer to be judging the best way in which the student can best achieve their learning outcomes. As a learning designer, the teacher is mindful of the affordances and constraints of the tools, technologies, and resources used during the lesson.

The conceptual foundation of teachers as designers of learning lies in the understanding of pedagogy as design (New London Group, 1996/2025). In their manifesto introducing the notion of multiliteracies, the New London Group (1996/2025) argues that both teachers and students are active designers of meaning. Teaching involves the intentional arrangement of resources, interactions, and environments to support meaningful engagement. Teachers are designers of learning who make principled decisions about what to teach, how to teach, and when to guide, model, scaffold, consolidate students' learning of when to step back to have students explore, lead and inquire in the learning experience. Teachers are not mere implementers of curriculum but are designers of learning who exercise agency and judgement in orchestrating the learning experience (Lim, in press). This involves selecting appropriate tools and technologies, sequencing tasks, and anticipating how students might engage with different forms of representation. Such a design-oriented view foregrounds intentionality, reflexivity, and contextual sensitivity in pedagogical practice.

Designing learning experiences goes beyond the design of tasks and materials to include the design of interactions. Teaching as a communicative act is inherently multimodal and embodied, involving speech, gesture, gaze, and spatial positioning. The teacher's semiotic choices shape the learning environment and influence how students participate (Lim, 2021). For example, a teacher's movement across the classroom, their use of the board, their modulation of voice, can contribute to the students' learning experience.

Teaching is an act of design and learning in a form of design (Lim, in press). Learning is more than a process of reproducing knowledge but of transforming and reconfiguring meanings in response to social, cultural, and technological contexts. As such, learning as design involves the augmentation and transformation of students' meaning-making resources (Adami et al., 2022). In the age of GenAI, where text can be generated with remarkable ease, the value of literacy cannot reside solely in the production of grammatically correct sentences. Instead, it must encompass the ability to critically evaluate, adapt, and integrate multimodal resources in purposeful ways (Lim & Tan-Chia, 2022). Literacy becomes a matter of design, where meaning-making involves selecting, combining, and transforming semiotic resources in response to specific contexts and purposes. Designing literacy learning thus entails supporting students in making informed choices about how to combine modes to achieve communicative goals as an expression of their multimodal literacy.

The Learning by Design framework introduced by the New London Group (1996/2025) provides a productive lens for operationalising this perspective. Literacy is recognised to be plural and dynamic, as well as responsive to the increasing diversity of communication channels and the growing cultural and linguistic diversity of societies. Within the Learning by Design framework, learning is understood as a process of design, where students engage with available semiotic resources to create new meanings. This process is iterative and transformative, involving cycles of experiencing, conceptualising, analysing, and applying (Cope & Kalantzis, 2015).

These knowledge processes can be translated into learning processes such as encountering, exploring, evaluating, and expressing to develop students' multimodal literacy (Lim & Tan-Chia, 2023). For instance, students might encounter a range of texts drawn from their lifeworlds before exploring their features and affordances, guided by a pedagogic metalanguage (Lim, Cope & Kalantzis, 2022). Students may then evaluate these texts critically, examining issues of authorship, bias, and credibility, before expressing their own meanings through digital multimodal composing (Lim & Unsworth, 2023). Such a design goes beyond students' learning as developing competence to the cultivation of criticality and creativity as well as multimodal literacy.

Learning as design accounts for literacy as a social practice (Street, 1995) which involves the development of competence, that is knowledge and skills, as well as students' sense of identity (Moje & Luke, 2009; Weninger, 2020). The latter involves nurturing the students' attitudes, beliefs and values (Lim & Yee, forthcoming) as well as a rebalancing of the cognitive focus in many literacy classrooms with attention to the affective and embodied domains (Lim, Cope, & Kalantzis, 2022). On the one hand, students must develop competence in using a range of semiotic resources, understanding their affordances, and orchestrating them effectively. On the other hand, they must develop dispositions that enable them to engage critically and creatively with multimodal texts. This includes an awareness of issues such as representation, bias, and the privileging of certain modes or forms of expression over others. As such, literacy learning goes beyond what students can do to how they see themselves as meaning-makers in a complex, multimodal, and technologically mediated world.

Ultimately, the goal of literacy learning is to build students' semiotic capital, that is their capacity to augment and transform semiotic resources to express meanings across diverse contexts. This includes mastering privileged forms of disciplinary knowledge as well as engaging with emerging forms of communication. In contemporary digital cultures, this may involve practices such as multimodal composing, social media communication, and even prompt engineering. These practices are central to how meaning is made and shared in the world beyond the classroom. Semiotic capital is accumulated through exposure, practice, and participation in diverse communicative contexts. However, semiotic capital is not evenly distributed. Students come to the classroom with diverse backgrounds, experiences, and resources, which shape their capacities for meaning making. Literacy pedagogy must therefore recognise and build on this diversity and students' existing semiotic repertoires, including those developed in informal and digital contexts, and providing opportunities for these repertoires to be expanded and transformed. Designing literacy learning, therefore, goes beyond equipping students with knowledge and skills to enabling them to participate fully and critically in contemporary communicative practices so that they can grow their semiotic capital to become designers of their social futures (New London Group, 1996/2025).

Multimodality in Literacy Learning

Fundamental to the design of literacy learning in contemporary contexts is the concept of multimodality (Jewitt et al., 2016). From a social semiotic perspective, multimodality focuses on how meaning is made through the deployment and orchestration of multiple semiotic modes, each of which offers distinct affordances for representation and communication. Semiotic modes such as language, image, gesture, sound, and spatial arrangement are socially shaped and culturally given resources for meaning making (Kress, 2010).

Despite its increasing prominence in educational discourse (Lim, 2024a), multimodality is frequently misunderstood and often conflated with the use of multimedia technologies or reduced to simplistic notions of 'learning styles', such as visual or auditory preferences. Multimodality is neither about matching instruction to presumed sensory preferences, nor is it simply about incorporating a variety of media into teaching. Rather, multimodality is concerned with the distribution of meaning across modes and the ways in which these modes interact to produce coherent and meaningful texts.

The role of multimodality can be illustrated through the seemingly simple example of expressing emotion. A spoken utterance such as "I'm happy for you" can convey sincerity, ambivalence, or sarcasm depending on accompanying gestures, facial expressions, and tone of voice. Meaning, in this case, emerges from the interplay of multiple modes. This example underscores the inadequacy of viewing communication, and by extension, literacy, as purely linguistic. Designing literacy learning must therefore account for the complexity of real-world communicative practices, where meaning is inherently multimodal and context-dependent. Within this expanded view, language is recognised to be almost always nestled within a broader ensemble of semiotic resources, interacting with other modes to produce meaning (Jewitt, 2014). This has significant implications for literacy education, which has historically privileged monomodal forms of language.

To design effectively for literacy learning, it is therefore necessary to understand the relationship between multimodality and learning. This can be explored from the perspective of how multimodal resources are used to support learning as a means to the ends as well as the perspective of multimodal literacy, that is students learning how to engage critically with the evaluation and creation of multimodal texts as the ends in themselves. This former is described as multimodality for learning, and the latter, multimodality as learning (Lim, 2024b).

Multimodality *for* learning involves recognising that disciplinary knowledge itself is multimodal. Scientific knowledge representations, for example, are often realised through diagrams, graphs, and mathematical notation. To design effective literacy learning, teachers must attend to how knowledge is represented across modes and how students can be supported in navigating these representations. Multimodality *as* learning involves the orchestration of semiotics modes in ways that are contextually appropriate and socially meaningful. This orchestration is motivated by the communicative interests of the meaning-maker and the constraints and possibilities of the available semiotic resources.

Two other concepts are useful for theorising multimodality in teaching and learning contexts: intersemiosis and transduction (Lim, 2023). Intersemiosis refers to the interaction between modes within a single communicative event or text (O'Halloran, 2004). It captures how meanings are distributed across modes and how these modes complement, reinforce, or even contradict one another. For example, in a classroom explanation, a teacher's verbal description may be accompanied by gestures that highlight key elements or by diagrams that provide visual clarification. The meaning that emerges is constituted through the interaction across different semiotic modes.

Transduction, on the other hand, involves the transformation of meaning from one mode to another (Kress, 2010). This process is particularly significant in educational contexts, where learning often entails re-representing knowledge across modes. For instance, students may be asked to transform a written narrative into a visual storyboard, or to convert data into a graphical representation. Such tasks involve both technical skills and interpretive judgement, as students must decide what aspects of meaning to retain, emphasise, or omit in the new mode. Transduction thus foregrounds the active and transformative nature of meaning-making, positioning students engaging in learning as design, reshaping knowledge in response to new representational demands.

Multimodality *in* learning focuses on the teacher's multimodal pedagogy in designing learning experiences. The teacher's multimodal pedagogy can be explored from the perspective of embodied teaching and use of semiotic technologies. Teaching is inherently multimodal and embodied, involving the orchestration of speech, gesture, gaze, movement, and spatial arrangement (Lim, 2021). These embodied resources play a crucial role in shaping classroom interactions and influencing how students engage with content. A teacher's gesture can direct attention, illustrate relationships, or emphasise key points; gaze can signal inclusion, authority, or invitation; movement and positioning can structure interaction and participation (Kress et al., 2005). These dimensions of teaching are often taken for granted but are central to the teacher design of effective learning environments.

Complementing embodied teaching is the recognition that the tools and resources used in the classroom can be understood from the lenses of semiotic technologies (Djonov & van Leeuwen, 2018). These include resources such as textbooks and whiteboards, as well as digital tools such as presentation software, video editing platforms, social media, and GenAI systems. Each of these technologies affords particular forms of knowledge representations, pedagogic interactions, and ways learning in the lesson is organised (Lim, 2024c).

Semiotic technologies are not neutral tools but are social practices. They express specific values, assumptions, and design choices that influence meaning-making processes (Zhao et al., 2014). Algorithms, interfaces, and platform logics all shape the ways in which content is produced, distributed, and consumed. In the context of GenAI, these issues become particularly salient, as the output generated by such systems are shaped by training data, model architectures, and implicit biases.

The teacher's role as a designer of learning is therefore pivotal in mediating students' engagement with multimodal resources and semiotic technologies. As designers, teachers must make informed decisions about which tools to use, how to use them, and for what purposes. This involves understanding the affordances and constraints of different technologies and aligning them with pedagogical goals. It also involves scaffolding students' use of these tools, providing guidance and support to ensure that their engagement is both meaningful and critical (Lim, 2024c).

In this light, multimodality, as the foundation for the emerging field of educational semiotics (Lim & Unsworth, in press), provides a productive framework for rethinking literacy learning in the age of GenAI. Educational semiotics foregrounds the complexity of meaning-making, the diversity of semiotic resources, and the importance of design in learning. Designing for multimodal literacy involves developing students' competence and identity as meaning-makers, expanding their semiotic capital, and engaging them critically with the affordances and limitations of semiotic technologies. It requires an embodied teaching pedagogy that is attentive to the orchestration of modes, the dynamics of classroom interaction, and the broader social and technological contexts in which meaning is made.

Promise and Perils of Generative AI for Literacy Learning

GenAI represents a significant inflection point in the evolution of technologies. Unlike earlier forms of artificial intelligence that focused on classification, prediction, or recommendation, GenAI systems generate new content through probabilistic modelling trained on vast corpora of data. These systems are capable of producing text, images, and other multimodal artefacts that are often indistinguishable from those created by humans. This shift from curation-based to creation-based AI marks a profound transformation in the epistemic conditions of literacy learning.

The implications of this transformation for literacy learning are substantial. On the one hand, GenAI offers unprecedented opportunities to support students' engagement with reading and writing. On the other hand, it introduces new challenges related to authorship, agency, reliability, and criticality (Cope & Kalantzis, 2022). Designing literacy learning in this context requires careful

consideration of both the affordances and the limitations of GenAI, as well as a recognition of the central role of pedagogical design and teacher mediation.

Chandel and Lim (2024) conducted a systematic review on studies involving GenAI tools for students' literacy learning and found reports of GenAI tools enhancing students' writing performance across several dimensions, including idea generation, organisation, grammatical accuracy, and coherence. These GenAI tools enable students to overcome common barriers in the writing process, such as writer's block, by providing prompts, suggestions, and draft texts that can be iteratively refined. In this sense, GenAI functions as a form of cognitive scaffolding, supporting students in the early stages of composition and enabling them to focus on higher-order aspects of writing.

In addition to writing, GenAI has been reported to support students' reading comprehension as well. By providing customised explanations, summaries, and contextualised information, these systems can assist students in making sense of complex texts. This is particularly valuable in diverse classrooms, where students may have varying levels of prior knowledge and linguistic proficiency. The capability of GenAI to adapt its output to individual students' needs also suggests its potential as a tool for differentiated instruction, enabling more personalised learning experiences for students.

GenAI tools have been reported to be used for multimodal literacy learning as well as it enables students' creation of multimodal artefacts. Students use these tools to generate words, images, audio, and video in their digital multimodal composing. In engaging with GenAI, studies reported that students develop digital literacies, including skills in prompt design, evaluation of outputs, and iterative refinement. These practices foster critical thinking, problem-solving, and metacognitive awareness, which are essential for navigating complex digital environments.

Notwithstanding, Chandel and Lim (2024) also cautioned that the affordances of GenAI tools must be understood alongside significant limitations. GenAI systems do not possess genuine understanding; their outputs are generated based on statistical patterns rather than epistemological grounding. As such, they may produce content that is plausible but inaccurate, a phenomenon often referred to as "hallucination." This raises concerns about the reliability of AI-generated texts and underscores the need for critical evaluation. Students must learn not to accept such output uncritically but to interrogate their accuracy, coherence, and underlying assumptions.

Furthermore, GenAI systems often operate as "black boxes," with limited transparency regarding their sources and processes. This lack of transparency complicates efforts to evaluate the credibility and provenance of information. Peters et al. (2024) have characterised such systems as "stochastic parrots," emphasising their reliance on pattern reproduction rather than genuine knowledge. Another significant concern relates to bias and representation. GenAI systems are trained on data that reflect existing social and cultural patterns, including inequalities and prejudices. As a result, their outputs may reproduce and even amplify stereotypical representations related to gender, race, profession, and other social categories (Burrell, 2016). For example, image generation systems have been shown to produce stereotypical depictions of occupations, reinforcing hegemonic norms. In textual outputs, similar biases may manifest in subtle or overt ways, shaping the

perspectives and values embedded in generated content (UNESCO, IRCAI, 2024). Designing literacy learning in this context requires equipping students with the tools to recognise and critique such biases, developing critical multimodal literacy (Lim, & Bernad-Mechó, forthcoming).

The affective and relational dimensions of learning further complicate the integration of GenAI into educational contexts. As such, empirical studies comparing human–AI interaction with human–human interaction provide valuable insights into these dynamics. Yee et al. (2025) report on a study examining university students' perceptions and physiological response as they engaged in brainstorming tasks either with a teacher or with a chatbot designed to adopt a Socratic questioning approach. The findings revealed a nuanced pattern. Students interacting with the chatbot initially reported higher levels of positive mood, possibly due to the novelty of the technology or the perceived absence of judgement. However, over time, this positive mood diminished, and negative emotions such as stress, confusion, and frustration increased, possibly because students were unaccustomed to the Socratic questioning style of the chatbot.

In contrast, students interacting with a teacher experienced a sustained increase in positive mood, including motivation, inspiration, and a sense of support. These findings highlight the importance of the relational and emotional dimensions of teaching, which are not easily replicated by AI systems. While GenAI can provide cognitive support, it lacks the capacity for genuine empathy, responsiveness, and relational connection. Notwithstanding, it must be acknowledged that students who engaged with the chatbot also reported increased motivation and engagement, although these levels remained lower than those observed among students who interacted with the teacher.

The quality of essay outlines produced by students in both conditions was broadly similar. However, the AI condition produced more polarised results, with a higher proportion of both high and low grades, while the teacher condition resulted in more consistent, moderate performance. This suggests that high-performing students may be better able to leverage GenAI independently, using it as a tool to enhance creativity and critical thinking. In contrast, lower-performing students may struggle without the structured support and adaptive feedback provided by a teacher.

These findings point to the importance of a differentiated and design-oriented approach to the integration of GenAI. GenAI appears to be particularly well suited for low-stakes, exploratory, and cognitively oriented tasks, such as brainstorming, drafting, and idea generation. It can also support iterative learning, allowing students to refine their work through cycles of feedback and revision. However, it is less effective in addressing affective needs, providing nuanced feedback, or supporting equitable learning outcomes across diverse student populations. Teachers, therefore, remain indispensable, particularly in providing emotional support, scaffolding complex learning, and ensuring that all students are able to benefit from technological resources (Lim, Yee, & Quek, 2025).

From a social semiotic perspective, GenAI tools can be conceptualised as semiotic technologies (Lim, & Bernad-Mechó, forthcoming). However, it differs from traditional semiotic technologies in that it actively participates in the production of meaning. Rather than merely representing information, it generates new artefacts that shape the communicative landscape. This raises important

questions about students' agency. While students exercise agency in prompting and refining AI output, this agency is mediated by the underlying algorithms and training data. The meanings that can be produced are thus constrained by the design of the system, including its datasets, parameters, and embedded assumptions.

This mediated agency has significant implications for literacy learning. Students must develop an understanding of how GenAI systems work, including their limitations and biases, in order to use them effectively and critically. This goes beyond technical knowledge to include epistemic awareness, an understanding of how knowledge is constructed, validated, and communicated. In this sense, literacy learning must expand to include an engagement with the epistemological dimensions of AI, enabling students to navigate a landscape in which knowledge is increasingly co-produced by humans and machines.

The integration of GenAI into literacy learning also raises important ethical considerations. Issues of authorship, ownership, and academic integrity become more complex when texts are co-produced with AI systems. Traditional assessment practices, which often rely on the assumption of individual authorship, may no longer be adequate. Instead, there is a need to design assessments that account for the use of AI as part of the learning process, focusing on students' ability to critically engage with and refine AI-generated outputs. This shifts the emphasis from product to process, from the generation of text to the evaluation and transformation of meaning.

Critical multimodal literacy is thus an essential component of literacy education in the age of GenAI. Students must be equipped to analyse both the content of texts and the processes and technologies through which they are produced. This includes understanding how algorithms shape outputs, recognising biases and assumptions, and evaluating the credibility and reliability of information. It also involves an awareness of the ethical implications of using AI, including issues of fairness, accountability, and transparency.

Rather than resisting the integration of GenAI, teachers should seek to harness its potential through thoughtful pedagogical design. This involves creating learning environments in which GenAI is used as a tool for exploration, reflection, and refinement, rather than as a substitute for thinking. For example, students might be asked to generate a draft using AI and then critically evaluate and revise it, identifying strengths, weaknesses, and areas for improvement. Such tasks encourage active engagement and critical thinking, engaging students in learning as design.

A blended approach, in which GenAI serves as a pedagogical aide, appears to be the most productive way forward. In this model, the strengths of both human and machine are leveraged to support learning. GenAI provides rapid feedback, idea generation, and opportunities for iterative practice, while teachers provide guidance, support, and critical perspective. This combination allows for a practicable approach to literacy learning in the digital age.

The promise and perils of GenAI for literacy learning are deeply intertwined. GenAI offers powerful tools for supporting writing, reading, and multimodal composing. At the same time, it introduces significant challenges related to reliability, bias, authorship, and the nature of knowledge itself. Designing literacy learning in this context requires a careful balancing of these affordances and constraints. Above all, the teacher as a designer of learning is key in mediating the

complex interactions between learners, technologies, and meaning-making practices in the age of GenAI.

Designing Literacy Learning for the Future

Designing literacy learning in the age of GenAI requires a fundamental rethinking of pedagogy, curriculum, and assessment. The preceding discussions on multimodality and GenAI have underscored that literacy is no longer confined to the production and interpretation of alphabetic text, nor can it be adequately assessed through traditional measures that assume individual authorship and stable knowledge. Instead, literacy must be understood as a dynamic, multimodal, and socially situated practice, mediated by increasingly complex interactions between human and technological agents (Cope et al., 2026). In this section, I outline the key educational implications of this reconceptualisation, focusing on the design of curriculum, assessment, pedagogy, and teacher development for future-oriented literacy learning.

A primary implication concerns the need to expand the forms of representation and expression recognised within literacy education. Traditional essay-based assessments, while still valuable, are insufficient in capturing the breadth of contemporary meaning-making practices. Communication is inherently multimodal, integrating text, image, sound, gesture, and interactivity. Students routinely engage in such practices outside the classroom, producing and interpreting content on social media platforms, video-sharing sites, and other digital spaces. Yet, schooling often maintains a narrow focus on print-based literacy, creating a disconnect between students' lived experiences and academic expectations.

Hence, designing literacy learning for the future requires the incorporation of multimodal forms such as presentations, videos, podcasts, digital compositions, and interactive media (Lim & Querol-Julian, 2024). These forms reflect contemporary communicative practices as well as enable students to draw on a wider range of semiotic resources, thereby expanding their semiotic repertoires and building their semiotic capital. Importantly, this is about recognising the complementary roles that different modes play in meaning-making. Students must learn to orchestrate these modes effectively, making principled choices about how to represent ideas in ways that are appropriate to context, audience, and purpose as part of the cultivation of multimodal literacy (Lim & Tan-Chia, 2023).

This shift has significant implications for assessment. If tasks can be easily completed by GenAI systems, they can no longer serve as valid indicators of student learning (Araújo et al., 2024; Lim & Tan, 2025). For instance, the writing of a conventional essay, particularly one that emphasises surface-level correctness and coherence, may be readily outsourced to AI tools. In such cases, the assessment ends up mostly measuring their ability to use technology. To address this, assessment practices must be reoriented towards higher-order skills that are less amenable to automation. These include critical analysis, creativity, synthesis, and the application of knowledge in contextually situated ways.

One approach is to emphasis the learning process over the learning product (Lim, in press). Rather than evaluating only the final artefact, assessments can be designed to capture the process of learning, including the stages of planning, drafting, revising, and reflecting. Students might be required to document their interactions with GenAI, explaining how they prompted the system, how they

evaluated its output, and how they refined their work. Such an approach enhances transparency and encourages metacognitive awareness, enabling students to reflect on their own meaning-making processes. It aligns with the notion of learning as design, where the emphasis is on transformation rather than mere reproduction.

In addition, assessment must account for the collaborative and distributed nature of knowledge construction in the age of GenAI (Cope et al., 2026). Learning increasingly takes place within networks of human and technological agents, where ideas are co-constructed through interaction. This "more-than-human" condition challenges traditional notions of individual achievement and calls for new forms of assessment that recognise collective and mediated forms of learning. Group projects, peer review, and collaborative multimodal compositions can provide opportunities for students to engage with diverse perspectives and to develop skills in negotiation, coordination, and co-design.

At the same time, there is a need to maintain rigour and ensure that assessments remain meaningful and equitable. This requires careful calibration of tasks to ensure that they demand genuine intellectual engagement. For example, students might be asked to critique AI-generated texts, identifying biases, inaccuracies, and assumptions, and to revise these texts in light of their analysis. Alternatively, they might be tasked with designing multimodal artefacts for specific audiences, justifying their semiotic choices and reflecting on the effectiveness of their designs. Such tasks require students to go beyond surface-level engagement, demonstrating deep understanding and criticality

The integration of GenAI as a pedagogical aide for teachers and a learning companion for students can be productive for literacy learning. As discussed earlier, GenAI can be effective in supporting low-stakes, cognitive tasks such as brainstorming, drafting, and generating feedback. When integrated thoughtfully, it can enhance students' productivity and provide opportunities for iterative learning. Students can experiment with different ideas, receive immediate responses, and refine their work through cycles of interaction. This aligns with the principles of formative assessment, where feedback is used to guide and improve learning. However, the effectiveness of GenAI in this role is contingent on pedagogical design and teacher mediation. Without appropriate guidance, students may become overly reliant on AI or fail to engage critically with its output. Teachers must therefore design tasks that encourage active engagement, prompting students to question, evaluate, and transform AI-generated content. This involves moving students from learning passively to learning as design.

Another important implication concerns the need to rebalance attention towards the affective and embodied dimensions of learning. As discussed earlier, GenAI chatbots are weaker in its capacity to provide emotional support and to engage with students when compared to human teachers (Yee et al., 2025). As such, human teachers play a crucial role in creating supportive learning environments, fostering motivation, and responding to students' emotional needs. Designing literacy learning for the future must therefore attend to these dimensions, recognising that learning is not only cognitive but also affective and embodied (Lim, Cope, & Kalantzis, 2022).

A productive way to conceptualise this is through a blended model of instruction, in which the complementary strengths of human teachers and AI systems are leveraged. GenAI can handle routine or repetitive tasks, freeing

teachers to focus on areas where human expertise is indispensable. These include providing nuanced feedback, supporting affective and relational dimensions of learning, and addressing the diverse needs of students. In this model, technology does not replace the teacher but augments their capacity, enabling more targeted and responsive forms of instruction. Differentiation is a particularly important consideration in this context. GenAI enables personalised learning pathways, allowing students to work at their own pace and level of complexity. High-performing students may use AI to explore advanced ideas and to extend their learning, while lower-performing students may benefit from additional scaffolding and support. Teachers can use insights from students' interactions with AI to identify areas of difficulty and to provide targeted interventions. This has the potential to enhance equity, ensuring that all students have access to appropriate levels of challenge and support (Koh, Jonathan, et al., 2023).

At the same time, it is essential to recognise that access to technology does not automatically translate into meaningful learning. Students require explicit instruction in how to use GenAI effectively and critically (Lim & Bernad-Mechó, forthcoming). This includes developing skills in prompt design, evaluating output, and integrating AI-generated content into their own work. It also involves fostering an awareness of the limitations and biases of AI systems, enabling students to use them responsibly and ethically. Designing literacy learning, therefore, entails cultivating the competencies and dispositions needed to use these tools well.

The curriculum must also evolve to incorporate multimodal and AI literacies as core components of education. This involves recognising that literacy is no longer a singular, monolithic construct but a set of practices that vary across contexts and modes (New London Group, 1996/2025). Students must be prepared to engage with diverse forms of communication, from traditional academic writing to digital and multimodal composing (Lim & Unsworth, 2023)

Teacher education and professional development are critical in supporting this transformation. Teachers must be equipped with the knowledge and skills needed to design effective multimodal and AI-integrated learning environments. This includes understanding the theoretical foundations of multimodality, developing competence in using digital tools, and cultivating the ability to critically evaluate emerging technologies. Professional development should also provide opportunities for teachers to experiment with new pedagogical approaches, reflect on their practice, and collaborate with colleagues (Lim & Nguyen, 2022). Without such support, the potential of GenAI to enhance literacy learning is unlikely to be realised.

Emerging technologies such as multimodal learning analytics offer new possibilities for capturing the complexity of learning processes (Koh, Lim, & Jonathan, 2026). By analysing data streams such as eye-tracking, gesture, and physiological responses, these tools can provide insights into students' engagement and understanding. This moves beyond a narrow focus on final products to consider the "signs of learning" that emerge throughout the process. While still in its early stages, such approaches have the potential to inform more responsive and adaptive forms of pedagogy, enabling teachers to better support students' learning.

Central to all these considerations is the development of student agency. From a social semiotic perspective, agency arises from the ability to navigate a range of meaning-making options and to make choices that reflect one's interests, values,

and intentions. In the context of GenAI, this involves understanding both the possibilities and limitations of the technology and using it in ways that enhance, rather than constrain, one's capacity for expression (Lim & Nguyen, 2023). While AI systems may exhibit a form of derivative agency, based on the patterns encoded in their training data, it is students who must exercise genuine agency in shaping meaning.

Designing literacy learning for the future thus involves fostering this sense of agency. Students must be encouraged to question AI output, to challenge assumptions, and to make informed decisions about how to represent their ideas. They must learn to see themselves not as passive users of technology but as active designers of meaning, capable of harnessing the affordances of AI while remaining critically aware of its limitations. This shift is crucial in ensuring that technology serves to empower rather than diminish human creativity and criticality.

Finally, there is a need for ongoing research to explore the long-term impacts of GenAI on literacy learning. While existing studies provide valuable insights, much remains to be understood about how these technologies influence learning across different contexts, disciplines, and populations. Research is needed to examine issues such as equity, access, and the development of critical literacies, as well as to evaluate the effectiveness of different pedagogical approaches. Such work will be essential in informing evidence-based practice and in guiding the responsible integration of GenAI into education. The educational implications of GenAI for literacy learning are both profound and far-reaching. They call for a reimagining of pedagogy, curriculum, and assessment, grounded in the work on educational semiotics. By exploring the pedagogical possibilities outlined here, educators can harness the potential of GenAI to enhance literacy learning while addressing its limitations and risks.

Conclusion

This paper has argued that the emergence of generative artificial intelligence necessitates a fundamental rethinking of literacy learning in contemporary education. As GenAI transforms how texts are produced, circulated, and interpreted, traditional conceptions of literacy are no longer sufficient. Instead, literacy must be understood as a social practice, in which meaning is constructed through the orchestration of diverse semiotic resources within technologically mediated environments. Central to this is the notion of pedagogy as design. Teachers are not merely transmitters of knowledge or facilitators of learning but designers of learning environments. They make principled decisions about how to integrate content, pedagogy, assessment, and technology in ways that support meaningful engagement and critical understanding. In the context of GenAI, this role becomes even more significant, as teachers must mediate students' interactions with powerful yet imperfect technologies, ensuring that learning remains purposeful, reflective, and equitable.

This paper has underscored the importance of multimodality as a foundational framework for literacy education in advancing the field of educational semiotics (Lim & Unsworth, in press). Communication is inherently multimodal. Recognising this enables a more expansive and inclusive understanding of literacy, one that aligns with contemporary communicative practices. At the same time, the integration of GenAI introduces both promise and peril. While these technologies

offer significant affordances, they also present limitations related to accuracy, bias and transparency. A blended approach, in which human and machine capabilities are strategically combined, appears to offer the most productive pathway forward. Importantly, the rise of GenAI compels a re-examination of assessment practices. Tasks that can be readily completed by AI no longer serve as valid indicators of learning. Instead, assessment must focus on higher-order processes, including critical analysis, creativity, and the ability to transform and apply knowledge in context. Process-oriented and multimodal assessments provide more robust means of capturing students' learning as design. Students must be equipped to interrogate and challenge the output arising from GenAI tools, making informed decisions about how meaning is produced and represented. This involves developing critical multimodal literacy, an understanding of the socio-technical systems that shape communication, and the confidence to participate actively in these systems through learning as design (Lim & Bernad-Mechó, forthcoming).

The enduring goal of literacy education remains unchanged building up students' semiotic capital so that they can become designers of their social futures (New London Group, 1996/2025). Designing literacy learning in the age of GenAI is more than simply a matter of integrating new technologies into existing practices. It requires a paradigm shift in how we reimagine literacy, pedagogy, and learning and I know, as education researchers and teachers, we can rise to this challenge.

References

Adami, E., Diamantopoulou, S., & Lim, F. V. (2022). Design in Gunther Kress's social semiotics. *London Review of Education*, *20*(1), Article 41. https://doi.org/10.14324/LRE.20.1.41

Araújo, A. D., Gualberto, C., Pinheiro, M. S., & Lim, F. V. (2024). Multimodality, AI, and education: An interview with Professor Fei Victor Lim. *Linguagem em Foco (Language in Focus) Journal*, *16*(2), 174-178. https://doi.org/10.46230/lef.v16i2.13856

Burrell, J. (2016). How the machine 'thinks': Understanding opacity in machine learning algorithms. *Big Data & Society*, *3*(1), 1-12. https://doi.org/10.1177/2053951715622512

Chandel, P., & Lim, F. V. (2024). Generative AI and literacy development in the literacy classroom: A Systematic review of literature. *Ubiquitous Learning: An International Journal*, *18*(2), 31-49. https://doi.org/10.18848/1835-9795/CGP/v18i02/31-49

Cope, B., & Kalantzis, M. (2015). An introduction to the pedagogy of multiliteracies. In B. Cope & M. Kalantzis (Eds.), *A pedagogy of multiliteracies: Learning by design* (pp. 1-36). Palgrave Macmillan.

Cope, B., & Kalantzis, M. (2022). Artificial intelligence in the long view: From mechanical intelligence to cyber-social systems. *Discover Artificial Intelligence*, *2*(1), Article 13. https://doi.org/10.1007/s44163-022-00029-1

Cope, B., Kalantzis, M., & Zapata, G. C. (2026). *Literacies in the age of AI: Teaching and learning in the digital era*. Wiley.

Djonov, E., & van Leeuwen, T. (2018). The power of semiotic software: A critical multimodal perspective. In J. Flowerdew & J. E. Richardson (Eds.), *The Routledge handbook of critical discourse studies* (pp. 566-581). Routledge.

Jewitt, C. (Ed.). (2014). *The Routledge handbook of multimodal analysis* (2nd ed.). Routledge.

Jewitt, C., Bezemer, J., & O'Halloran, K. L. (2016). *Introducing multimodality*. Routledge.

Koh, E., Jonathan, C., Lim, F. V., Kadir, M., & Tan, J. P-L. (2023). Value and challenges in using a collaborative critical reading and learning analytics system. *Proceedings of the 16th International Conference on Computer-Supported* Collaborative Learning.

Koh, E., Lim, F. V., & Jonathan, C. (2026). Twenty-first Century Competencies assessment using formative learning analytics in K-12: Case examples from Singapore. In K. L. Chue, A. Yeo, K. H. K. Tan, & T. H. Yong (Eds.), *Fundamentals of assessment: Principles and practices for the classroom* (pp 195-205). Routledge.

Kress, G. (2010). *Multimodality a social semiotic approach to contemporary communication*. Routledge.

Kress, G., Jewitt, C., Bourne, J., Franks, A., Hardcastle, J., Jones, K., & Reid, E. (2005). *English in urban classrooms: A multimodal perspective on teaching and learning* (2nd ed.). Routledge.

Kress, G., & Selander, S. (2012). Multimodal design, learning and cultures of recognition. *The Internet and Higher Education*, *15*(4), 265-268. https://doi.org/10.1016/j.iheduc.2011.12.003

Lim, F. V. (2021). *Designing learning with embodied teaching: Perspectives from multimodality*. Routledge.

Lim, F. V. (2023). Editorial: Transduction in evolving contexts of intermodal meaning making: Moving meaning across media, modes and multiple realities. *Frontiers in Communication, 8*, Article 1138753. https://doi.org/10.3389/fcomm.2023.1138753

Lim, F. V. (2024a). The multimodal turn in higher education. In V. Beltrán-Palanques & E. Bernad-Mechó (Eds.), *Current trends in EMI and multimodality in higher education* (pp. 9-25). Routledge.

Lim, F. V. (2024b). Multimodality and learning: Desiderata for designing social futures. In V. Tavares (Ed.), *Empowering language learners in a changing world through pedagogies of multiliteracies* (pp. 21-39). Springer.

Lim, F. V. (2024c). Designing synchronous online learning experiences with social media as semiotic technologies. In I. Pineda & R. Bosso (Eds.), *Virtual English as a lingua franca* (pp. 127-146). Routledge.

Lim, F. V. (in press). Designing learning and learning as design: Pedagogical and social change for the digital age. In V. Tavares (Ed.). *The Routledge handbook of language education and social change*. Routledge.

Lim, F. V., & Bernad-Mechó, E. (n.d.). Using generative artificial intelligence for digital multimodal composing in the pre-service literacy classroom [Manuscript under review].

Lim, F. V., Cope, B., & Kalantzis, M. (2022). A metalanguage for learning: Rebalancing the cognitive with the socio-material. *Frontiers in Communication*, *7,* Article 830613. https://doi.org/10.3389/fcomm.2022.830613

Lim, F. V., Cope, B., & Kalantzis, M. (in press). Reimagining pedagogies for multiliteracies in the age of Generative Artificial Intelligence, Special Issue, *Pedagogies.*

Lim, F. V., Gilje, Ø., & Djonov, E. (2025). Editorial for special issue on digital multimodal composing in the era of Artificial Intelligence, *Computers and Composition, 75,* Article 102911. https://doi.org/10.1016/j.compcom.2024.102911

Lim, F. V., & Nguyen, T. T. H. (2022). Design-based research approach for teacher learning: A case study from Singapore. *ELT Journal*, *76*(4), 452-464. https://doi.org/10.1093/elt/ccab035

Lim, F. V. & Nguyen, T. T. H. (2023). 'If you have the freedom, you don't need to even think hard' – Considerations in designing for students' agency through digital multimodal composing in the language classroom. *Language and Education*, *37*(4), 409-427. https://doi.org/10.1080/09500782.2022.2107875

Lim, F. V., & Querol-Julian, M. (Eds.). (2024). *Designing Learning with digital technologies: Perspectives from multimodality*. Routledge.

Lim, F. V., & Tan-Chia, L. (2023). *Designing learning for multimodal literacy: Teaching viewing and representing*. Routledge.

Lim, F. V., & Tan, X. (2025). "If ChatGPT was used … then it shouldn't be graded": Understanding pre-service teachers' perceptions towards Generative Artificial Intelligence for English teaching and learning. In G. Zapata & J. Jones (Eds.). *Generative AI technologies, multiliteracies, and language education*. Routledge.

Lim, F. V., & Toh, W. (2026). *Designing learning with digital play: A multimodal perspective*. Routledge.

Lim, F. V., & Unsworth, L. (2023). Multimodal composing in the English classroom: recontextualising the curriculum to learning. *English in Education, 57*(2), 102-119. https://doi.org/10.1080/04250494.2023.2187696

Lim, F. V., & Unsworth, L. (in press). *Handbook of educational semiotics: Multimodality and learning*. Bloomsbury.

Lim, F. V., & Yee, J. (forthcoming). Investigating digital literacies: Reflections from developing the student digital literacies profiling tool. In E. Baker (Ed.), *Research handbook on digital literacies*. Edward Elgar Publishing.

Lim, F. V., Yee, J. E., & Quek, J. (2025, October 1). What our body's response reveals about AI in the classroom. *University World News*, https://www.universityworldnews.com/post.php?story=20251001143334646

Moje, E. B., & Luke, A. (2009). Literacy and identity: Examining the metaphors in history and contemporary research. *Reading Research Quarterly*, *44*(4), 415-437. https://doi.org/10.1598/RRQ.44.4.7

New London Group. (1996/2025). Reprint: A pedagogy of multiliteracies: Designing social futures, *Harvard Educational Review*, *95*(1), 102-134. https://doi.org/10.17763/1943-5045-95.1.102

O'Halloran, K. L. (Ed.). (2004). *Multimodal discourse analysis: Systemic-functional perspectives*. Continuum.

Peters, M. A., Jackson, L., Papastephanou, M., Jandrić, P., Lazaroiu, G., Evers, C. W., … Fuller, S. (2024). AI and the future of humanity: ChatGPT-4, philosophy and education – Critical responses. *Educational Philosophy and Theory*, *56*(9), 828–862. https://doi.org/10.1080/00131857.2023.2213437

Street, B. V. (1995). *Social literacies: Critical approaches to literacy in development, ethnography and education*. Longman.

UNESCO, IRCAI. (2024). *Challenging systematic prejudices: An investigation into gender bias in large language models*.

Yee, J., Lim, F. V., & Quek, J. (2025). *Moods, bots, and bodies: University students' emotional and physiological responses to human vs. GenAI chatbots* [Preprint]. Research Square.

Weninger, C. (2020). *From language skills to literacy: Broadening the scope of English language education through media literacy*. Routledge

Zhao, S., Djonov, E., & van Leeuwen, T. (2014). Semiotic technology and practice: A multimodal social semiotic approach to PowerPoint. *Text & talk*, *34*(3), 349-375. https://doi.org/10.1515/text-2014-0005