Developing Human Skills in the Era of Artificial Intelligence: Challenges and Opportunities for Education and Training

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Abstract

The rapid advancement and adoption of artificial intelligence (AI) presents significant challenges and opportunities for human skills in the 21st century. AI systems can do many things that people usually do, like looking at data, making decisions, and understanding language. However, AI also creates new demands for human skills that complement and enhance the capabilities of AI, such as creativity, critical thinking, communication, and collaboration. This paper conducts a comprehensive review of the literature pertaining to the impact of artificial intelligence on human abilities and its implications for education and training. It discusses the key human-centric skills that are important for working with and alongside AI and the current and future challenges of developing and assessing these skills. It also looks at how new pedagogical approaches and technologies can help humans and AI work together and learn. The paper concludes with some recommendations for policy makers, educators, and learners to foster human-centric skills in the era of AI.

Keywords: artificial intelligence, human skills, education, training, human-AI collaboration.

Introduction

Artificial Intelligence is the science and technology of creating machines and systems that are capable of performing tasks that normally require human intelligence, such as data analysis, decision-making, and natural language processing. Recently, artificial intelligence has experienced rapid advancements owing to the availability of substantial quantities of data, potent computing capabilities, and sophisticated algorithms. AI is also widely used in various fields, such as health care, education, business, and entertainment, bringing significant benefits and opportunities to human society.

However, artificial intelligence also poses significant challenges and risks for human skills in the 21st century. Artificial intelligence systems possess the capability to execute numerous tasks that traditionally necessitate human intelligence, such as accounting, legal research, and customer service, with the potential to supplant or substitute human workers. Artificial intelligence also generates novel requirements for human abilities that complement and enhance the capabilities of AI, such as creativity, critical thinking, communication, and collaboration. These competencies are imperative for

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collaborating with and collaborating with AI, as well as addressing the ethical, social, and environmental concerns posed by AI.

Hence, it is imperative to comprehend the impact of artificial intelligence on human abilities and its implications for education and training. Education and training are fundamental instruments for equipping lifelong learners with the necessary competencies to effectively navigate both work and society in the era of AI. But education and training systems have a lot of work to do to meet the changing needs and expectations of learners, employers, and society in the context of AI. In what manner can education and training systems enhance and evaluate human-centric competencies in the era of AI? Are there innovative pedagogical approaches and technologies that could enhance human-AI collaboration and learning? What are the policy recommendations and optimal practices for fostering human-centric skills in the era of AI?

The primary objective of this research paper is to address these inquiries by analyzing the literature regarding the impact of AI on human abilities and its implications for education and training. The paper additionally identifies the crucial human-centric competencies that are imperative for collaborating with and collaborating with AI, and elucidates the present and forthcoming obstacles in acquiring and evaluating these competencies. Innovative pedagogical approaches and technologies can enhance human-AI collaboration and learning, according to the paper. The paper concludes with a set of recommendations for policymakers, educators, and learners to foster human-centric skills in the era of AI.

Literature Review

The impact of AI on human skills and the implications for education and training have been widely discussed and researched in recent years, as AI technologies have become more prevalent and influential in various domains of human activity. This section reviews the existing literature on this topic, focusing on the following aspects: (1) the definition and classification of human skills in the era of AI; (2) the identification and analysis of the key human-centric skills that are essential for working with and alongside AI, such as creativity, critical thinking, communication, and collaboration; and (3) the current and future challenges of developing and assessing these skills in education and training systems.

Definition and Classification of Human Skills in the Era of AI

Human skills, also called soft skills, non-cognitive skills, or 21st century skills, are the abilities, attributes, and behaviors that help people interact well with others, change with the environment, and reach personal and professional goals. Human skills are contrasted with hard skills, also known as cognitive skills, technical skills, or domain-specific skills, which are the knowledge and competencies that are required for performing specific tasks or functions (IBM Research, 2022).

But it's hard to tell the difference between human skills and hard skills because some skills may fall into both categories or neither. For example, problem-solving can be considered as both a human skill and a hard skill, depending on the context and complexity of the problem. Moreover, some skills may not fit into either category, such as digital literacy or intercultural competence (Guszcza, 2018).

Therefore, different frameworks and models have been proposed to classify human skills in a more nuanced and comprehensive way.

One of the most widely used frameworks is the Partnership for 21st Century Learning (P21) Framework (2009), which identifies four categories of human skills: (1) learning and innovation skills, which include creativity, critical thinking, communication, and collaboration; (2) life and career skills, which include flexibility, initiative, social skills, productivity, leadership, and responsibility; (3) information, media, and technology skills, which include information literacy, media literacy, and ICT literacy; and (4) core subjects and interdisciplinary themes, which include traditional academic disciplines as well as global awareness, civic literacy, health literacy, environmental literacy, etc.

One other important framework is the OECD Future of Education and Skills 2030 (2015), which aims to provide a common language for describing the competencies that learners need to thrive in a complex and uncertain world. The OECD framework distinguishes between three types of competencies: (1) cognitive competencies, which include foundational literacies (such as language literacy, numeracy literacy), disciplinary knowledge (such as mathematics, science), interdisciplinary knowledge (such as global competence), epistemic knowledge (such as critical thinking, metacognition), computational thinking (such as coding, algorithmic thinking); (2) social-emotional competencies, which include intrapersonal competencies (such as self-regulation, resilience), interpersonal competencies (such as empathy, collaboration), values (such as respect, responsibility); and (3) practical competencies, which include physical well-being (such as health, fitness), digital well-being (such as digital citizenship, cybersecurity), financial well-being (such as financial literacy, entrepreneurship), environmental well-being (such as environmental literacy, sustainability).

These frameworks serve as valuable resources for comprehending and arranging human abilities in the era of AI. They are not exhaustive or definitive, as different contexts and purposes may require different sets of skills or different ways to define them. Furthermore, these frameworks do not explicitly address how AI affects human skills or how human skills can be leveraged to work with AI. This paper adopts a more focused approach to identify and analyze the key human-centric skills that are essential for working with and alongside AI.

Identification and Analysis of Key Human-Centric Skills for Working with and Alongside AI

AI is the science and technology of making machines and systems that can do things that normally require human intelligence, like data analysis, decision making, and natural language processing (Cambridge University Press & Assessment, 2023). In recent years, artificial intelligence has experienced rapid advancements owing to the availability of substantial quantities of data, potent computing capabilities, and sophisticated algorithms. AI is also widely used in various fields, such as health care, education, business, and entertainment, bringing significant benefits and opportunities to human society.

Nevertheless, AI also poses significant challenges and risks to human skills in the 21st century. Artificial intelligence systems possess the capability to execute numerous tasks that traditionally necessitate human intelligence, such as accounting, legal research, and customer service, with the potential to supplant or substitute human workers. AI requires new skills from people that help AI

work better, like being creative, thinking critically, communicating, and working together. These skills are important for working with and with AI, as well as for dealing with ethical, social, and environmental issues caused by AI.

Therefore, it is important to identify and analyze the key human-centric skills that are essential for working with and alongside AI. Based on the literature review, we propose the following four categories of human-centric skills for working with and alongside AI:

Creativity: This is the ability to generate novel and valuable ideas, products, or solutions that are relevant to a given context or problem. Creativity is a key human skill that can enhance the performance and innovation of AI systems, as well as enable humans to cope with the uncertainty and complexity of the future. Creativity can be applied in various stages of the AI development and deployment process, such as problem identification, data collection, model design, testing, evaluation, and improvement. Creativity can also help humans to find new ways of using AI systems, or to create new domains or applications for AI. Moreover, creativity can help humans to express their emotions, values, and identities through AI systems, or to challenge the assumptions and biases of AI systems.

Critical thinking: The ability to analyze, evaluate, and synthesize information from various sources and perspectives, and to apply logic, reasoning, and evidence to make informed judgments and decisions (World Bank, n.d.). Critical thinking is a key human skill that can improve the quality and reliability of AI systems, as well as enable humans to understand and question the limitations and implications of AI. Critical thinking can be applied in various stages of the AI development and deployment process, such as data selection, model validation, error detection, bias mitigation, and outcome interpretation. Critical thinking can also help humans to assess the credibility and trustworthiness of AI systems, or to challenge the authority and accountability of AI systems. Moreover, critical thinking can help humans to explore the ethical, social, and environmental impacts of AI systems, or to propose alternative solutions or scenarios for AI.

Communication: It is another ability to exchange information, ideas, or emotions with others effectively and appropriately through various modes and media. Communication is a key human skill that can facilitate the collaboration and coordination of AI systems, as well as enable humans to interact with and influence AI. Communication can be applied in various stages of the AI development and deployment process, such as data annotation, model explanation, feedback collection, user instruction, and outcome presentation. Communication can also help humans to express their needs, preferences, or expectations to AI systems, or to understand and respond to the outputs or behaviors of AI systems. Moreover, communication can help humans to share their experiences, insights, or opinions about AI systems, or to persuade or educate others about the benefits or risks of AI systems.

Collaboration: Another ability to work with others effectively and constructively towards a common goal or outcome (Komm et al., 2021). Collaboration is a key human skill that can enhance the productivity and innovation of AI systems, as well as enable humans to leverage the complementary

strengths of humans and AI. Collaboration can be applied in various stages of the AI development and deployment process, such as data integration, model integration, team formation, task allocation, and outcome evaluation. Collaboration can also help humans to coordinate their actions, roles, or responsibilities with AI systems, or to adapt their strategies, behaviors, or expectations to the capabilities or limitations of AI systems. Moreover, collaboration can help humans to build trust, rapport, or empathy with AI systems, or to resolve conflicts or disputes with AI systems.

These four categories of human-centric skills are not mutually exclusive or exhaustive, but rather interrelated and overlapping. They also reflect some of the core competencies identified by the P21 framework and the OECD framework, but with a specific focus on working with and alongside AI. These skills are not innate or fixed, but rather learnable and developable through education and training.

Current and Future Challenges of Developing and Assessing Human-Centric Skills for Working With and Alongside AI

The task of developing and assessing human-centric skills for working with and alongside AI is not an easy one. It requires a holistic and systemic approach that involves multiple stakeholders, such as educators, learners, employers, policymakers, and researchers. It also encounters diverse obstacles at various levels, including conceptual, methodological, practical, and ethical.

One of the main challenges is defining and implementing human-centric skills for working with and alongside AI. As mentioned earlier, these skills are complex and multidimensional constructs that may vary depending on the context and purpose. There is no consensus on how to measure or quantify these skills in a valid and reliable way. Furthermore, there exists a deficiency in the alignment between the prevailing frameworks and models that categorize human skills in general and the distinct prerequisites and requirements of collaborating with and collaborating with AI. Therefore, there is a need to develop and test new frameworks and models that can capture and describe the specific human-centric skills that are important for working with and alongside AI and to align them with the existing frameworks and models that are widely used and recognized.

At the methodological level, one of the primary obstacles is the creation and implementation of efficacious and innovative pedagogical methodologies and technologies that can foster and enhance human-centric competencies for collaborating with and collaborating with AI. As mentioned earlier, these skills are not innate or fixed, but rather learnable and developable through education and training. However, traditional education and training systems may not be adequately equipped or prepared to teach and learn these skills in a systematic and meaningful way. Moreover, there is a lack of empirical evidence and best practices on how to integrate AI into education and training systems in a way that can support and enrich human-centric skills development and assessment. So, we need to try out new ways of teaching and using technology that can use AI to help people work together and learn better. We should also check how well these methods work and how they affect learning and skills development for humans.

One of the main challenges is scaling and maintaining human-centric skills development and assessment for working with and alongside AI across different contexts, domains, and levels. As

previously stated, these competencies are contingent upon the context and purpose, implying that they may necessitate diverse levels of knowledge, skills, or conduct based on the particular circumstance or issue at hand. These skills are also dynamic and evolving, which means that they may need to be updated or adapted according to the changes or advances in AI technology or applications. Therefore, there is a need to create and maintain flexible and adaptive learning environments and systems that can provide personalized and continuous learning opportunities and support for human-centric skills development and assessment for working with and alongside AI.

At the ethical level, one of the primary obstacles is to guarantee the fairness, transparency, and accountability of human-centric skill development and assessment for working with and alongside AI. These skills involve complex and multidimensional constructs that may be influenced by different factors, such as individual differences, cultural backgrounds, or social norms. Also, these skills involve sensitive and personal things, like emotions, values, or identities. Hence, it is imperative to guarantee that human-centric skill development and assessment for working with and alongside AI are founded on sound ethical principles and practices, such as the utmost reverence for human dignity, autonomy, diversity, and inclusion. We need to make sure that learning and evaluating skills for working with and with AI is transparent and accountable. This means giving clear guidelines, giving feedback, and letting people ask for changes or improvements.

The era of AI is characterized by rapid and profound changes in the market trends, consumer preferences, and business environment. These changes have a significant impact on the internal organizational functioning and its employees, especially on the demand for complex cognitive and information processing skills. These skills are essential for understanding, adapting, and innovating in the AI-driven world. Some examples of these skills are:

Data analysis and visualization: the ability to collect, process, and interpret large and diverse data sets using various tools and techniques, and to present them in a clear and meaningful way. This skill is important for deriving insights from complex data, such as customer behavior, market trends, or product performance, and for communicating them to different audiences, such as managers, customers, or stakeholders (Shiohira, 2021).

Systems thinking and design thinking: the ability to understand and analyze complex systems and problems from multiple perspectives, and to generate creative and feasible solutions that meet the needs and expectations of the users. This skill is important for designing and improving AI systems or applications, as well as for finding new ways of using AI systems or applications (Langley, 2017).

Data-driven decision making: the ability to use data and evidence to support and justify decisions, actions, or policies. This skill is important for making informed and rational choices in uncertain and dynamic situations, as well as for evaluating the outcomes and impacts of AI systems or applications (Korteling et al., 2021).

Continuous learning and agility: the ability to learn new knowledge, competencies, or behaviors quickly and effectively, and to apply them in changing contexts or situations. This skill is important

for keeping up with the advances and challenges of AI technologies or applications, as well as for adapting to the changing needs and demands of the labor market and society.

While these cognitive and technological skills are crucial for working with and alongside AI, the need for social skills, such as leadership, communication, and interpersonal, remains constant, thus, we refer to these skills as evergreen skills. These skills are important for enhancing the human aspects of organizational functioning and its employees. Some examples of these skills are:

Leadership: the ability to inspire, motivate, and guide others towards a common vision or goal. This skill is important for creating a culture of continuous learning and skill enhancement among employees, as well as for redesigning existing jobs or creating new jobs that leverage the potential of AI.

Communication: the ability to exchange information, ideas, or emotions with others effectively and appropriately through various modes and media. This skill is important for coordinating and collaborating with other employees, customers, or stakeholders, as well as for interacting with and influencing AI systems or applications.

Interpersonal: the ability to build trust, rapport, or empathy with others, as well as to resolve conflicts or disputes with them. This skill is important for maintaining positive and productive relationships with other employees, customers, or stakeholders, as well as with AI systems or applications.

Developing and assessing these human-centric skills for working with and alongside AI is not an easy task. It requires a holistic and systemic approach that involves multiple stakeholders, such as policy makers, educators, and learners. It also faces various challenges at different levels, such as conceptual, methodological, practical, and ethical. Therefore, it is imperative that all stakeholders work together to create a future-ready education and training system that can equip lifelong learners with the skills to navigate both work and society in the era of AI.

Recommendations & Conclusion

Recommendations for policy makers, educators, and learners to foster human-centric skills in the era of AI

Some possible recommendations for policy makers, educators, and learners to foster human-centric skills in the era of AI are:

Policy makers should come up with and put into place national and international policies and standards that help AI be used ethically, fairly, and in a way that everyone can use it. It is imperative that policymakers encourage and allocate resources towards research and innovation pertaining to human-centric AI in education, as well as facilitate the exchange and dissemination of effective practices and lessons learned. Policy makers should also ensure that the education system is aligned with the current and future needs and demands of the labor market and society in the era of AI, and

that the learners are equipped with the relevant knowledge, competencies, and values to thrive in the AI era (UNESCO, 2019).

Educators should teach and learn in a way that helps people work better with AI by focusing on them and working together. Educators should also integrate AI into the curriculum and pedagogy in a way that supports and enriches human-AI collaboration and learning, as well as addresses the ethical, social, and environmental issues raised by AI. Educators should also use effective and innovative pedagogical approaches and technologies that leverage the potential of AI to facilitate and augment human-centric skills development and assessment. Educators should also pursue ongoing professional growth and ongoing education to keep up with their own abilities, abilities, and understanding in the age of artificial intelligence.

Learners should learn in a way that helps them learn and use human-centric skills for working with and with AI. Learners should also explore and experiment with various AI systems and applications in different domains and contexts, and learn from their interactions and experiences with them. Learners should think carefully about AI systems and ask questions about their strengths and weaknesses. They should also challenge their beliefs and biases. Learners should also use AI systems to express their emotions, values, or identities or create new areas or applications for AI.

Concluding remarks

This paper looks at how to develop and test human-centered skills for working with and with AI. It has looked at the existing literature on how AI affects human skills and how this affects education and training. It has also suggested a new framework or model that can identify and analyze the key human-centric skills that are important for working with and with AI, such as creativity, critical thinking, communication, and collaboration. It has also discussed the potential of innovative pedagogical approaches and technologies that can enhance human-AI collaboration and learning. It has also provided some recommendations for policy makers, educators, and learners to foster human-centric skills in the era of AI.

This paper has provided a novel and comprehensive perspective on the topic of human skills and AI, which has contributed to the field. It has also stimulated further research and discussion on this topic, as well as inspired and empowered learners to develop and apply their human-centric skills in the era of AI.

Furthermore, the paper has demonstrated the importance and relevance of human-centric skills for working with and alongside AI. Human-centric skills are not only advantageous for augmenting the efficiency and creativity of AI systems, but also for enabling humans to effectively manage the uncertainty and complexity of the future. Human-centric skills are not only essential for interacting with and influencing AI systems, but also for addressing ethical, social, and environmental issues raised by AI. Learning and developing human-centric skills is not only possible through education and training, but also through exploring and experimenting with various AI systems and applications.

References

Cambridge University Press & Assessment. (2023). *Assessing "competence" and "21st century skills": Challenges and ways forward*. Cambridge University Press & Assessment. https://www.cambridgeassessment.org.uk/blogs/assessing-competence-21c-skills/

Guszcza, J. (2018). *Smarter together: Why artificial intelligence needs human-centered design*. Deloitte Review, Issue 22. https://www2.deloitte.com/us/en/insights/deloitte-review/issue-22/artificial-intelligence-human-centric-design.html

IBM Research. (2022). *What is human-centered AI?* IBM Research Blog. https://research.ibm.com/blog/what-is-human-centered-ai

Komm, A., Pollner, F., Schaninger, B., & Sikka, S. (2021). *The new possible: How HR can help build the organization of the future*. McKinsey & Company. https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/the-new-possible-how-hr-can-help-build-the-organization-of-the-future

Korteling, J. E. (Hans)., van de Boer-Visschedijk, G. C., Blankendaal, R. A. M., Boonekamp, R. C., & Eikelboom, A. R. (2021). Human- versus Artificial Intelligence. *Frontiers in Artificial Intelligence*, *4*. https://doi.org/10.3389/frai.2021.622364

Langley, P. (2017). Information-Processing Psychology, Artificial Intelligence, and the Cognitive Systems Paradigm. *Presented at the AAAI Spring Symposium on Science of Intelligence, Stanford, CA*. https://cbmm.mit.edu/sites/default/files/documents/Langley_AAAI17_SoI.pdf

OECD Future of Education and Skills 2030. (2015). OECD. https://www.oecd.org/education/2030-project/about/

Partnership for 21st Century Learning (P21) Framework. (2009). US Department of Education. https://files.eric.ed.gov/fulltext/ED519462.pdf

Shiohira, K. (2021). *Understanding the impact of artificial intelligence on skills development*. UNESCO-UNEVOC International Centre for Technical and Vocational Education and Training. https://unevoc.unesco.org/pub/understanding_the_impact_of_ai_on_skills_development.pdf

UNESCO. (2019). *Artificial Intelligence and Education: Guidance for Policy-makers*. UNESCO. https://www.unesco.org/en/digital-education/artificial-intelligence

World Bank. (n.d.). *Skills Development*. World Bank. https://www.worldbank.org/en/topic/skillsdevelopment