AI Literacy in the Age of Generative AI — Building a Future-Ready Society

Viriya Taecharungroj
Kanok Karnchanapoo

AI Governance Clinic Expert Fellows

Abstract

This paper provides an in-depth exploration of the rapidly changing world of Artificial Intelligence (AI), with a special focus on the transformative role and implications of generative AI technologies. As AI continues to integrate into various facets of daily life and industry, the need for broad-based AI literacy has become increasingly urgent. To address these needs, the paper synthesizes a range of existing frameworks and introduces a comprehensive new model, the "Six E's Model for AI Literacy". This novel model incorporates six crucial components: Essentials, which cover basic knowledge and understanding; Engineering, focusing on the technical aspects; Enabling, which discusses the tools and environments conducive to AI; Evaluation, concerned with the assessment of AI technologies; Effects, which scrutinize the impact of AI on society and individuals; and Ethics, that delves into moral and ethical considerations. Furthermore, the paper offers actionable strategies and guidelines that individuals, organizations, and policymakers can employ to improve AI literacy levels. By providing these insights and actionable strategies, the paper aims to contribute significantly to building a resilient, future-proof society that is prepared for an AI-augmented future.

1. Introduction

Introduced in 1956 as a field devoted to creating intelligent machines, Artificial Intelligence (AI) has since evolved into sophisticated systems and algorithms that emulate human intelligence, operating on environmental cues and predefined rules (Ng et al., 2021). As AI finds application in diverse sectors such as education,

medicine, engineering, and finance, the demand for *AI literacy* — encompassing the critical evaluation, effective collaboration, and understanding of AI's concepts and ethical implications — has intensified (Long & Magerko, 2020; Markauskaite et al., 2022; Ng et al., 2021; Tenório et al., 2023).

However, the emergence of "generative AI" tools, like ChatGPT, in late 2022 has significantly disrupted societal and economic landscapes, stirring concerns about job displacement and the proliferation of misinformation (Cao & Zhai, 2023; Carvalho & Ivanov, 2023; N. Curtis, 2023). With the expanding capabilities of AI, updating AI literacy models to inform both professionals and students about AI's benefits, risks, and limitations has become an urgent necessity (Dwivedi et al., 2023; L. S. Lo, 2023; Luo et al., 2023).

This paper synthesizes the existing AI literacy frameworks, aiming to provide a comprehensive understanding of AI, its applications, ethical implications, and limitations (Cetindamar et al., 2022; Ng et al., 2021; Southworth et al., 2023). It incorporates sector-specific considerations like healthcare, education, and human resources (Kandlhofer et al., 2016; Karaca, Çalışkan, & Demir, 2021; Mikalef & Gupta, 2021). We formulate the new "Six E's Model for AI Literacy" based on this synthesis, but the rapid adoption and development of generative AI necessitates an immediate update. Using the most recent academic and professional literature post-ChatGPT's launch, we propose an updated AI Literacy Model and six primary propositions to improve AI literacy.

Furthermore, the emerging field of AI literacy reveals gaps, underlining the necessity for effective teaching strategies for non-technical audiences, particularly given AI's limited reach beyond traditional STEM fields (Laupichler et al., 2022). Expanding the scope of AI literacy to include businesses and professional organizations, not just K-12 education, can contribute to optimizing AI's use and mitigating its potential negatives (Cetindamar et al., 2022; Kong, Cheung, & Zhang, 2021; Xu & Babaian, 2021). Consequently, this paper introduces practical society-wide strategies concerning the six components of the newly developed AI literacy model. These strategic actions are designed to equip individuals and organizations, regardless of their scale or nature, with AI literacy proficiency, preparing them for an uncharted future.

2. Background

2.1 The Dawn of the Generative AI Era

The late 2022 introduction of ChatGPT, OpenAI's cutting-edge large language model (LLM), signified a crucial advancement in natural language processing (Carvalho & Ivanov, 2023; Taecharungroj, 2023). LLMs, including ChatGPT, have displayed remarkable proficiencies in generating new content, deciphering and mimicking human language nuances, and executing tasks such as automatic summarization, translation, and question-answering (Carvalho & Ivanov, 2023). The subsequent GPT-4 model has even surpassed expectations, excelling in tests like the SAT, GRE, and university exams (Cao & Zhai, 2023). The upsurge in generative AI technologies in early 2023, accentuated by innovations like Visual ChatGPT, GigaGAN, and GPT-4, has highlighted the extensive applicability of AI across sectors — from text and image generation to office task automation (Cao & Zhai, 2023). These "generative AI" technologies collectively generate intelligent output across varied media types — text, code, simulations, images, 3D objects, and videos — in response to human inputs (prompts) (Peres et al., 2023).

The rapid advancement of technology has triggered significant disruptions in both society and the economy, raising concerns about potential job displacement across various sectors (Cao & Zhai, 2023). Simultaneously, the rise of tools like ChatGPT has fueled worries about the spread of misinformation (Carvalho & Ivanov, 2023; N. Curtis, 2023). Amid this scenario, the rapid and widespread integration of tools such as ChatGPT offers growth opportunities to businesses but also entails inherent risks and transformative challenges that must be addressed (Dwivedi et al., 2023). This accelerated implementation of AI in business operations is intensifying competitive pressures and emphasizing the necessity of ethical AI adoption due to associated ethical concerns and risks.

As AI capabilities continue to expand, they introduce challenges at both societal and organizational levels (Jarrahi et al., 2023). This rapid technological evolution and the significant impact of technologies like ChatGPT demands new skill sets and work approaches, challenging conventional assumptions and highlights the pressing need for updated AI literacy models (Dwivedi et al., 2023). In light of AI's increasing influence, it becomes crucial for professionals, educators, and students to enhance their AI literacy, integrating models like ChatGPT into their workflows and learning processes while comprehending AI's advantages, limitations, and risks (Dwivedi et

al., 2023; C. K. Lo, 2023; Luo et al., 2023; Rillig et al., 2023). The subsequent sections will delve into the concept of AI literacy, its significance, existing gaps, and current models.

2.1 The Importance and Definition of AI Literacy

AI, as defined by Zerfass, Hagelstein, and Tench (2020), encompasses the flexible decision-making processes and actions of software-driven agents that can adapt to changing objectives and unforeseen situations, learn from experiences, aim for rationality, and function despite perceptual and computational constraints. With strides in machine learning, natural language processing, and neural networks, AI's capabilities now extend to cognitive tasks, particularly learning and problem-solving (Wang, 2019). As a foundational technology in industrial operations, AI has a broad spectrum of applications across various sectors such as education, engineering, medicine, and finance (Tenório et al., 2023).

The increasing adoption of AI has correspondingly amplified the demand for AI literacy (Tenório et al., 2023). Primarily, AI literacy is a set of competencies that empower individuals to critically evaluate AI technologies, communicate and collaborate effectively with AI, and leverage AI as a tool online, at home, and in the workplace (Long & Magerko, 2020). It extends beyond merely using AI applications to include understanding underlying AI principles and ethical implications of AI use, thus promoting responsible technology usage (Markauskaite et al., 2022; Ng et al., 2021).

AI literacy encompasses a variety of multifaceted dimensions, including digital literacy, computational thinking, programming abilities, AI comprehension, and AI ethics, all aimed at enhancing the effective use of AI (Lee, 2021; Liu & Xie, 2021). McCoy et al. (2020) stress the importance of using AI appropriately, interpreting its results, and understanding its operation. Meanwhile, Cetindamar et al. (2022) highlight the need for technology-related, work-related, human-machine-related, and learning-related skills. In specialized sectors like healthcare, AI literacy may comprise understanding data governance principles, basic statistics, algorithmic decision-making, data visualization capabilities, and recognizing the impact on clinical processes (Wiljer & Hakim, 2019).

Despite a general consensus on AI literacy's importance, ongoing debates persist about its specifics (Laupichler et al., 2022). Questions such as the necessity of

programming skills or whether everyone, regardless of profession, should comprehend a "basic vocabulary" about AI, remain. Some propose the term "AI capabilities" as a more comprehensive descriptor for the broader skill sets required in an AI-influenced world (Markauskaite et al., 2022). While the exact elements of AI literacy may still be under discussion, there's a consensus on its necessity across multiple disciplines and contexts, from K-12 education to adult learning (Gašević, Siemens, & Sadiq, 2023; Laupichler et al., 2022; Ng et al., 2021).

2.2 The Significance and Challenges of AI Literacy

The rising dependence on computer technologies for social and economic opportunities has emphasized the importance of digital literacy (Ng et al., 2021). As AI becomes increasingly prevalent in work environments, individuals with a comprehensive understanding and proficiency in AI hold a significant advantage over those lacking these skills (Southworth et al., 2023). Studies suggest that AI-literate individuals demonstrate more confidence in using AI, perceive its relevance, and are more likely to exploit its potential (Chai et al., 2020; Dai et al., 2020). This proficiency can provide students with critical insights into emerging career opportunities, stimulate interdisciplinary engagement, and boost their preparedness for the workforce (Southworth et al., 2023). The implementation of AI is anticipated to yield substantial benefits for businesses, users, and economies, fostering knowledge proliferation, enhancing productivity, and driving economic growth (Jarrahi et al., 2023; Ng et al., 2021). Indeed, AI is seen as a powerful technology in the business realm, with its growth projected to increase from $10.1 billion in 2018 to $126 billion by 2025 (Vlačić et al., 2021).

However, the benefits of AI come with their own set of challenges. While AI promotes productivity and growth, it also poses the threat of replacing millions of existing jobs (Ng et al., 2021). The pervasive yet often invisible presence of AI, combined with low public awareness and literacy, rapid large-scale deployment, inadequate regulation, and a disconnect between trustworthy AI principles and practices, exacerbates the risk of societal harm from AI (C. Curtis, Gillespie, & Lockey, 2023). Despite these challenges, public awareness of AI remains surprisingly low, thus limiting the capacity for substantial engagement with AI policy and governance proposals (C. Curtis et al., 2023).

AI literacy, therefore, is an urgent societal issue. Its influence spans students, medical professionals, employees, and organizations. Higher and adult education learners, for instance, need to improve their AI literacy as they will soon encounter AI applications in their professional and everyday lives (Laupichler et al., 2022). Healthcare professionals must comprehend AI technologies like expert systems, robotic process automation, natural language processing, machine learning, and deep learning (Wiljer & Hakim, 2019). Similarly, employees require foundational knowledge and skills to engage effectively with AI design and usage (Cetindamar et al., 2022). Organizations also need to grasp how to develop an AI capability and invest in complementary resources to maximize their AI investments (Mikalef & Gupta, 2021). Thus, promoting AI literacy across diverse societal sectors is crucial for optimizing AI use and mitigating its potential negative impacts.

2.3 The Existing Models for AI Literacy

AI literacy frameworks aim to provide a comprehensive understanding of Artificial Intelligence (AI), encapsulating its implications, applications, and constraints. In recent years, scholars have strived to formulate models for comprehending AI literacy. Ng et al. (2021) put forth a holistic AI literacy framework, covering an array of aspects such as understanding AI concepts, practical application of AI, critical evaluation, effective communication with AI, and comprehension of the ethical implications of AI use. Southworth et al. (2023) expanded this framework by introducing a fifth category, “Enabling AI,” focusing on the development of pertinent knowledge and skills to facilitate AI applications.

Diverging from these, Cetindamar et al. (2022) proposed a framework revolving around four pivotal capabilities: Technology-Related, Work-Related, Human-Machine-Related, and Learning-Related. Meanwhile,, Long and Magerko (2020) suggested 17 competencies for understanding, applying, and evaluating AI, with an emphasis on discerning AI’s strengths and weaknesses and conceptualizing its future applications.

Several industry-specific AI literacy frameworks cater to the distinct needs and challenges of certain sectors. For instance, Karaca et al. (2021) devised a framework for AI readiness in the medical sector, grounded on four pillars: cognition, ability, vision, and ethics. This model emphasizes understanding AI, its practical application in healthcare, and the awareness of ethical and legal norms when utilizing health data

and AI technologies. Kandlhofer et al. (2016) developed a technically-oriented framework for the education sector, stressing the importance of an early introduction to AI and computer science concepts as crucial parts of AI literacy. On the other hand, Mikalef and Gupta (2021) shed light on the role of human resources in nurturing AI capabilities within organizations, particularly highlighting the technical and business skills essential for the implementation and management of AI technologies.

The significance of AI literacy stretches beyond AI-specific frameworks, as concepts such as "Digital Interaction Literacy" proposed by Carolus et al. (2023) and a framework from a joint written polylogue by Markauskaite et al. (2022) gain traction. The former posits understanding functional principles, mindful usage, and user group-dependent competencies as integral components, while the latter stresses four critical skills: interpreting AI outputs, assimilating these into human knowledge systems, evaluating AI's ethical implications, and enhancing human cognitive work. Despite the variety in these frameworks, a shared consensus emerges: AI literacy, regardless of the context, mandates a comprehensive understanding of AI's technical and ethical dimensions, its applications, and its potential limitations.

3. The Six E's Model of AI Literacy in the Era of Generative AI

The "Six E's" model introduced in this paper, provides a comprehensive framework for understanding and fostering AI Literacy. It synthesizes existing models and incorporates new imperatives in the era of generative AI. This model comprises six essential components: Essentials, covering fundamental AI principles and foundational knowledge; Engineering, emphasizing skills needed for AI system design and construction; Enabling, focusing on AI application in personal, professional, and business contexts; Evaluation, centered on assessing AI system performance and reliability; Effects, examining broader societal impacts of AI; and Ethics, addressing moral obligations and ethical implications of AI technologies. This model offers a structured approach to comprehending and engaging with AI comprehensively.

The following section elaborates on each component of the model and emphasizes the need for updates in light of the emergence of generative AI. Each component is accompanied by a proposition that highlights the importance of promoting widespread AI literacy in society.

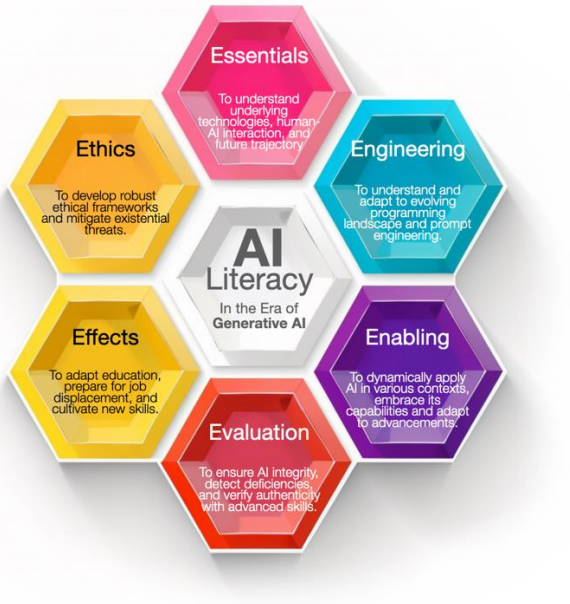

Figure 1 The Six E's Model of AI Literacy in The Era of Generative AI

3.1 Essentials: Understanding Technologies, Human-AI Interaction, and Future Trajectory

Understanding the foundational concepts of AI, its key themes, and components, forms the bedrock of AI literacy, often referred to as "essentials". This aspect involves the acquisition of critical concepts, skills, knowledge, and attitudes, requiring no prior expertise, as it forms the core of AI literacy (Ng et al., 2021). Defining basic AI-related concepts and terminology is vital for cultivating AI literacy (Karaca et al., 2021). Moreover, an integral component of AI literacy is the ability to distinguish between technological artifacts that employ AI and those that do not (Long & Magerko, 2020).

Among these essentials, understanding underlying concepts and technologies like machine learning (ML) is crucial. Long and Magerko (2020) advocate that AI literacy entails comprehending the steps involved in ML and how computers rationalize and make decisions. Familiarity with diverse technologies that incorporate AI is also indispensable. Moreover, technological competencies such as cognitive systems and robotics significantly contribute to AI literacy (Cetindamar et al., 2022; Ng et al., 2021). AI literacy should strike a balance between foundational AI topics and advanced techniques like deep learning (Xu & Babaian, 2021).

AI literacy further demands recognition of AI's applications and an understanding of humans' role within AI. It requires the capability to identify and

explain AI applications across various domains (Southworth et al., 2023). AI literacy competency includes understanding the human role in programming, selecting models, and fine-tuning AI systems (Long & Magerko, 2020). Given the "black box" nature of AI systems, developing skills to comprehend the hidden and pervasive roles that AI systems play in diverse contexts is also vital (C. Curtis et al., 2023).

Updating the "Essentials" Component in Light of Generative AI

The swift progression of generative AI underscores the necessity to adjust the "Essentials" component of AI literacy. Drawing on recent literature on generative AI's impact, we identified four crucial themes necessitating updates to the Essentials.

Understanding Generative AI Technology: It is now imperative to understand generative AI's underlying technology and how these language models function (Dwivedi et al., 2023). At the heart of this is grasping the generative pre-training transformer (GPT) architecture, as employed in OpenAI's ChatGPT, which amalgamates deep learning with language models to significantly enhance chatbots' capabilities (Dwivedi et al., 2023). Kalla and Smith (2023), detail how these technologies process user inputs, leveraging the model's language pattern knowledge and relationships to generate responses. Crucial is the understanding of the supervised fine-tuning and reinforcement learning models underpinning these processes (Kalla & Smith, 2023). Lund and Wang (2023) further stress becoming familiar with various terms and concepts like attention mechanism, chatbot, generative model, GPT, language model, and supervised fine-tuning.

Recognizing Generative AI's Limitations: The second theme pertains to acknowledging generative AI's inherent constraints. Despite ChatGPT's remarkable linguistic abilities, it falls short of humans' depth of knowledge Although these AI tools can generate a wide array of ideas, they may struggle to identify the most innovative ones, signifying they cannot fully supplant human intellect. Additionally, AI systems like ChatGPT have received criticism for their 'black box' nature, as they do not offer clear explanations for their solutions (Dwivedi et al., 2023). Pavlik (2023) reaffirms these limitations, arguing that while these AI tools may present information seemingly in a human-like manner, they lack self-awareness and sentience.

Comprehending Human-AI Interaction: The third theme for consideration is human interaction with AI. Gašević et al. (2023) highlight the significance of explainability in AI, especially as human-AI intersections necessitate greater

collaboration (Houston & Corrado, 2023). The efficiency, customizability, and inquiry ability of ChatGPT, as discussed by Kalla and Smith (2023) and Lund and Wang (2023), make it a valuable tool for tasks like customer service and language translation. However, these tools are only as effective as the quality of human prompts they receive.

Envisioning the AI Trajectory: Finally, understanding AI's history and future trajectory is fundamental to AI literacy. The introduction of advanced AI technologies, including large language models like GPT-4, has sparked transformative shifts similar to the impact of the locomotive during the industrial revolution (Cao & Zhai, 2023). This evolution reflects the transition from Artificial Narrow Intelligence (ANI) to Artificial General Intelligence (AGI), promising significant productivity leaps in the coming years (Dwivedi et al., 2023). The forthcoming changes could reconfigure society and personal interactions on a scale surpassing previous technological advancements (Dwivedi et al., 2023). ChatGPT's progress toward AGI is undeniable, and as these technologies evolve, they present both challenges and opportunities for further improvement and expansion into various domains (Taecharungroj, 2023). Recognizing and anticipating these trends enables us to exploit the potential benefits of this AI revolution optimally.

Proposition 1: In the era of generative AI, AI literacy must encompass an understanding of the underlying technologies of generative AI and their limitations, the interaction between humans and AI, and the evolving landscape of AI.

3.2 Engineering: Adapting to Evolving Programming Landscape and Prompt Engineering

The importance of technical proficiency in AI literacy generates divergent views among scholars. While some deem technical skills as non-essential for AI literacy, many maintain that a foundational grasp of computer science, programming, and statistics is indispensable (Southworth et al., 2023). This component encompasses understanding data collection and preparation, model selection, training, testing, and prediction, all crucial for a comprehensive AI understanding (Long & Magerko, 2020). How and Hung (2019) emphasize the significance of transforming algorithms from mathematical symbols into computer code, suggesting that mastering a computer programming language is key.

A deeper comprehension of AI algorithms is crucial, particularly for professional applications. Kandlhofer et al. (2016) detail various core AI literacy topics related to algorithms, including search problem-solving, classic planning, and machine learning. This knowledge facilitates the creation and deployment of AI applications. The significance of developing and deploying AI for professional use is also highlighted, underlining the need for higher-order thinking activities and collaborative efforts in AI development (Cetindamar et al., 2022; Ng et al., 2021).

Updating the "Engineering" Component in Light of Generative AI

The integration of generative AI across various domains has disrupted traditional operational models, necessitating a reassessment of established educational and skill-set frameworks. Two key themes have subsequently emerged: the transformation of traditional computer programming and the emergence of a new technical skill-set, "prompt engineering".

Revisiting Computer Programming Education: Advancements in generative AI models like ChatGPT and GPT-4 have showcased their remarkable ability to write and debug code across multiple programming languages (Taecharungroj, 2023). This shift is mirrored in software developers' adoption of AI as a tool for code writing, error management, and task automation (Dwivedi et al., 2023). However, challenges persist. Generative AI models don't inherently adhere to company-specific norms, values, or branding strategies, requiring skilled programmers to train and integrate these models into company systems (Carvalho & Ivanov, 2023). Consequently, developers' roles may be evolving towards more integration and iterative work with AI, highlighting the need for skills beyond traditional coding abilities.

Mastering Prompt Engineering: Generative AI's rise has ushered in prompt engineering as a pivotal skill. Mastery of prompt engineering principles and effective query construction is crucial for generating accurate, coherent, and relevant content in line with specific needs and objectives, ensuring AI language models' optimal performance (L. S. Lo, 2023). Additionally, LLM's ability to generate prompts has found creative applications such as AI art, indicating potential integration with other technologies and platforms (Taecharungroj, 2023). Prompt engineering proficiency also extends to understanding technical aspects like tokens, temperature, and top-p parameters that influence AI-generated content (L. S. Lo, 2023). Developing skills in formulating effective prompts and exploring various prompting strategies can spur

creativity among researchers and professionals, empowering them to derive insights from analogous fields and diverge from traditional thinking patterns (Peres et al., 2023).

Proposition 2: AI literacy must encompass a comprehensive understanding of the evolving landscape of computer programming, extending beyond coding and algorithms, as well as the emerging field of prompt engineering.

3.3 Enabling: Applying AI, Embracing Its Capabilities and Adapting to Advancements

The practical application of AI literacy necessitates a thorough understanding of how AI concepts can be employed in various contexts and daily scenarios (Ng et al., 2021; Rodríguez-García et al., 2020). However, this application extends beyond sheer understanding. Southworth et al. (2023) emphasize the importance of choosing and utilizing AI tools and techniques tailored to specific contexts and applications. This application of AI knowledge and concepts is viewed as a critical thinking skill fused with content knowledge.

Beyond understanding and applying AI, integrating AI outputs into human workflows is a vital component of AI literacy (Markauskaite et al., 2022). As Markauskaite et al. (2022) elucidate, the ability to process and integrate AI outputs into human systems facilitates timely decision-making and sense-making. This notion is further reinforced by Karaca et al. (2021), who stress the ability to organize workflows in accordance with AI logic. In professional environments, this understanding and integration of AI can enhance efficiency and decision-making across various sectors, including healthcare, education, and service delivery (Karaca et al., 2021; Zhao, Wu, & Luo, 2022).

Grasping the “know-why” of AI is crucial for its application and usage, as the intricacy of emerging AI systems often renders explaining their inferences challenging (Jarrahi et al., 2023). Merging professional knowledge with AI can exploit AI to its maximum potential, emphasizing the importance of AI literacy in everyday life and the workplace (Karaca et al., 2021).

Updating the "Enabling" Component in Light of Generative AI

The advent and widespread acceptance of ChatGPT and other generative AI technologies have brought about significant shifts in the application and usage of AI. Three key themes have surfaced: the acceleration of productivity, the holistic improvement of workflows and processes, and the inventive modification of existing technology.

Unleashing Productivity Potential: The rise of generative AI, exemplified by tools like ChatGPT, has shown immense potential in diverse fields, offering user-friendly, flexible, and customizable capabilities (Dwivedi et al., 2023). The user-friendly nature of ChatGPT, exemplified by its ease of use, has greatly amplified the response and sparked widespread enthusiasm towards its adoption (Taecharungroj, 2023). It has proven valuable in customer service, automating routine tasks, providing customer behavior insights, and enhancing content performance in marketing (Dwivedi et al., 2023; Peres et al., 2023). In sectors like banking and finance, generative AI can be used for regulatory analysis, enabling executives to focus on more critical tasks (Dwivedi et al., 2023). In health promotion, ChatGPT can provide relevant information based on guidelines, streamline clinical workflows, assist in diagnostics, and improve health literacy (Biswas, 2023; Sallam, 2023). In education, generative AI can boost student productivity, assist in academic writing, and support instructors in creating teaching materials (Dwivedi et al., 2023; Johinke, Cummings, & Di Lauro, 2023; C. K. Lo, 2023). It promotes a dynamic relationship between teachers and AI, optimizing student outcomes (Jeon & Lee, 2023). ChatGPT's ability to assemble disjointed information underscores its value in academic writing support (Alkaissi & McFarlane, 2023). These examples highlight that AI literacy must incorporate the skills necessary to effectively utilize generative AI, enhancing personal and professional productivity across various sectors.

Enhancing Holistic Workflow: The emergence of generative AI is driving a comprehensive transformation across various sectors, not only expediting productivity but also revolutionizing workflows. ChatGPT, with its accessibility and democratization of AI usage, is reshaping organizational hierarchies and enabling data-driven decision-making (Dwivedi et al., 2023). The capacity of generative AI to analyze large datasets, communicate complex information, and drive revolutionary changes is evident in industries such as research, medicine, sport science, and tourism (Carvalho & Ivanov, 2023; Cheng, Guo, He, Lu, Gu, et al., 2023; Cheng, Guo, He,

Lu, Xie, et al., 2023; Dwivedi et al., 2023; Lund & Wang, 2023). The practical utilization of generative AI has the potential to significantly enhance the overall processes of various organizations in unprecedented ways.

Modifying the Existing Technology: Generative AI has demonstrated an outstanding potential to augment and enhance legacy technologies, resulting in improved productivity, efficiency, and broadened accessibility (Kalla & Smith, 2023). A diverse spectrum of startups, as well as established corporations, have capitalized on the capabilities of GPT technologies to significantly enhance their product offerings (Cao & Zhai, 2023). Numerous technologies, from copywriting platforms to fintech solutions, have been profoundly transformed by integrating Language Model Learning (LLMs) as highlighted by Cao and Zhai (2023). This remarkable range of applications signals a major shift towards the acceptance and widespread adoption of GPT technologies. It highlights the power of generative AI to revolutionize the existing technology landscapes. As a result, AI literacy must broaden its horizons to include the use of AI in augmenting and enhancing existing technologies.

Proposition 3: AI literacy should encompass a dynamic understanding and application of AI in various contexts. This includes the effective integration of AI outputs into human workflows, the ability to understand and exploit AI's capabilities, and the agility to adapt to the ongoing advancements in AI.

3.4 Evaluation: Ensuring AI Integrity, Detecting Deficiencies, and Verifying Authenticity

Evaluation forms a critical aspect of AI literacy, comprising the ability to critically assess AI technologies, their outputs, and the effectiveness of their deployment (Ng et al., 2021). This process demands individuals to distinguish not only between the functionalities and features of AI tools and applications (Karaca et al., 2021) but also between general and narrow AI (Long & Magerko, 2020). It underlines the need for a critical interpretation of results, comprehending that data should not be accepted at face value and requires meticulous analysis (Long & Magerko, 2020).

The capability to interpret and understand AI system outputs, taking into account the data sources and the reliability of AI system outputs, is pivotal (Markauskaite et al., 2022). Zhao et al. (2022) emphasize the importance of assessing

the functionality and effectiveness of AI products or services post-usage, indicating the ability to select the most suitable solution from the options provided by the AI product or service. These evaluation skills hold significant importance in sectors such as education, where AI products or services are used to give feedback to students on their learning progress, making the selection of the most appropriate AI assessment tool crucial (Zhao et al., 2022).

Updating the "Evaluation" Component in Light of Generative AI

As AI literacy continues to evolve with the emergence of generative AI, two themes in "Evaluation" are increasingly prominent. These themes stress the necessity to cultivate more sophisticated skills in recognizing the deficiencies and verifying the authenticity of AI-generated content.

Detecting AI Deficiencies: Identifying limitations in generative AI, such as ChatGPT, is crucial due to its potential to generate nonsensical, false, and outdated responses (Alkaissi & McFarlane, 2023). Although ChatGPT's text generation capabilities have been praised, user experiences have been diverse, revealing concerns regarding logical flow, accuracy, and critical elaboration in the generated content (Dwivedi et al., 2023; Houston & Corrado, 2023). Although ChatGPT's text generation capabilities have been praised, user experiences have been diverse, revealing concerns regarding logical flow, accuracy, and critical elaboration in the generated content (Carvalho & Ivanov, 2023; Dwivedi et al., 2023). It has been observed that despite ChatGPT's human-like fluency, it falls short in terms of human reasoning, often resulting in incorrect and unverified responses (Kalla & Smith, 2023; Taecharungroj, 2023). Given these limitations, it is essential for new AI users to possess the skills required to recognize and address these issues.

Seeking Verification Methods: The emergence of deep fake text has become a major concern, necessitating ongoing research for effective detection methods (Dwivedi et al., 2023). Recognizing the unique characteristics of generative AI can assist in verifying the authenticity of the generated output, even though these features may become less apparent as the technology evolves (Houston & Corrado, 2023). Ensuring the accuracy of content generated by platforms like ChatGPT is critical due to its text prediction mechanism, which can create seemingly credible yet potentially unreliable information (Dwivedi et al., 2023). The current technological landscape demands stringent verification of AI-generated content, including student

assignments and research articles, inciting discussions on the acceptable use and potential plagiarism concerns (Dwivedi et al., 2023).

Proposition 4: In the era of generative AI, updating the "evaluation" component of AI literacy to include advanced skills in detecting AI deficiencies and implementing rigorous verification methods is essential to ensure the integrity and authenticity of AI-generated content, safeguarding against the dissemination of false information.

3.5 Effects: Adapting Education, Preparing for Job Displacement, and Cultivating New skills.

Advancements in artificial intelligence (AI) have sparked significant discussions about the future job market. Heightened concerns revolve around the potential displacement of human workers, particularly in routine tasks, as increasing AI-driven automation takes over, reducing the demand for human labor (Long & Magerko, 2020). The projected scale of displacement is substantial, with estimates suggesting that by 2030, between 75 million and 375 million global workers might need to transition to new roles or enhance their skills due to AI integration (Zhang et al., 2022). However, it's important to acknowledge that while AI may replace some jobs, it also serves as a catalyst for job creation, not just a tool for replacing skilled labor (Su, Togay, & Côté, 2021). Hence, the "effects" facet of AI literacy involves comprehending the potential risks and opportunities that AI brings, along with preparing for the evolving workplace dynamics.

Emerging AI technologies are likely to create new roles that demand the development of abstract managerial skills and critical thinking capabilities, which AI currently struggles to imitate (Su et al., 2021). The evolution of jobs like knowledge engineers, process analysts, and system engineers, responsible for digitizing expert knowledge, overseeing practical aspects of knowledge digitalization, and creating intelligent machines, respectively, is anticipated (Su et al., 2021).

Another significant effect of AI on the job market is the gradual transformation in the nature of work and the requisite skills. The ascendancy of AI stresses the importance of cognitive abilities and social skills, including empathy, persuasion, decision-making, strategy development, crisis management, creativity, and the ability to establish trusted relationships (Su et al., 2021; Zerfass et al., 2020). This evolving

landscape requires workers to enhance their collaboration skills with AI, transitioning from routine tasks to more creative and strategic roles (Markauskaite et al., 2022). For instance, in the concept of an "augmented workforce," humans and machines combine their strengths to achieve superior results, underlining the need to comprehend the strengths and limitations of AI technologygy (Karaca et al., 2021).

Updating the "Effects" Component in Light of Generative AI

Generative AI has had a profound impact on society, sparking discussions about the positive and negative effects of AI, including job loss and skill transformation. Current literature identifies three key themes that reflect the significant changes brought about by generative AI technologies and emphasize the need to adapt and evolve in response to these transformations.

Rethinking Education: The academic sector, including teaching, learning, and research, is expected to experience some of the most transformative impacts of AI, particularly with the advent of generative AI (Dwivedi et al., 2023). This reinforces the idea that generative AI has the potential to revolutionize academics by providing customized, interactive explanations and automated feedback to students (Kalla & Smith, 2023). Moreover, LLM-based chatbots could transform education and research, potentially transitioning from "teacher-student" interactions to "teacher-AI-student" co-creation (Ivanov & Soliman, 2023). This aligns with the concept that more effective learning is co-created by AI and human facilitators, not just by teachers or AI alone (Jeon & Lee, 2023). Nevertheless, several challenges require attention. Issues concerning assessments, examinations, and plagiarism emerge due to the sophisticated capabilities of generative AI (Dwivedi et al., 2023). Further, the implementation of AI in academics could influence students' motivation and their ability to think independently (Dwivedi et al., 2023).

Preparing for Job Displacement: The advent of generative AI, particularly models like ChatGPT, is predicted to significantly disrupt various job domains. In alignment with the job replacement theory, AI initially substitutes tasks requiring mechanical and analytical intelligence, but with the advancement of LLMs, jobs demanding even intuitive and empathetic intelligence might be threatened (Carvalho & Ivanov, 2023). Additionally, even professions considered to be "safe," such as AI coders, trainers, and analysts, might face danger (Taecharungroj, 2023). Dwivedi et al. (2023) argue for a comprehensive understanding of the disruptions caused by AI

in various professional domains to better anticipate the future job landscape. Thus, it is vital for leaders in both the public and business sectors to reflect on the future of the job market, particularly considering the rapid advancements in generative AI (Taecharungroj, 2023).

Transforming Skills and Jobs: The transformative effects of generative AI, especially ChatGPT, on skills and jobs are profound. The integration of AI has not only led to improved productivity and efficiency but also instigated a paradigm shift in the nature of work itself (Carvalho & Ivanov, 2023). AI has moved beyond simple automation, paving the way for the creation of hybrid teams where humans and machines collaboratively execute tasks (Dwivedi et al., 2023). This signifies the rise of human augmentation, with AI technology integrated in various ways into our lives. As Luo et al. (2023) predict, the future of ChatGPT lies in its role as a resource for Intelligence Augmentation (IA), enhancing human capabilities and skills. Generative AI, often perceived as a competitor for jobs, has the potential to foster a mutually beneficial symbiotic relationship with human actors, augmenting human intelligence to tackle complex problems and facilitate decision-making (Dwivedi et al., 2023). While job substitution is a possibility, there is also an emergence of job opportunities in AI-related fields (Kalla & Smith, 2023). Collaboration between humans and AI requires a shift in skills and an updated understanding of AI literacy.

Proposition 5: With the profound influence of generative AI on societal structures, AI literacy must encompass an understanding of the evolving role of education, proactive preparation for job displacement, and the cultivation of new skills to effectively collaborate with AI.

3.6 Ethics: Developing Robust Ethical Frameworks and Mitigating Existential Threats

Unpacking the ethical implications of AI is paramount within AI literacy, as AI systems profoundly impact various aspects of our lives. Ethical dilemmas stemming from AI encompass the propagation of misinformation, privacy violations, existential threats and discriminatory outcomes (Long & Magerko, 2020). As AI systems amass, store, and scrutinize personal data, issues surrounding privacy and surveillance intensify. Further, the surge in disinformation can be attributed to AI algorithms promoting sensationalist content and cultivating echo chambers (Long & Magerko,

2020). Addressing these dilemmas calls for a comprehensive understanding of AI ethics as part of AI literacy, allowing users to operate within legal and ethical parameters (Karaca et al., 2021).

An efficacious framework to tackle these ethical dilemmas should incorporate key elements of AI ethics, as proposed by Hermann (2022). Ethical principles concerning AI revolve around the specific attributes of the technology or its use consequences, with an emphasis on beneficence, non-maleficence, justice, explicability, and autonomy (Hermann, 2022). Other frameworks feature principles such as fairness, responsibility, accountability, and transparency in AI use (Shih et al., 2021; Southworth et al., 2023). AI literacy should empower individuals to assess ethical implications, ensuring a clear understanding of AI-driven mass personalization's advantages and pitfalls (Hermann, 2022).

Nonetheless, ethical considerations in AI reach beyond individual literacy. Unregulated AI systems can endanger societal values and constitutional rights, causing power imbalances when used extensively (C. Curtis et al., 2023). The regulation of AI systems is lagging, and most citizens are skeptical about existing safeguards (C. Curtis et al., 2023). Collective responsibility ensures an equitable distribution of AI use's benefits and burdens, preserving social cohesion (Hermann, 2022).

Updating the "Ethics" Component in Light of Generative AI

Mirroring the effects component, the advent of generative AI has actualized many of the anticipated ethical concerns. The recent literature on ChatGPT and generative AI identified several pressing issues, culminating in the two themes discussed below.

Elevating the Need for AI Ethics Framework: The emergence of generative AI technologies like ChatGPT has amplified ethical concerns, necessitating the development and refinement of AI ethics frameworks. Potential misuse of these technologies could lead to the generation and circulation of harmful content and disinformation (Carvalho & Ivanov, 2023; Dwivedi et al., 2023). Academic integrity is another concern, as ChatGPT could potentially produce student essays or low-quality academic papers, eroding trust within the academic community (N. Curtis, 2023; Dwivedi et al., 2023). Urgent considerations such as privacy, transparency, and accountability call for clear policies and procedures for user consent and opt-out

options (Lund & Wang, 2023). Accountability is also vital to address potential fraud or criminal activities associated with generative AI use (Dwivedi et al., 2023). The ethical complexities extend to biases in generative AI systems and their effects on intellectual property laws, particularly regarding copyright issues (Lund & Wang, 2023; Peres et al., 2023). An ethical framework for generative AI must tackle these emerging issues and establish appropriate strategies and structures to alleviate potential harms.

Considering the Existential Threat: The rapid advancement of AI, particularly with the introduction of generative AI tools like ChatGPT, has raised significant ethical and existential concerns (Dwivedi et al., 2023). The lack of ethical and legal judgment capabilities in AI systems poses challenges in providing consistent moral advice and raises questions about their impact on users' moral judgment (Krügel, Ostermaier, & Uhl, 2023). As a result, critics are engaging in discussions regarding the existential threat of AI (Yatoo & Habib, 2023). It is crucial to carefully consider AI system design and user training to enhance AI literacy and address these concerns (Krügel et al., 2023).

Proposition 6: Considering the transformative impact of generative AI, it is imperative for AI literacy to encompass the understanding and development of robust, flexible, and adaptive ethical frameworks, along with preventive measures to mitigate existential threats.

The Six E's model of AI literacy, presented in this paper, provides a comprehensive framework for individuals and organizations to enhance AI literacy, enabling them to effectively address significant societal challenges and capitalize on opportunities. The model draws from existing literature and evolves in response to the emergence of generative AI's impact. However, the model's transformative potential for society requires practical implementation guidelines. The subsequent section of this paper offers actionable strategies to enhance AI literacy and capability within our society, empowering individuals to harness AI's full potential.

4. The Path Forward for a Future-Proof Society

As we stand on the brink of a new era defined by artificial intelligence, particularly generative AI, it is crucial to not merely adapt passively but actively

shape this technological landscape for the betterment of society. The "Path Forward for a Future-Proof Society" acts as a guide, blending the insights and propositions from the Six E's of AI Literacy model. Its aim is to provide a comprehensive strategy that harmonizes innovation and ethical considerations, employment prospects and reskilling requirements, and technological proficiency and societal well-being. This collection of actionable strategies acknowledges the necessity for cross-sector collaborations and emphasizes the importance of creating partnerships that are agile, resilient, and socially responsible.

4.1 Strategies for Elevating "Essentials" of AI Literacy

Integrate Generative AI into Organizational Strategy: Generative AI should be recognized as a strategic resource, fully integrated into an organization's broader vision, rather than being pigeonholed as a mere tool for specific tasks (Jarrahi et al., 2023). Businesses should invest in internal educational programs to impart knowledge about the core elements of generative AI, such as its underlying technology and mathematical models, different model classifications, and both its limitations and potential (Feuerriegel et al., 2023; Gozalo-Brizuela & Garrido-Merchan, 2023; Hatzius, 2023). These programs will enable team members to leverage the technology effectively and align it with organizational objectives. For instance, internal workshops could explore applications ranging from the transformation of business processes to enhanced customer interactions, potentially unleashing new opportunities and innovation.

Formalize Generative AI Education Across Educational Institutes: Educational institutions should intensify their focus on generative AI essentials by integrating them into curricula. This trend is already visible, as demonstrated by Stanford University's substantial increase in AI courses, particularly those that cover generative AI topics (Varanasi, 2023). Additionally, prominent institutions like MIT and Vanderbilt University offer specialized courses on the subject (MIT Professional Programs, 2023; Vanderbilt University, 2023). Governments should make a concerted effort to incorporate generative AI into the national educational curriculum. As an example, the United Kingdom's Department of Education has issued a detailed plan for educating students about generative AI, emphasizing foundational knowledge, potential biases, and safety considerations (UK Department of Education, 2023). Hong Kong has taken similar steps by mandating hours of AI education in secondary schools (Chen, 2023).

Foster Industry-Academia Partnerships for Practical Training: To bridge the gap between theoretical knowledge and real-world application, a collaborative approach is required between the educational sector and industry. Such partnerships could include internships, consulting projects, mentorship programs, and hackathons. The recent AI Hackathon conducted by the University of California's Berkeley, sponsored by Microsoft and OpenAI, serves as an exemplary case of this approach in action (Cal Hacks, 2023). By aligning academic rigor with practical exposure, students are better prepared to adapt to rapidly evolving technological landscapes.

Establish Research and Innovation Centers: Private sector firms should consider following the example of Amazon Web Services, which has invested $100 million in establishing a generative AI innovation center. This facility aims to engage with customers in exploring generative AI solutions and applications through free training and workshops (Amazon Web Services, 2023). Not only does this benefit the company by fostering a better-trained customer base, but it also propels the field of AI forward by encouraging practical, hands-on experience.

Expand Access through Online Learning Platforms: Governments, educational institutions, and even private companies should contribute to or develop high-quality online learning platforms for generative AI. This will democratize access to education in this burgeoning field. Platforms like Coursera, Udemy, and Edx already offer generative AI courses, but there is room for more specialized content that keeps pace with the rapid advancements in technology.

4.2 Strategies for Improving "Engineering" of AI Literacy

Adapt Educational Programs to Include Prompt Engineering: As prompt engineering emerges as a skill vital to effective use of LLMs, educational institutions should update their curricula to include it. Topics should not be limited to traditional programming or machine learning but should also incorporate the categories and patterns for prompt engineering outlined by White et al. (2023). These include Input Semantics, Output Customization, Error Identification, Prompt Improvement, Interaction, and Context Control. This move will help students to understand how to leverage the capabilities of generative AI in various ways (Hatzius, J., et al., 2023).

Create Workshops to Enhance "Promptability": Real-world applications of prompt engineering often go beyond what can be covered in a formal educational setting. Therefore, workshops that specifically focus on enhancing "Promptability"—

the ability to craft and fine-tune prompts—are essential. Such training should include exercises on communicating background contexts and conditions, understanding AI limitations, and crafting specific prompts from generic requirements (Karun, 2023).

Utilize AI-Assisted Code Generation Tools in Coding Practices: Coding environments are one of the key areas where generative AI can be a game-changer. Development teams should integrate the use of AI-assisted code generation tools like Amazon Codewhisperer, Github Copilot, and Meta's Code Llama into their workflows. These tools use LLMs to produce extensive outputs based on a programmer's input and represent the latest advancements from code completion tools (Yetiştiren et al., 2023).

4.3 Strategies for Strengthing "Enabling" of AI Literacy

Implement Generative AI at the Organizational Hierarchy for Comprehensive Impact: To harness the full potential of generative AI, organizations should adopt a comprehensive approach, integrating this technology across management, functional, and administrative levels. At the top, executives can leverage generative AI for strategic planning and decision-making. For instance, AI can be used to formulate strategies based on market trends, competitive landscapes, and company capabilities (Korzynski et al., 2023). Businesses can further utilize generative AI for stakeholder communication, crafting impactful messages for investors, board members, and employees. This technology can also offer robust support in risk management by analyzing complex regulatory frameworks and providing actionable insights. OpenAI's ChatGPT Enterprise, for example, offers a suite of services that include advanced security and customization, designed to suit organizational needs (OpenAI, 2023).

Utilize Generative AI to Enhance Specialized Roles and Job Functions: For professionals in specialized roles, the implementation of generative AI can be revolutionary. In marketing, AI can help craft product descriptions, social media posts, and customer-centric messages (Deveau, Griffin, & Reis, 2023; Gill, 2023). Human Resources departments can employ generative AI to automate materials for employee engagement and performance appraisal (Grillo, 2023). Even in finance and legal departments, generative AI can automate the generation of financial reports and standardized contracts, respectively (Jiang, 2023; Thomson Reuters Institute, 2023). To maximize these benefits, organizations should not only rely on generic solutions

but also consider platforms like Salesforce's AI cloud that cater to specialized functions while maintaining data privacy and security (Salesforce, 2023).

Leverage Generative AI for Industry-Specific Applications: Different industries offer unique opportunities for applying generative AI. In healthcare, AI can assist in 3D visualization and treatment planning (Deloitte Institute, 2023). In the media sector, AI can help in the creation of games, storylines, and trailers. The travel industry can offer personalized itineraries based on generative AI algorithms (Weed, 2023). Given this variety of applications, industry players should actively invest in AI solutions tailored to their specific needs. For instance, ABN Amro is piloting generative AI for improving customer interactions and understanding behavior, a model that other financial institutions can emulate (Browne & Sigalos, 2023).

Enable Public Sector Efficiency Through Generative AI: Public sector organizations should also embrace generative AI to enhance efficiency and citizen engagement. Just as AI can be employed to improve customer service in the private sector (Cooper, 2023), it can also enhance citizen service experiences in the public sector. For example, AI chatbots can handle inquiries and requests, freeing up public officers to focus on more critical tasks. Similarly, generative AI can assist in internal government functions like HR, finance, and legal departments, reducing administrative burdens (Heise, 2023; StClair, 2023). These technologies can also help in crafting public communications that are both clear and impactful, thus boosting public trust.

Invest in Data-Driven Decision-Making Tools for Strategic Alignment: Last but not least, organizations must invest in generative AI for data-driven decision-making. Both private and public sector organizations can benefit from AI's capability to analyze and summarize large data sets. For example, governments can utilize generative AI for public policy formulation, by analyzing economic data, demographic data, and citizens' feedback (StClair, 2023). This enables a more tailored approach to meeting the needs of various stakeholders. In the business context, generative AI can play a pivotal role in real-time decision-making based on customer behavior and market trends.

4.4 Strategies for Enhancing "Evaluation" of AI Literacy

Implement Comprehensive Data Evaluation Strategies to Minimize Bias: To address the high dependency on the quality of data and potential biases in

generative AI, one of the first steps should be implementing comprehensive data evaluation strategies (Buolamwini & Gebru, 2018). Organizations and users could encourage the development and training of AI models by diverse groups of people that reflect the target user landscape. By enhancing data diversity and quality, AI systems can be more representative, lessening the likelihood of bias. Direct efforts to improve data quality can substantially boost the AI's reliability and fairness, thus maximizing the technology's capabilities.

Establish Performance Metrics and Benchmarks for Quality Assurance: It is essential to establish performance metrics that go beyond speed and quality of responses to include customer satisfaction and error rates (Davenport et al., 2020). Benchmarking AI performance against human capabilities in various fields can offer a more in-depth understanding of where the technology stands and what improvements are required. This dual approach ensures well-rounded performance assessments that not only gauge the AI's effectiveness but also provide actionable insights for development.

Actively Collect and Integrate User Feedback: The complexity of human-AI interaction cannot be understated. It often involves misunderstandings, frustrations, and communication challenges. Therefore, active collection and analysis of user feedback should be a standard procedure for any AI implementation. The insights from these user experiences can serve as a valuable guide for making iterative improvements to the AI system, ultimately enhancing the user's journey.

Develop Regulatory Frameworks Focused on Authenticity and Integrity: In addition to performance, the evaluation of generative AI should also prioritize its authenticity and integrity. Regulatory compliance should be enforced to AI service providers with practical guidelines (Mittelstadt, 2019). These could include explicit accountability and responsibility protocols, transparency directives, and robust risk management strategies. Additionally, the media should adopt clear protocols for content verification. The use of technologies such as blockchain for originality checks and machine learning models to detect deepfake content can be integrated into these regulatory frameworks (Caporusso, Zhang, & Carlson, 2020; Hasan & Salah, 2019).

Foster Multi-Sector Collaborations for Robust Evaluations: The multi-faceted challenge of ensuring AI's authenticity and integrity requires a collective approach involving public sectors, private sectors, and general users. Collaborative efforts could range from creating open data networks for cross-verifying information

to establishing tracking systems for AI-generated content traceability. Empowering users to report misleading information and fake content can provide an additional layer of security and reliability. Such a collaborative framework can effectively pool resources and expertise to build a more robust evaluation mechanism.

4.5 Strategies for Enriching "Effects" of AI Literacy

Implement Comprehensive Reskilling and Upskilling Programs: The transformation induced by generative AI makes upskilling and reskilling an urgent imperative for both private and public sectors. Governments may follow the United States' National AI Initiative Act of 2020 and France's Professional Future Law to establish comprehensive training programs aimed at preparing the workforce for a future dominated by AI (French Government, 2018; U.S. Congress, 2020). These programs should focus on the emerging roles in the AI landscape, such as prompt engineering, a role reported to be in high demand with attractive salary packages (Popli, 2023).

Similarly, private organizations should consider large-scale investment in workforce development like Amazon's $700 million initiative aimed at upskilling 100,000 employees in areas like machine learning and data science (Amazon, 2019). Special emphasis should be on training programs that enable employees to collaborate with AI systems in decision-making processes, as inspired by Singapore's Model AI Governance Framework (IMDA, 2021). Given the reported high salaries for prompt engineers and their increasing demand, companies should prioritize such roles in their upskilling initiatives.

Foster Human-AI Collaboration Across Industries: In light of the societal impacts and possible unintended consequences of AI, including job displacement and economic risks, fostering human-AI collaboration is essential. Public policy should be geared towards encouraging human involvement in AI decision-making processes, as advocated by the European Union's Artificial Intelligence Act and Singapore's Infocomm Media Development Authority (European Commission, 2021; IMDA, 2021).

Private sector companies can learn from IBM's human-centered AI approach, which focuses on fostering collaboration and co-creation between humans and AI (Geyer et al., 2022). This can help mitigate the risks of job displacement by integrating human roles in strategic and creative tasks, while AI handles the technical

and detailed coding. The ultimate aim is to design workflows and strategies that integrate human creativity and strategic thinking with AI capabilities, thereby enhancing organizational effectiveness and gaining competitive advantages.

Strengthen Social Safety Nets for AI-Induced Job Displacement: Despite preventive measures, some level of job displacement is inevitable. Therefore, governments need to strengthen social safety nets to protect workers affected by the AI transition. Existing schemes like Canada's Employment Insurance Program and South Korea's Employment Insurance System should be examined and updated to include scenarios involving job losses due to AI adoption (Government of Canada, 2020; Korean Ministry of Employment and Labor, 2021). Experimental models like Universal Basic Income (UBI) in Spain and Finland can also be considered as potential safety nets for citizens affected by AI-induced job displacement, even though these models were not originally designed with AI in mind (Henley, 2020; Sevilla, 2020).

Create a Multifaceted Strategy for Long-term Adaptation: Given the potential for long-term economic growth and also increased inequality due to AI, a multifaceted strategy is essential. Private corporations should be incentivized to consider long-term impacts when integrating AI into their workflows. They should be encouraged to not only streamline their operations but also contribute to long-term societal welfare. For example, like PwC's $3 billion investment for upskilling its workforce (PwC, 2019), corporations should consider the long-term societal impacts and create initiatives that also contribute to societal welfare.

4.6 Strategies for Upgrading "Ethics" of AI Literacy

Strengthen Accountability Mechanisms in Generative AI Use: Addressing accountability is a pivotal issue given that generative AI models can function autonomously, thereby complicating responsibility, especially when harmful or misleading information is generated (Wach et al., 2023). Practical steps include implementing structured ethical guidelines within organizations that are reinforced by visible accountability measures. Companies like Google and IBM are leading the way in this respect, and their efforts could be supported by governmental guidelines such as those laid out in the National AI Initiative Act of 2020 (Google, 2023; IBM, 2022; U.S. Congress, 2020).

Develop Comprehensive Data Privacy Policies and User Consent Protocols: Robust data privacy measures are particularly essential when generative AI technologies can circumvent user consent, thus risking potential misuse of sensitive personal or corporate data (Gupta et al., 2023). Guidelines from the Australian Government's AI Ethics Framework can serve as a foundational guide for privacy protection and security (Australian Government, 2022). Such policies could be complemented by tools for detecting misuse, similar to those developed by OpenAI (OpenAI, 2023).

Mitigate Bias Through Continuous Monitoring and Updates: Bias in generative AI remains a persistent issue, as these systems can perpetuate harmful stereotypes (Feuerriegel et al., 2023). Real-time monitoring mechanisms can help companies identify and address biases more effectively. Such efforts are already underway, evidenced by Google's bias detection tools (Mitchell et al., 2019) and IBM's AI factsheets (Arnold et al., 2019). Standardizing these practices at a broader scale could follow guidelines such as the Canadian Directive on Automated Decision-Making, which mandates values like fairness and transparency (Treasury Board of Canada Secretariat, 2020).

Address Intellectual Property Concerns Through Legal Clarifications: Intellectual property issues with generative AI are intricate, especially when it comes to the possibility of copyright infringement (Franceschelli & Musolesi, 2022). Existing copyright laws may need to be adapted to tackle these complexities, taking cues perhaps from California's AB 730 law that specifically deals with deepfakes in a political setting (California Legislature, 2022).

Foster Interdisciplinary Ethical Frameworks for Generative AI: The complex ethical challenges of generative AI require a comprehensive approach that goes beyond single-discipline perspectives (Mittelstadt, 2019). Ethical frameworks should be developed in a bottom-up fashion, incorporating local practices and multi-disciplinary research to ensure they are tailored to the unique challenges posed by these technologies.

5. Conclusion

The proliferation of generative AI technologies has marked a significant evolution in the landscape of artificial intelligence. These advancements, while offering unprecedented capabilities and opportunities, also bring forth complex

challenges and ethical considerations. Society faces an imperative to adapt to this evolving landscape by understanding the profound implications of generative AI, including its limitations and the interaction between humans and AI. Generative AI's rise necessitates a multifaceted approach to AI literacy, synthesized into six key components — Essentials, Engineering, Enabling, Evaluation, Effects, and Ethics — and propositions. These encompass understanding the core technologies and limitations of generative AI, recognizing the broader landscape beyond coding, fostering a dynamic application across contexts, enhancing evaluation skills for content integrity, preparing society for AI's profound influence, and developing adaptive ethical frameworks to navigate existential challenges. Together, these propositions outline a comprehensive and detailed approach to AI literacy in the age of generative AI, highlighting essential competencies and considerations.

The paper presents a novel guideline for governments, private sectors, and individuals through a series of actionable strategies accompanied by emerging real-life cases. These strategies encompass minimizing data bias, enhancing performance metrics, offering comprehensive reskilling programs, fostering human-AI collaboration, and establishing ethical frameworks for responsible AI use. The core of this approach is the Six E's framework, representing the essence of modern AI literacy. The ensuing proposed strategies provide actionable insights to convert challenges into opportunities, fostering a harmonious, innovative, and equitable AI-augmented society.

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