

Generative AI, learning and new literacies

Su-Yen Chen 

National Tsing Hua University

suychen@mx.nthu.edu.tw

Abstract: *Launched in November 2022, OpenAI's ChatGPT garnered over 100 million users within two months, sparking a surge in research and concern over potential risks of extensive AI experiments. The article, originating from a conference presentation by Tsinghua University and NTHU, Taiwan, provides a nuanced overview of Generative AI. It explores the classifications, applications, governance challenges, societal implications, and development trajectory of Generative AI, emphasizing its transformative role in employment and education. The piece highlights ChatGPT's significant impact and the strategic adaptations required in various sectors, including medical education, engineering, information management, and distance education. Furthermore, it explores the opportunities and challenges associated with incorporating ChatGPT in educational settings, emphasizing its support in facilitating personalized learning, developing 21st-century competencies, fostering self-directed learning, and enhancing information accessibility. It also illustrates the integration of ChatGPT and text-to-image models in high school language courses through the lens of new literacies. The text uniquely integrates three layers of discourse: introductions to Generative AI by experts, scholarly debates on its merits and drawbacks, and practical classroom applications, offering a reflective snapshot of the current and potential states of Generative AI applications while emphasizing the interconnected discussions across various layers of discourse.*

Keywords: Generative AI, ChatGPT, learning, new literacies, education

1. Introduction

ChatGPT (Chat Generative Pre-trained Transformer) is a large language model-based chatbot developed by OpenAI and was launched on November 30, 2022. Within two months, it gained over 100 million users. In 2023, tens of thousands of articles related to this topic were published in the research community. Despite its popularity, more than 30 thousand people signed the “Pause Giant AI Experiments” petition. The virality of ChatGPT underscores the growing prominence of generative AI in analyzing and creating various forms of content. This signals a transformative phase in research, learning, and teaching across domains, presenting both opportunities and potential risks.

At the sixth joint conference of the Institute of Education at Tsinghua University and the Institute of Learning Science and Technologies at NTHU, Taiwan, titled “Challenges and Changes: Education and Learning in the Digital Age,” which was held on August 28, 2023, in Beijing, I presented on “Generative AI Applications: Examples in Learning and Research. This article builds upon the aforementioned presentation with three main objectives: (1) to present an overview of Generative AI, covering its categories and renowned models, areas of application and associated challenges, societal concerns and recommendations for AI governance, and its development outlook; (2) to delve into Generative AI’s transformative role and ChatGPT’s influence on employment and required job skills, explore ChatGPT’s impact and necessary strategic adaptations across key application domains, and scrutinize the opportunities, challenges, and critical implications of using ChatGPT in school learning environments; and (3) to demonstrate how ChatGPT and text-to-image models can be integrated into high school language

classes, viewed through the lens of new literacy theories.

2. Generative AI

Generative AI is a branch of artificial intelligence that produces new content, setting it apart from traditional expert systems which primarily process existing data. This is in contrast to predictive machine learning models. Generative AI uses advanced architectures, such as transformers and discriminators, to generate novel outputs from diverse inputs. These systems employ methods like unsupervised, semi-supervised, or supervised learning. Thanks to advancements in computing, deep learning technologies—including deep neural networks, transformers, and generative adversarial networks—have emerged. These models can process vast amounts of data and are often trained on extensive sources such as Wikipedia, GitHub, social networks, and Google images. Such in-depth training enables them to transform multimedia inputs, like text, into varied outputs, including images, videos, audio, or alternative text formats. These capabilities open doors to a multitude of applications across different sectors (Gozalo-Brizuela & Garrido-Merchan, 2023; Yu & Guo, 2023).

Numerous studies have examined Generative AI models across various categories such as text-to-text, text-to-image, and text-to-audio, focusing on their global trends, basic techniques, top-tier models, applications, and challenges (Aydın & Karaarslan, 2023; Gozalo-Brizuela & Garrido-Merchan, 2023; Zhang et al., 2023). These analyses highlight both the advancements in the field and the vision for its future. Additionally, corporations, higher education institutions, and civic groups also actively participated in the discussion in 2023.

First, when considering tasks and popular models, Generative AI operates across various modalities, including: (1) text tasks such as content creation, chatbots, and data synthesis; (2) image tasks that involve generating and editing images; (3) audio tasks that cover text-to-voice conversion, sound creation, and editing; (4) video-related tasks encompassing the creation and editing of videos, as well as adjusting voice translations; and (5) tasks in 3D and other domains, including generating 3D objects and assisting in product design. Table 1 showcases some prominent English-based models and their providers, categorized by three access types: (1) dark blue represents

closed source, not accessible to the public; (2) light blue signifies closed source but accessible via an API; and (3) gray indicates open source, which offers public access to the code for viewing or modification. Beyond English-centric models, Chinese industry leaders Baidu and ByteDance have developed the text model ‘Ernie’ and a text-to-speech model (Jiang et al., 2023; Rudolph, Tan & Tan, 2023; Zhao et al., 2023). These advancements illustrate China’s position as one of the AI frontrunners, with data reflecting the country’s significant interest in Generative AI based on internet search trends (Zhang et al., 2023).

Table 1

Western Generative AI models across modalities, their providers, and access types

	Text	Image	Audio or music	Video	3D
Open AI	GPT-4	DALL-E2	Jukebox		Point-E
Microsoft			VALL-E	RODIN Diffusion	GODIVA
Midjourney Inc.		Midjourney			
Stable AI	StableLM	Stable Diffusion2	Dance Diffusion		
Meta	LLaMA	Make-a-scene	AudioGen	Make-a-video	Builder Bot
Google/DeepMind	LaMDA	Imagen	MusicLM	Image video	DreamFusion
Amazon	Lex		DeepComposer		
Apple					GODIVA
NVIDIA	MT-NLG	Edify		Edify	Edify

Sources: 1. <https://reurl.cc/o7oYQD>, 2. <https://outlook.stpi.narl.org.tw/index>

Second, addressing the applications of Generative AI across various domains and their associated challenges, Stanford HAI (Human-Centered Artificial Intelligence) proposed the following: (1) within medical education and healthcare, the model can accelerate scientific discovery and enhance diagnostic accuracy; (2) in basic science,

it can offer profound insights into the very fabric of nature, spanning biological, physical, and mental dimensions, with significant implications for addressing societal issues; (3) in computer science, it serves as a powerful tool that lowers entry barriers, but also presents challenges in distinguishing reality from artificial creations; (4) in the realm of

creative expression, there is a potential risk where efficiency and speed could overshadow the unique legacy of human creativity; (5) For the social sciences, the focus is on reimagining work to augment rather than replace human workers; and (6) In education, it holds the potential to complement human educators, while ensuring the preservation of students' cognitive processes (<https://hai.stanford.edu/generative-ai-perspectives-stanford-hai>).

Third, in addressing concerns, the Future of Life Institute (FLI) identified several AI risks: (a) commercial competition driving development, potentially overshadowing public interests and societal values; (b) the potential marginalization of vulnerable groups and diverse viewpoints; (c) disruptions in the labor market; (d) threats to political stability; and (e) the creation of deceptive information, which could compromise human rights, personal safety, and the inherent value of human life. In response, FLI launched the "Pause Giant AI Experiments" Petition and suggested the following AI governance measures: (1) mandate stringent third-party auditing and certification; (2) regulate access to computational power; (3) establish dedicated AI agencies at the national level; (4) determine liability for damages inflicted by AI; (5) devise strategies to prevent and oversee AI model leaks; (6) boost funding for technical AI safety research; and (7) set guidelines for detecting and managing AI-generated content and recommendations (<https://futureoflife.org/open-letter/pause-giant-ai-experiments/>). Moreover, a study comparing the AI strategies of the European Union and China—both leaders in AI governance—revealed that the EU focuses on promoting ethical outcomes by safeguarding fundamental rights, while China emphasizes fostering innovation, with a recent inclination towards "common prosperity" (Roberts et al., 2023).

Lastly, when considering the future of

Generative AI, both OpenAI's CEO Sam Altman (2022) (<https://www.youtube.com/watch?v=WHoWGNQRXb0>) and Zhang et al. (2023) suggested that the refinement of foundational models for specific downstream tasks remains largely uncharted territory. There exists a need for more precise control to align better with user expectations. As attention shifts from the foundational technology to its applications, we anticipate a rise in startups responding to the growing demand.

3. Generative AI and Learning

If we aim for the educational system to not simply trail behind the real world but proactively guide societal development, understanding the relationship between Generative AI and future learning becomes crucial. So, how do we grasp the link between this emerging technology and learning, especially given the extensive research on ChatGPT? Key questions include: How might ChatGPT transform the future employment landscape? How do experts in ChatGPT's primary application areas evaluate its impact and recommend adaptation strategies? Moreover, we need to ask how do educational researchers view the potential advantages and challenges ChatGPT presents for student learning and classroom instruction?

The following three sections consist of discussing first Generative AI: Transforming Employment and Job Skill Landscape--the analysis of occupations at risk of computerization and the emergence of AI-related skills in job postings. It also highlights the transformative role of Generative AI and ChatGPT in various employment sectors and the need for adaptation to these changes. Second, ChatGPT: Impact and Strategic Adaptation in Key Application Spheres --exploraes the impact and adaptive strategies of

ChatGPT across various application domains, including medical education, engineering education, information management and distance education. The discussion focuses on ChatGPT's evolving roles, strengths, and challenges in these fields, and how experts and practitioners can navigate and optimize its use. And third ChatGPT: Opportunities and Challenges in School Learning -- explores ChatGPT's advantages and concerns in promoting personalized learning, facilitating skill development, supporting self-directed learning, and providing accessible information in school settings. It implies a critical exploration of its benefits, limitations, and implications for students and educators. Additionally, ChatGPT aids teachers but cannot replace their expertise; educators need training to use it effectively while addressing academic integrity and bias challenges, necessitating AI tools and training in schools as AI's workforce presence grows.

3.1. Generative AI: Transforming Employment and Job Skill Landscape

Not long ago, researchers analyzed the likelihood of computerization across 702 specific occupations, examining its potential implications for the US job market. Their findings indicated that sectors such as healthcare, education, computer science, and management faced a low risk of job displacement (Frey & Osborne, 2017). However, with the advent of Generative AI and ChatGPT, these domains have become focal points for AI applications. This shift is corroborated by recent empirical studies on ChatGPT (Leiter et al., 2023; Sohail et al., 2023), literature reviews (Hariri et al., 2023; Ray, 2023), and insights from AI thought leaders like Stanford HAI in 2023. Notable application areas include healthcare, education, computer science, management, media, entertainment, creative writing, content

creation, and more. This evolution underscores the unpredictable nature of technological advancements and their profound effects on professional landscapes.

In a comprehensive study, China's premier online recruitment platform explored the ChatGPT-enabled labor market by analyzing extensive job posting data (Chen et al., 2023). Their primary findings are as follows: (1) approximately 28% of current job listings seek ChatGPT-related skills, (2) job postings with a focus on ChatGPT typically offer higher salaries, (3) leveraging an occupation-centered knowledge graph, their analysis predicts that ChatGPT is likely to enable additional 45% occupations in the future, (4) new job roles emerging from ChatGPT span multiple sectors, such as manufacturing, services, education, technology, health science, architecture, construction, and design, and (5) professions like advertising, interactive design, game numerical planning, full-stack engineering, community operations, artificial intelligence, and legal specialist roles will increasingly demand proficiency in ChatGPT and other AIGC models. These demands will be especially pronounced in sectors such as technology, marketing, operations, and administration. In contrast, areas like manufacturing, services, education, and health science may require a lesser degree of proficiency.

These observations emphasize the significant role that AI, especially large language models (LLMs) like ChatGPT, will play in determining present and future employment landscapes. They also stress the importance of continuous adaptation and readiness in an ever-changing professional world.

3.2. ChatGPT: Impact and Strategic Adaptation in Key Application Spheres

Before diving into the insights from experts across core application areas such as medical education, engineering education, information management, and distance education, it is crucial to distinguish between GPT and ChatGPT. GPT serves as an AI model available through an API, providing on-demand intelligence. In contrast, ChatGPT operates as a chatbot, designed for user interaction and task execution (Ray, 2023). Notably, GPT's main applications include semantic text comprehension, information retrieval, building assistant-like applications, and fostering a diverse array of application development. GPT has evolved through several iterations: GPT-1 debuted in June 2018, GPT-2 utilized Web Text, GPT-3 employed the common crawl dataset, and GPT-4, launched in March 2023, harnessed an undisclosed data source and embraced multimodal learning (Wu et al., 2023). Conversely, ChatGPT specializes in activities such as content generation, query handling, code assistance, language translation, and language enhancement (Ray, 2023).

Medical education: Numerous studies have endorsed ChatGPT's performance in US-based medical exams. However, Wang et al. (2023) scrutinized its proficiency concerning Chinese medical knowledge. Their findings indicated that despite challenges, GPT-4 exhibits promise, especially in understanding Chinese medical tasks. As ChatGPT thrives in group learning and holds transformative potential for education, there might be a push to revisit conventional teaching methodologies, particularly as emerging AI tools promise reduced learning costs. Nevertheless, in clinical settings where evidence-based approaches and transparent decision-making reign supreme, models like ChatGPT grapple with complex clinical inquiries and transparency mandates. Moreover, ChatGPT shows potential as an electronic health

infrastructure in China, with avenues for enhancement through prompt engineering and feedback from medical experts; yet, it faces hurdles like business competition and potential political interference.

Engineering education: Johri et al. (2023) discussed the potential impact of Generative AI, like ChatGPT, on engineering education and pondered the need for adaptation. The teaching assessment segment highlights the utilization of LLMs in generating multiple forms of assessments, including question creation for various evaluation types, assignment generation, and using AI as an initial assessment tool to auto-grade assignments, which can be later refined by instructors. The teaching support section emphasizes using AI tools for preparations like testing response quality, creating syllabi, generating new concepts based on prompts, augmenting topics with essential background knowledge, crafting lesson plans tailored to specific prompts, and summarizing extensive documents for a comprehensive overview or focused topics. More significantly, Generative AI offers easy access to information, leading to critical questions about the essence and methods of teaching. While it might substitute many knowledge-based roles, professions rooted in care and empathy could remain less affected, though the value added by human educators might become harder to justify. Furthermore, as experienced researchers, it is essential to ensure newcomers understand the foundational concepts, preserving the transfer of tacit knowledge and maintaining trust in the research process.

Information management: The "International Journal of Information Management" published a collective opinion piece by over 70 researchers, presenting a comprehensive framework on the various

aspects of generative conversational AI (Dwivedi et al., 2023). This article elucidated a detailed structure of arguments. The concluding remarks lay out an insightful roadmap for future research questions: (1) does ChatGPT question established research beliefs and initiate a paradigm shift associated with introducing groundbreaking applications? (2) does ChatGPT simplify the process of transferring knowledge among individuals, teams, and organizations? (3) how can tools like ChatGPT be seamlessly introduced into curriculum design, and how do these AI-driven conversational technologies influence teaching effectiveness, student learning experiences, and support for students with disabilities? (4) in the context of teaching and learning, what are the long-term advantages, potential pitfalls, and overall impact of ChatGPT on student performance, critical thinking development, and scholarly writing, especially considering the balance between AI and human creativity? and (5) given the potential disruptions posed by ChatGPT and similar technologies in academia, how can the academic community advance its understanding of these tools and proactively address challenges to traditional practices in teaching, learning, and research?

Distance education: Lastly, Bozkurt et al. (2023) engaged in a collaborative exploration, offering reflections on the future educational implications of ChatGPT and Generative AI. The research proposed that as AI increasingly assumed roles traditionally occupied by human educators, redefining the balance between human and AI contributions to education becomes crucial. Speculative narratives about the future of AI in education present both optimistic and concerning perspectives. On the positive side, there is potential for an educational paradigm shift, a redefinition of human and AI roles, and the responsible use of AI to achieve optimized outcomes. Conversely, concerns include the

loss of deep and authentic learning, issues related to data ethics and privacy, potential biases in AI, and the emergence of a pervasive surveillance society. Moreover, the article astutely suggests that to harness the full potential of AIED could result in deep-rooted epistemological and ontological shifts. Such shifts may introduce new or varied methods of knowledge acquisition, comprehension, existence, and actions within the framework of technology-driven educational environments and experiences.

3.3. ChatGPT: Opportunities and Challenges in School Learning

Within the academic community, there is extensive discussion about the opportunities and challenges ChatGPT presents in a school setting. When focusing on student learning, several key aspects emerge.

Promotion of personalized learning: A consensus across various studies suggests that ChatGPT excels in delivering personalized content, fostering adaptive learning, and effectively serving in roles related to tutoring, mentorship, and even as learning partners (Baidoo-Anu & Ansah, 2023; Farrokhnia et al., 2023; Grassini et al., 2023; Kasneci et al., 2023; Kohnke, Moorhouse & Zou, 2023; Ray, 2023; Rudolph, Tan & Tan, 2023; Tlili et al., 2023; Yu & Guo, 2023; Zhai, 2022). Proper integration of ChatGPT into the classroom can reduce the workload for teachers.

Facilitation of 21st-century learning skills: These skills encompass critical thinking, problem-solving, collaboration, and argumentation (Chiu, 2023; Farrokhnia et al., 2023; Grassini et al., 2023; Kasneci et al., 2023; Lo, 2023; Ray, 2023; Rudolph, Tan & Tan, 2023; Tlili et al., 2023; Zhai, 2022). While many scholars believe that ChatGPT holds the potential to bolster these skills, especially with well-thought-out instructional

designs, there is a cautionary perspective. Some scholars warn against an over-reliance on ChatGPT without strategic integration, suggesting it might detract from authentic learning experiences and potentially hinder skill development.

Supporting self-directed learning: A few studies have explored this possibility (Baidoo-Anu & Ansah, 2023; Kohnke, Moorhouse & Zou, 2023; Rudolph, Tan & Tan, 2023; Tlili et al., 2023). Self-directed learning is a priority worldwide, with a notable emphasis in Taiwan's education system. Understanding diverse human-machine collaboration strategies is vital, especially when using chatbots like ChatGPT to boost student engagement and optimize learning outcomes. Probing the nuances of "collaborative intelligence"—via design strategies and necessary competencies—can shed light on the convergence of human and machine strengths, creating a synergistic space to achieve distinct learning objectives. An intriguing research direction could be investigating how ChatGPT, in conjunction with human educators, can amplify online self-directed learning experiences for students.

Increasing accessibility of information: ChatGPT enables students to effortlessly access information across multiple platforms, such as websites or smartphone apps, and within diverse domains. Unlike traditional search engines that often present mere lists of sources, ChatGPT directly provides concise, written answers. This efficient data retrieval system streamlines the information-gathering process for students, allowing them to quickly grasp the essentials. As a result, they can allocate more time to in-depth reading and critical analysis of the content (Farrokhnia et al., 2023). The efficacy of chatbots in school operations hinges on the quality of their responses. In a recent study, a majority of

participants rated ChatGPT's dialogue quality and information accuracy as commendable. However, there were observations about occasional inaccuracies and information constraints (Tlili et al., 2023). To boost ChatGPT's efficacy, refining its responses to rarer or entirely new queries is recommended. Ray (2023) advocated for iterative prompting: when a preliminary answer did not measure up, users can adjust their prompts or segment them into more detailed inquiries, guiding ChatGPT to a more fitting response.

Numerous studies highlight the advantages ChatGPT offers to teachers, such as aiding in material creation, planning activities, designing instructional methods, curating teaching resources, and providing feedback on student performance (Chiu, 2023; Dwivedi et al. 2023; Farrokhnia et al., 2023; Johri et al., 2023; Kasneci et al., 2023; Kohnke et al., 2023; Lo, 2023; Tlili et al., 2023; Zhai, 2022). However, some of these studies also caution that ChatGPT lacks the nuanced expertise to fully understand students, learning processes, and the broader educational context. Thus, while ChatGPT is a valuable tool, it cannot replace teachers, who remain pivotal in the educational landscape. Kohnke et al. (2023) posited that teachers require additional skills to effectively use ChatGPT. These skills encompass three aspects: (1) technological proficiency, which includes understanding ChatGPT's features, crafting effective prompts, troubleshooting issues, and staying updated with its changes. (2) pedagogical compatibility, which involves strategizing on integrating ChatGPT into teaching, implementing relevant tasks, and guiding students towards self-directed learning using the tool, and (3) social awareness, emphasizing the critical understanding of ChatGPT's limitations, and informing students about its risks and ethical considerations.

Moreover, in addition to the opportunities tied to student learning and concerns regarding the social risks of Generative AI, educational experts have pinpointed at least two distinct challenges within school settings. Firstly, the inability to distinguish between answers generated by the model and those written by students might jeopardizes academic integrity (Farrokhnia et al., 2023; Kohnke et al., 2023; Lo, 2023; Susnjak, 2022; Tlili et al., 2023). Suggested remedies encompass: deploying multimedia task designs; advocating for lucid institutional guidelines concerning ChatGPT usage declarations; and formulating detection tools, paired with student training on ethical utilization. Secondly, there exists a pressing necessity to confront potential linguistic and cultural biases in ChatGPT during the learning process, potentially stemming from its training datasets or intrinsic algorithms (Cao et al., 2023; Ferrara, 2023; Lai et al., 2023).

Finally, Baidoo-Anu and Owusu Ansah (2023) noted that as AI becomes more common in workplaces, it is essential to introduce AI tools in schools. This prepares students for future jobs and helps them use AI safely. Therefore, educators should consider using AI tools like ChatGPT in the classroom. This brings up key questions: How can we use ChatGPT to help students learn? Should we teach both teachers and students how to use these AI tools? And, how can we include AI training in courses for future teachers?

4. Generative AI and new literacies

New literacies scholars do not just see literacy as reading and writing skills; instead, they view it as socially acknowledged ways of communicating meaningful content through active participation, as proposed by Lankshear and Knobel (2006). Although there is ongoing debate about what constitutes new literacies, there is general agreement

on several key features. Firstly, as defining technologies undergo change, new social practices consequently emerge. Secondly, new literacies are characterized by their diversity, multimodality, and multi-faceted nature. Thirdly, these multiliteracies are indispensable for full engagement in civic, personal, and economic spheres within the global community. Lastly, active participation in these new literacies necessitates the employment of novel strategies and dispositions (Chen, Kuo & Hsieh, 2019; Coiro, Knobel, Lankshear, & Leu, 2008; International Reading Association, 2009; Lankshear & Knobel, 2003).

Lankshear and Knobel (2007) classified literacies into conventional, peripheral, and paradigm categories. While conventional literacies lack new technical and ethos elements, peripheral literacies include new technical elements. In contrast, paradigm literacies incorporate both new technical and ethos elements. Stordy (2015) expanded on this framework, explaining that focusing on “technical stuff” equated to analyzing new literacies through digital and Internet literacy lenses. At the same time, considering “ethos stuff” involves interpreting new literacies through information and critical literacy perspectives.

The introduction of Generative AI has added significantly to the “technical stuff” category with the emergence of AI literacy. Concurrently, the “ethos stuff” category has expanded to include a deeper understanding of Generative AI’s role and influence, evident in the advent of smart applications, data abundance, and personalized approaches to information interpretation and appropriation.

4.1. Integrating Text and Image Generation Models in Language Classes: Sparking Initial Imagination

Generative AI intersects with language

learning, introducing innovative, collaborative methods to enhance educational experiences. Language learning platforms, powered by Generative AI, offer personalized and efficient experiences, helping learners acquire languages in a manner suited to their needs and preferences. Technologies like ChatGPT support various language education applications, including reading comprehension aid, writing improvement, personalized learning material provision, interactive conversational agents, language skill assessment, dynamic games, cultural context explanation, and multi-modal learning environments. Additionally, there is growing interest in image generation models such as Midjourney, Stable Diffusion, and DALLE-2, which are becoming increasingly important in content creation and education (Chiu, 2023; Dehouche & Dehouche, 2023; Hutson & Cotroneo, 2023).

The core proposition here is to incorporate text and image generation models into language classes. This integration allows students to use generative AI to enhance their reading reflections and generate content that includes both text and images. The objective is to foster collaboration between stakeholders in language education and experts in generative AI, creating a reading experience characterized by data richness, intelligent applications, improved engagement, and personalized user-generated content. For instance, the proposal suggests using text-based Generative AI models (like ChatGPT, GPT4) and text-to-image generative models (such as Midjourney, Stable Diffusion) for reflective reading exercises on the Chinese classic “The Peach Blossom Land” (桃花源记) by Tao Yuanming. This exercise aims to foster understanding that is both multimodal (text and image) and multicultural (Chinese Mandarin and English). Here is a brief walkthrough of the process:

1. GPT4 Prompt: *Main theme of “Peach*

Blossom Land”

- GPT4 Response: The central theme is the discovery of a utopian society where people lead simple, peaceful lives in harmony with nature, symbolizing a dream of an ideal society.
2. GPT4 Prompt: *Examples of English text with similar themes.*
 - GPT4 Response: Among several examples, “Walden” reflects utopian ideals similar to “The Peach Blossom Land” with themes like harmony with nature and the quest for a simple, fulfilling life.
 3. Prompt Generation for Midjourney/Stable Diffusion: *Provide prompts for both “Peach Blossom Land” and “Walden.”*
 4. Example Midjourney Prompt: A serene and picturesque scene where a fisherman in a small boat discovers a utopian land of peach blossoms, captured with specific settings and lenses. (Refer to Figure 1 for examples and images generated by Midjourney and Stable Diffusion.)

This initial concept showcases the potential of Generative AI in fostering new literacy practices by enhancing reader engagement, promoting individualized interpretation, and fostering responsible AI awareness. This approach encourages students to explore diverse reading reflection angles and create various content types, thereby fostering interpretations and appropriations that align with their perspectives. Furthermore, it stimulates discussions about the making, limitations, and potential biases of Generative AI, alongside fostering awareness of the associated risks, ethical considerations, and potential drawbacks of AI technology.



Figure 1
Images generated by Generative AI text2image models

4.2. Executing a Pilot Study for Teacher Preparation: Integrating ChatGPT and Text2Image Models

Since August 2023, a project titled “New Literacies and Teacher Preparation in the Generative AI Era: Applications of ChatGPT, Midjourney, and Stable Diffusion” has been underway. This initiative, focused on training pre-service teachers using English and Chinese texts from high school textbooks, aims to provide students with opportunities to leverage generative AI for enhancing reading reflection and for generating content that integrates both text and images. While it is imperative for students to establish a solid foundation in the core competencies of each subject matter, we also advocate for the incorporation of innovative strategies in teacher training. Such strategies are designed to facilitate connections to the social practices of new literacies in the near future. Below, I share the insights gained from our initial two months of the project.

The pilot project is comprised of three teams, with each team’s members, primary goals, unit themes, and activity designs outlined below:

Team 1:

Members: A professor specializing in English teaching materials and methodologies, a high school English teacher, a junior high school English teacher, and two pre-service English teachers serving as seed teachers.

Primary Goals: Team 1 seeks to ensure that the application of AI tools like ChatGPT and Text2Image is integral to the learning process, contributing effectively to English learning without being extraneous or supplementary activities. The carefully designed activities are meant to provide students with valuable international communication experience and enhance their English writing and cultural understanding through the aid of generative AI tools.

Unit Themes and Activity Designs:

Junior High School English Unit: The primary emphasis is on communication.

Activity Design: After using ChatGPT for reading comprehension, students will write postcards to their pen pals.

The use of Generative AI includes employing Midjourney to generate images for the backs of the postcards. Once students compose the English content, ChatGPT will serve as an international pen pal and learning partner, offering feedback to enhance student engagement. Subsequently, ChatGPT will assume the role of an English tutor, assisting students in refining their English writing skills. Teachers will provide learning sheets with guiding prompts to help students become familiar with and master the skill of crafting prompts.

High School English Unit: This unit is also related to cultural exchange.

Activity Design: After using ChatGPT for vocabulary building and multiple text reading comprehension, students will be tasked with creating travel brochures to introduce Taiwanese local culture. The use of Generative AI in this task includes having students collaborate with ChatGPT to generate key points and content for the tour guide. Students will also use image generation models to produce various corresponding images. The activity encourages students to engage in both collaborative and adaptive learning.

Team 2:

Members: A professor specializing in Chinese teaching materials and methodologies, along with two pre-service Chinese teachers serving as seed teachers.

Primary Goals: Team 2 aims to use Generative AI to enhance students' learning motivation towards Chinese classics, which are typically the type of texts students find hard to understand and relate to their daily lives.

Unit Themes and Activity Designs:

Text One - “The Daoist Monk of Mount Lao” (勞山道士): The story narrates how student Wang, in pursuit of spiritual enlightenment on Mount Lao, ultimately fails due to his lack of resolve and desire for quick success, becoming a laughingstock for violating his master's teachings. The tale serves as a satirical warning against human laziness and the pursuit of shortcuts in life.

Text Two - “The Tale of the Bearded Guest” (虬髯客傳) This narrative depicts the love story between the courtesan Hong Fu and Li Jing, as well as the tale of the ambitious Bearded Guest who aspires to be king. The Guest ultimately submits to the “true heir,” Li Shimin, and establishes a domain overseas, reflecting the public's desire for peace and aversion to war.

Activity Design: Students will use an AI-driven Algorithm game to explore the character-rich and plot-intensive tales and link to drama creation. The activity design maximizes the use of Generative AI and ChatGPT in areas where they can significantly contribute to teaching Chinese language and literature, such as in character analysis and plot development, facilitating extended learning. On the other hand, it turns the weakness of ChatGPT—its relatively weak foundation in Chinese knowledge and its tendency to provide incorrect answers—into a learning opportunity for students. For example, students take ChatGPT as a virtual learning partner and are encouraged to provide feedback for correct information.

Team 3:

Members: A professor specialized in new literacies study and AI applications in Humanities and Social Sciences, two undergraduate students from Computer Science and Electrophysics with expertise in Generative AI, and two graduate students from Learning Sciences and Technologies.

Primary Goals: Led by the author of this article (who is also the Project PI for this pilot study), Team 3 aims to integrate efforts across the three teams, provide technical support to the other two teams, address encountered challenges, identify possible solutions, and outline findings and future directions.

Tasks:

1. The Project Investigator (PI) wrote the proposal and extended invitations to two other team leaders.
2. A 6-hour Generative AI workshop was organized for all team members, with monthly meetings scheduled every three weeks. These meetings focus on the ‘Why,’ ‘What,’ ‘Who,’ and ‘How’”
 - (a) Each team needs to establish its purpose. For instance, the English teaching team emphasizes feasibility, while the Chinese teaching team aims to enhance motivation for learning classical Chinese texts.
 - (b) Discussions included identifying the types of learning units most suitable for Generative AI. The English teaching team considered integrating ChatGPT

and Midjourney in poetry units, conducting debate activities with ChatGPT for argumentative essays, and then decided to focus on a theme of cultural exchange. Meanwhile, the Chinese teaching team discussed using ChatGPT and image-generation models for emotional essay writing, delving into one of the Four Great Classical Novels of Chinese literature, like *Dream of the Red Chamber*, and decided to focus on enhancing motivation for learning individual classical texts.

- (c) Consideration was given to whether students are expected to use Generative AI in future classes or if it suffices for only teachers to master its use, depending on the students’ technological proficiency at each learning stage.
 - (d) Strategies were explored to maximize effectiveness without risking misuse, such as guiding students to view ChatGPT not as a tool for completing assignments but as a learning partner or tutor.
3. Team 3 is tasked with finding solutions to the limitations of Generative AI models. For example, ChatGPT’s performance is not as robust when applied to Chinese subjects compared to English, especially in terms of accuracy in responding to classical texts. The team is exploring solutions such as using GPT-4’s plugin feature and comparing the effectiveness of various models like Chinese LLaMA, Taiwan LLaMA, and Baidu’s Ernie. We also compared the advantages

and disadvantages of Midjourney and Stable Diffusion, providing reference points for other team members.

5. Conclusion

This article delivers an overview of Generative AI, probing into its categories, applications, governance, and concerns while examining its transformative role, ChatGPT's influence on employment, and the opportunities and challenges presented in the educational realm. The piece delineates the practical incorporation of ChatGPT and text-to-image models in high school language classes, viewed through the lens of new literacies. The text synthesizes three distinct layers of discourse, typically found dispersed across different publications: AI experts introducing Generative AI, educational scholars conducting comprehensive discussions on Generative AI and ChatGPT's merits and demerits, and the practical applications of Generative AI observed in classrooms. While contributing to the academic dialogue, this approach effectively bridges these diverse layers of discourse. However, the article might exhibit limitations like a potential lack of depth and cohesion due to the wide array of topics covered. In wrapping up, the article provides reflections and observations on the present state of Generative AI applications and prospects, especially emphasizing the linkage of discussions across the three identified layers of discourse.

1. AI experts have highlighted refining foundational models for unique downstream applications as an emergent, yet largely untapped, future direction. Within diverse AI fields, there is a ripple of optimism with individuals anticipating promising outcomes. For instance, advocates within the realm of

medical education are identifying tools like ChatGPT as potentially pivotal in crafting electronic health infrastructures. Nonetheless, the domain is still fledgling, with substantial use-cases and tangible examples being relatively rare and emerging.

2. There is a consensus among AI experts about the necessity for enhanced precision and control in AI models to ensure closer alignment with user expectations. While typical research labs may lack the extensive resources available to larger entities, they can still participate significantly in AI research and development. There are accessible strategies available to facilitate this engagement, including Prompt Engineering (refer to Dehouche & Dehouche, 2023; Hutson & Cotroneo, 2023; White et al., 2023), Reinforcement Learning-Based Tuning (with available open-source tools and frameworks), Low-Rank Adaptation (LORA) (Hu et al., 2021), and Data Augmentation. In the practical integration of ChatGPT and text-to-image models into high school language classes, this study experimented with strategies related to both Prompt Engineering and LORA, and also engaged in discussions about Reinforcement Learning.

3. Strategies for navigating advancements in Generative AI can draw lessons from past academic responses to AI development. For instance, similar to approaches with self-driving cars, there is a need for governance and regulation to evolve alongside technology (Chen, Kuo & Lee, 2020; Cohen & Cavoli, 2019). The Future of Life Institute (FLI) has proposed a similar emphasis on governance for Generative AI. Proactive strategies, such as anticipating societal impacts through scenario analyses (Milakis et al., 2017; Staricco et al., 2019), and initiatives like developing benchmarks for robotics based on desired tasks (Li et al., 2023), are aligned

with this approach. However, the development of Generative AI has deviated from initial predictions in AI research. Contrary to the belief that AI would not significantly impact professions requiring complex skills, social intelligence, and creativity (e.g. Chen & Lee, 2019; Frey & Osborne, 2017), Generative AI has not only excelled in performing complex tasks but also surpassed expectations in domains related to social sciences and creative expressions. This divergence is evidenced by the 2023 Hollywood writers' strike, which brought forth new issues, including disputes over intellectual property rights related to the training data used by Generative AI.

4. Discourse regarding the intersection of Generative AI and learning primarily focuses on Large Language Models (LLMs) like ChatGPT, with occasional references to text-to-image models and rare mentions of audio and video models. Scholars have suggested that ChatGPT has the potential to disrupt existing research and teaching paradigms (Dwivedi et al., 2023), shift epistemological and ontological foundations (Bozkurt et al., 2023), and redefine the criteria for an ideal teacher (Johri et al., 2023). However, its level of application and impact, as observed in practical classroom integrations, currently remains limited to enhancing information accessibility, advancing personalized learning,

fostering 21st-century learning skills, and supporting self-directed learning.

5. The application of Generative AI and ChatGPT varies among individuals. For instance, at the higher education level, students use it more extensively, while most high school students in Taiwan, primarily focused on college entrance exams, exhibit varying levels of familiarity with these technologies. Differences also exist among teachers; however, some schools have begun inviting experts on ChatGPT and Midjourney to conduct workshops during teacher professional development sessions. Examining how people react to this trend and exploring variables related to the technology's acceptance levels could be interesting topics for future research. Furthermore, I would like to express my gratitude to the authors of the papers presented at the "Challenges and Changes: Education and Learning in the Digital Age" conference. Topics such as future learning, digital transformation in higher education, language learning, engineering education, data governance, multimodal learning analysis in real classrooms, and discussions on big data analysis, teaching strategies, and neuroscience have provided valuable insights, significantly contributing to the conceptualization of this extended article.

References

- Aydın, Ö., & Karaarslan, E. (2023). Is ChatGPT leading generative AI? What is beyond expectations?. *Academic Platform Journal of Engineering and Smart Systems*, 11(3), 118-134. <http://dx.doi.org/10.2139/ssrn.4341500>
- Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. *Journal of AI*, 7(1), 52-62. <http://dx.doi.org/10.2139/ssrn.4337484>
- Bozkurt, A., Xiao, J., Lambert, S., Pazurek, A., Crompton, H., Koseoglu, S., & Jandrić, P. (2023). Speculative futures on ChatGPT and generative artificial intelligence (AI): A collective reflection from the educational landscape. *Asian Journal of Distance Education*, 18(1). <http://dx.doi.org/10.5281/zenodo.7636568>
- Cao, Y., Zhou, L., Lee, S., Cabello, L., Chen, M., & Hershovich, D. (2023). *Assessing cross-cultural alignment between chatgpt and human societies: An empirical study*. arXiv. <https://doi.org/10.48550/arXiv.2303.17466>
- Chen, L., Chen, X., Wu, S., Yang, Y., Chang, M., & Zhu, H. (2023). *The future of chatgpt-enabled labor market: A preliminary study*. arXiv. <https://doi.org/10.48550/arXiv.2304.09823>
- Chen, S. Y., Kuo, H.-Y., & Hsieh, T. C. (2019). New Literacy practice in a facebook group: The case of a residential learning community. *Computers & Education*, 134, 119-131. <https://doi.org/10.1016/j.compedu.2019.01.008>
- Chen, S. Y., Kuo, H. Y., & Lee, C. C. (2020). Preparing society for automated vehicles: Perceptions of the importance and urgency of emerging issues of governance, regulations, and wider impacts. *Sustainability*, 12, 7844. <https://doi.org/10.3390/su12197844>
- Chen, S. Y. & Lee, C. C. (2019). Perceptions on the impact of high-level machine-intelligence from university students in Taiwan: The case for human professions, autonomous vehicles, and smart homes. *Sustainability*, 11, 6133. <https://doi.org/10.3390/su11216133>
- Chiu, T. K. (2023). The impact of Generative AI (GenAI) on practices, policies and research direction in education: a case of ChatGPT and Midjourney. *Interactive Learning Environments*, 1-17. <https://doi.org/10.1080/10494820.2023.2253861>
- Cohen, T., & Cavoli, C. (2019). Automated vehicles: Exploring possible consequences of government (non) intervention for congestion and accessibility. *Transport reviews*, 39(1), 129-151. <https://doi.org/10.1080/01441647.2018.1524401>
- Coiro, J., Knobel, M., Lankshear, C., & Leu, D. J. (2014). Central issues in new literacies and new literacies research. In *Handbook of research on new literacies* (pp. 1-22). Routledge.
- Dehouche, N., & Dehouche, K. (2023). What's in a text-to-image prompt? The potential of stable diffusion in visual arts education. *Heliyon* 9, E16757. <https://doi.org/10.1016/j.heliyon.2023.e16757>
- Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., & Wright, R. (2023). "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management*, 71, 102642. <https://doi.org/10.1016/j.ijinfomgt.2023.102642>
- Farrokhnia, M., Banihashem, S. K., Noroozi, O., & Wals, A. (2023). A SWOT analysis of ChatGPT: Implications for educational practice and research. *Innovations in Education and Teaching International*,

- 1-15. <https://doi.org/10.1080/14703297.2023.2195846>
- Ferrara, E. (2023). *Should ChatGPT be Biased? Challenges and Risks of Bias in Large Language Models*. arXiv. <https://doi.org/10.48550/arXiv.2304.03738>
- Frey & Osborne (2017). The future of employment: How susceptible are jobs to computerisation. *Technological Forecasting and Social Change*, 114, 254-280. <https://doi.org/10.1016/j.techfore.2016.08.019>
- Gozalo-Brizuela, R., & Garrido-Merchan, E. C. (2023). *ChatGPT is not all you need. A State of the Art Review of large Generative AI models*. arXiv. <https://doi.org/10.48550/arXiv.2301.04655>
- Grassini, S. (2023). Shaping the future of education: exploring the potential and consequences of AI and ChatGPT in educational settings. *Education Sciences*, 13(7), 692. <https://doi.org/10.3390/educsci13070692>
- Hariri, W. (2023). *Unlocking the potential of ChatGPT: A comprehensive exploration of its applications, advantages, limitations, and future directions in natural language processing*. arXiv. <https://doi.org/10.48550/arXiv.2304.02017>
- Hu, E. J., Shen, Y., Wallis, P., Allen-Zhu, Z., Li, Y., Wang, S., ... & Chen, W. (2021). *Lora: Low-rank adaptation of large language models*. arXiv. <https://doi.org/10.48550/arXiv.2106.09685>
- Hutson, J., & Cotroneo, P. (2023). Generative AI tools in art education: Exploring prompt engineering and iterative processes for enhanced creativity. *Metaverse*, 4(1). <http://dx.doi.org/10.54517/m.v4i1.2164>
- International Reading Association (2009). *New literacies and 21st-century technologies: A position statement of the international reading association*. <http://www.reading.org>
- Jiang, Z., Ren, Y., Ye, Z., Liu, J., Zhang, C., Yang, Q., & Zhao, Z. (2023). *Mega-TTS: Zero-shot text-to-speech at scale with intrinsic inductive bias*. arXiv. <https://doi.org/10.48550/arXiv.2306.03509>
- Johri, A., Katz, A. S., Qadir, J., & Hingle, A. (2023). Generative artificial intelligence and engineering education. *Journal of Engineering Education*, 112(3), 572-577. <https://doi.org/10.1002/jee.20537>
- Kasneci, E., Seßler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., & Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, 103, 102274. <https://doi.org/10.1016/j.lindif.2023.102274>
- Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). ChatGPT for Language Teaching and Learning. *RELC Journal*, 54(2), 537-550. <https://doi.org/10.1177/00336882231162868>
- Lai, V. D., Ngo, N. T., Veyseh, A. P. B., Man, H., Dernoncourt, F., Bui, T., & Nguyen, T. H. (2023). *ChatGPT beyond English: towards a comprehensive evaluation of large language models in multilingual learning*. arXiv. <https://doi.org/10.48550/arXiv.2304.05613>
- Lankshear, C., & Knobel, M. (2003). *New Literacies: Changing knowledge and classroom learning*. Open University Press.
- Lankshear, C., & Knobel, M. (2006). *New literacies: Everyday practices and classroom learning* (2nd ed.). Open University Press.
- Lankshear, C., & Knobel, M. (2007). "Sampling "the new" in new literacies. In M. L. C. Knobel (Ed.). *A new literacies sampler* (pp. 1-24). Peter Lang.
- Leiter, C., Zhang, R., Chen, Y., Belouadi, J., Larionov, D., Fresen, V., & Eger, S. (2023). *Chatgpt: A meta-analysis after 2.5 months*. arXiv. <https://doi.org/10.48550/>

- arXiv.2302.1379
- Lo, C. K. (2023). What is the impact of ChatGPT on education? A rapid review of the literature. *Education Sciences*, 13(4), 410. <https://doi.org/10.3390/educsci13040410>
- Milakis, D., Snelder, M., Van Arem, B., Van Wee, B., & de Almeida Correia, G. H. (2017). Development and transport implications of automated vehicles in the Netherlands: scenarios for 2030 and 2050. *European Journal of Transport and Infrastructure Research*, 17(1). <https://doi.org/10.18757/ejtir.2017.17.1.3180>
- Ray, P. P. (2023). ChatGPT: A comprehensive review on background, applications, key challenges, bias, ethics, limitations and future scope. *Internet of Things and Cyber-Physical Systems*. <https://doi.org/10.1016/j.iotcps.2023.04.003>
- Roberts, H., Cows, J., Hine, E., Morley, J., Wang, V., Taddeo, M., & Floridi, L. (2023). Governing artificial intelligence in China and the European Union: Comparing aims and promoting ethical outcomes. *The Information Society*, 39(2), 79-97. <https://doi.org/10.1080/01972243.2022.2124565>
- Rudolph, J., Tan, S., & Tan, S. (2023). War of the chatbots: Bard, Bing Chat, ChatGPT, Ernie and beyond. The new AI gold rush and its impact on higher education. *Journal of Applied Learning and Teaching*, 6(1). <https://doi.org/10.37074/jalt.2023.6.1.23>
- Sohail, S. S., Farhat, F., Himeur, Y., Nadeem, M., Madsen, D. Ø., Singh, Y., & Mansoor, W. (2023). *The future of gpt: A taxonomy of existing chatgpt research, current challenges, and possible future directions*. SSRN. <http://dx.doi.org/10.2139/ssrn.4413921>
- Staricco, L., Rappazzo, V., Scudellari, J., & Vitale Brovarone, E. (2019). Toward policies to manage the impacts of autonomous vehicles on the city: a visioning exercise. *Sustainability*, 11(19), 5222. <https://doi.org/10.3390/su11195222>
- Stordy, P. (2015). Taxonomy of literacies. *Journal of Documentation*, 71(3), 456-476. <https://doi.org/10.1108/JD-10-2013-0128>
- Susnjak, T. (2022). *ChatGPT: The end of online exam integrity?* arXiv. <https://doi.org/10.48550/arXiv.2212.09292>
- Tlili, A., Shehata, B., Adarkwah, M. A., Bozkurt, A., Hickey, D. T., Huang, R., & Agyemang, B. (2023). What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. *Smart Learning Environments*, 10(1), 1-24. <https://doi.org/10.1186/s40561-023-00237-x>
- Wang, H., Wu, W., Dou, Z., He, L., & Yang, L. (2023). Performance and Exploration of ChatGPT in Medical Examination, Records and Education in Chinese: Pave the Way for Medical AI. *International Journal of Medical Informatics*, 105173. <https://doi.org/10.1016/j.ijmedinf.2023.105173>
- White, J., Fu, Q., Hays, S., Sandborn, M., Olea, C., Gilbert, H., & Schmidt, D. C. (2023). *A Prompt Pattern Catalog to Enhance Prompt Engineering with ChatGPT*. arXiv. <https://doi.org/10.48550/arXiv.2302.11382>
- Wu, T., He, S., Liu, J., Sun, S., Liu, K., Han, Q. L., & Tang, Y. (2023). A brief overview of ChatGPT: The history, status quo and potential future development. *IEEE/CAA Journal of Automatica Sinica*, 10(5), 1122-1136. <https://doi.org/10.1109/JAS.2023.123618>
- Yu, H., & Guo, Y. (2023). Generative artificial intelligence empowers educational reform: current status, issues, and prospects. *Frontiers in Education*, 8. <https://doi.org/10.3389/feduc.2023.1183162>
- Zhang, C., Zhang, C., Zheng, S., Qiao, Y.,

- Li, C., Zhang, M., & Hong, C. S. (2023). *A Complete Survey on Generative AI (AIGC): Is ChatGPT from GPT-4 to GPT-5 All You Need?* arXiv. <https://doi.org/10.48550/arXiv.2303.11717>
- Zhao, W. X., Zhou, K., Li, J., Tang, T., Wang, X., Hou, Y., & Wen, J. R. (2023). *A survey of large language models.* arXiv. <https://doi.org/10.48550/arXiv.2303.18223>

Author Information

Dr. Su-Yen Chen 

Institute of Learning Sciences and Technologies, National Tsing Hua University, Taiwan, China
suychen@mx.nthu.edu.tw

Acknowledgements

The author extends gratitude to National Tsing Hua University for funding this research and to all project members from “New Literacies and Teacher Preparation in the Generative AI Era: Applications of ChatGPT, Midjourney, and Stable Diffusion” for content from the section 4.2 titled “Executing a Pilot Study for Teacher Preparation: Integrating ChatGPT and Text2Image Models.” Special acknowledgment is due to team leaders Professor Hsu, A. Y. and Professor Lo, S.-L., as well as team members Lin, K. H., Tsai, R, and Kuo, H.-Y. A special thanks is also extended to GPT-4 for great English editing.